Media Multitasking in Relation to Cognition and Socioemotional Well-being: A Literature Review

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With the rapid expansion of media use by children and adults, media multitasking (engaging in more than one media activity at a time) has rapidly become a lifestyle for American youth (Roberts, Foehr, & Rideout, 2005). The aim of this systematic review is to examine the cognitive and socio-emotional impacts of media multitasking (MMT). This review analyzed 59 articles from 2006 to 2016 that investigated MMT across a range of ages, including pre-adolescents to adults, although primarily focused on college-aged students.

Concerning academic and cognitive skills, media multitasking is detrimental to the learning of both those multitasking and other classroom peers in the vicinity. In-class multitasking is negatively associated with grades, note taking, test performance, and self-regulation, and is not buffered by achievement level (Fried, 2006; Zhang, 2015).

In terms of socio-emotional well-being, media multitasking has mixed effects dependent upon medium and context. Research on tweens using technology points to
multiple negative socio-emotional outcomes with respect to usage, including psychological distress, diminished sleep, and higher levels of social stress (Pea et al., 2012). Similarly, college females demonstrated more maladaptive behavior with respect to mobile phone use (i.e., deterioration of family and social relationships, reduction of activities, tendency to evade problems; Beranuy et al., 2009). Still, tweens reported some positive social feelings: media multitasking was associated with a greater orientation to finding positive feelings from friends.

Overall, constant multitasking has multiple cognitive and socio-emotional effects for students, such as (a) high ratings of distractibility, (b) negative impact on academic performance, (c) decreased speed when performing academic tasks, (d) psychological distress, (e) greater levels of social stress.

*Keywords:* multitasking, media multitasking, cognition, socioemotional
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Media Multitasking in Relation to Cognition and Socioemotional Well-being:

A Literature Review

Media multitasking, using two or more medias concurrently, prevails among adolescents and emerging adults (Carrier, Cheever, Rosen, Benitez, & Chang, 2009; Judd & Kennedy, 2011; Roberts, Foehr, & Rideout, 2010). The inherent mental habits of media multitasking—dividing attention, switching attention, and maintaining multiple trains of thought—have significant implications on students' ability to attend, to plan, to relate to other people, and to understand the world (Cirell, 2014). In academic environments, media multitasking often occurs in the classroom as a distractor to the lecture or the primary academic task. Such occurrences of media multitasking frequently involve texting or off-task laptop use. Media multitasking is detrimental to cognitive functioning by interfering with attention and working memory and consequently negatively affecting GPA, test performance, reading comprehension, and efficiency. These effects are not buffered by higher achievement level. Furthermore, these effects are not limited to the multitasking individual; classroom peers in the vicinity of multitaskers exhibit similar effect. Outside of the classroom, media multitasking is used to accomplish social goals. In terms of socioemotional well-being, media multitasking has mixed effects dependent upon medium and context. Technology can serve as a tool to achieve identity and intimacy for adolescents and young adults. Furthermore, technology provides means for nearly instantaneous social connection; however, there is a potential for negative impact in terms of distress and health. The increase in media multitasking among today's
students raises concerns for potential negative consequences in regards to regulation, academic performance, and socioemotional functioning.

Prevalence and motives for media multitasking behavior

According to the Kaiser Family Foundation (2010), media use is the dominant way adolescents and young adults spend their time, averaging more than 7.5 hours of use a day—almost the equivalent in length of a full work day (Roberts et al., 2010). Students increase media absorption by using two or more mediums simultaneously via media multitasking. Because of the high frequency of media multitasking, today’s youth experience a total of 10 hours and 45 minutes of media content within their daily 7.5 hours of time spent using technology. This behavior carries into college, where media use is largely unregulated. Hwang, Kim, and Jeong (2014) found that 90% of university students multitask when using media and that more than half of time spent on media involves multitasking. Moreover, 73% of university students’ daily text messaging are sent while doing homework (Junco & Cotten, 2012).

Motives for multitasking range among students, however, common themes include motivational goals and inaccurate metacognitive beliefs. In online questionnaires, American college students report multitasking due to time pressures, boredom, a desire for connection, and for entertainment (Carrier, Rosen, Cheever, & Lim, 2015). Self-report questionnaires of Korean adults age 19 to 59 point to efficiency as the primary drive for multitasking, identifying the major motives as information seeking, social engagement, entertainment, efficiency, and out of habit (Hwang et al., 2014).
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College students commonly but erroneously report that multitasking increases productivity (Lin, Cockerham, Chang, & Natividad, 2015). Junco and Cotten (2012) concluded that this inaccurate metacognitive belief could lead to a multitasking habit that transcends all domains and situations, regardless of the importance or demand of the task. Other students multitask on a situational basis according to motive; thereby a student with a specific goal and sufficient motivation is less likely to multitask than students with less consequential goals such as communicating with friends for leisure via Facebook or email (Judd & Kennedy, 2011).

The ubiquity of media multitasking among today’s students raises concerns about its potential deleterious consequences and positive outcomes in relation to student learning and well-being. This paper reviews pertinent theories and analyzes research evidence for the effects of media multitasking on aspects related to both cognitive functioning—including academics, GPA, efficiency, reading comprehension, self-regulation, test performance—and aspects of social emotional functioning, including mental health, social connection, entertainment and enjoyment.

Cognitive Functioning

Theoretical Foundation

Multitasking may impair learning through rapid use of the limited capacity of learners’ information processing channels, especially attention processes, leaving insufficient space for meaningful learning. This is based in information processing theory, the scattered attention hypothesis, and bottleneck theory in which attention is a limited resource (Maslovat, Chua, Spencer, Forgaard, Carlsen, & Franks; van dur Schuur,
Baumgartner, Sumter, & Valkenburg, 2015). The term ‘attention’ refers to how individuals actively process specific information in their environment. Attention is selective and enhances processing of the attended stimulus while diminishing processing of unattended stimuli. Furthermore, attention is biased towards objects that match the current contents of working memory (Hollingworth & Beck, 2013). Working memory is a part of short-term memory concerned with immediate conscious perceptual processing that mediates the maintenance and manipulation of information for a few seconds or minutes. Working memory is a cognitive system with a limited capacity to hold information available for processing. Information processing theory provides a broad scope understanding of the manner in which individuals process stimuli input, highlighting the role of attention in stimulus response. Theories of working memory offer a memory model in which attention serves as a critical component. Bottleneck theory considers how selective attention operates, suggesting that individuals have a limited amount of attentional resources that they can use at one time. The scattered attention hypothesis postulates that because of this resource limitation, media multitasking creates cognitive strain. Collectively, these theories serve to elucidate the manner in which media multitasking decreases academic performance as well as the various components of cognition media multitasking impacts.

Theories of attention. According to the bottleneck theory of attention, attention can be allocated to only one task at a time. Thus, multitasking is a myth; instead, the mind switches between tasks. For example, a student watching television while doing homework may believe himself to be effectively attending to both tasks simultaneously.
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However, the student instead switches allocation of attention from the television to the assignment; attention is only devoted to one task at a time rather than both simultaneously. Stimuli arrives at a processing ‘bottleneck,’ at which only one item can be processed at a time (Broadbent, 1958; Maslovat et al., 2013). This theory suggests that because attentional resources are limited, filtering of stimuli must occur at some point in the system. The bottleneck postpones aspects of processing of the second task until the primary task is completed. Overtime, research has debated at which point in attention processing this filter occurs but there is no consensus; however, the most common explanation is a response selection bottleneck.

Van dur Schuur and colleagues (2015) identified two potential, opposing consequences of media multitasking with regards to cognitive control, which they referred to as the scattered attention and trained attention hypotheses. According to the scattered attention hypothesis, media multitasking negatively affects cognitive control (van dur Schuur et al., 2015). Cognitive control includes several processes, such as focusing attention on goal-relevant information, filtering irrelevant information, switching efficiently between tasks, and retaining temporary information (van der Schuur et al., 2015; Uncapher, Thieu, & Wagner, 2016). By attending to all information to which they are exposed (i.e. task switching or multitasking), the individual easily distracts from the primary activity (van der Schuur et al., 2015). Engaging in multiple tasks highly demands attentional capacity, resulting in deficits in cognitive control abilities (Chinchanchokchai, Duff, & Sar, 2015; Miller & Cohen, 2001; Ophir, Nass, & Wagner, 2009; van der Schuur et al., 2015). Thus, multitasking reduces performance by causing
interference, distraction, and ultimately errors (Courage, Bakhtiar, Fitzpatrick, Kenny, & Brandeau, 2015). According to the scattered attention hypothesis, long-term media multitasking may lead to disrupted cognitive control in which the individual gravitates towards the preferred task rather than maintaining focus on the primary task in spite of attentional distractions (van der Schuur et al., 2015).

The scattered attention hypothesis maintains the information processing theoretical approach to cognitive development, in which the brain is a device that employs mental resources to carry out operations and complete tasks. According to this theory, the executive system controls mental resources, allocating resources where it deems most necessary. Per information processing theory, attention is a limited resource. Only a limited quantity of stimuli can be processed at any given time. According to the scattered attention hypothesis, media multitasking hastens the depletion of the attentional resource, consequently diminishing performance on the primary task. Attention is a fixed resource; individuals have a finite amount of attention available for allocation of tasks throughout the day. Media multitasking hastens the usage of the attentional resource, leaving little attention to be employed to remaining daily tasks. Thus, performance suffers. If—as is the case with media multitasking—attentional demand exceeds attentional capacity, the cognitive system overloads and performance suffers.

On the other hand, the trained attention hypothesis argues that frequent media multitasking could have a positive effect on cognitive control via eventual training and improvement of control processes. This view holds that multitasking enables high-level efficiency and productivity, and that these skills are essential components for success in
modern work and learning environments (Courage et al., 2015). According to this theory, multitasking promotes mental flexibility that potentially changes the way individuals learn and retain information. The trained attention hypothesis asserts that ability to filter irrelevant information could improve through frequent practice multitasking (Alzahabi & Becker, 2013; Ophir et al., 2009). Frequent task switching and efficient coping with multiple streams of information could improve an individual’s ability to determine relevant information from irrelevant information. Similarly, Lui & Wong (2012) found that a higher degree of media multitasking is associated with better multisensory integration, which could serve as cognitive skills beneficial to learning. This is particularly true for children, who have high neural plasticity.

Research is more consistent with the scattered attention hypothesis than the trained attention hypothesis (van der Schuur et al., 2015). This is because experimental literature to date on divided attention and dual-task performance demonstrates a limited processing system in humans and consequential deterioration in performance and productivity when multitasking (Courage et al., 2015).

**Working memory theories.** Theories of working memory also provide insight to the cognition of media multitasking. With regards to visual working memory (VWM), attention is biased towards objects that match the current contents of VWM (Hollingworth & Beck, 2016). Visual working memory is a cognitive system that holds a limited amount of visual information in a temporary storage buffer so that it may be accessed quickly and efficiently to achieve goals. This relationship is well established, but researchers debate the cognitive mechanisms upholding this relationship.
Recent research points to working memory as a critical component of multitasking ability, indicating that working memory capacity predicts multitasking performance more so than other cognitive, personality, and experience-based variables. For example, when examining individual differences in multitasking across a group of adolescents, Cain and colleagues (2016) found that more frequent media multitasking was associated with poorer performance on behavioral measures of working memory capacity. However, studies like that of Cain and colleagues (2016) rely on measures of working memory that were dual-tasks. Thus, Redick (2016) examined whether working memory measures must be dual-tasks to predict multitasking performance, or if other types of measures that are not of dual-task methodology also predict multitasking. His research found that single-task working memory measures are predictive of multitasking performance. Thus, the relationship between working memory and multitasking is independent of the method of task used to assess working memory. Furthermore, working memory is strongly related to one's ability to multitask and working memory serves as a strong predictor of multitasking. This indicates that working memory is perhaps fundamental to an individual's ability to multitask. Cognitive effects occur through overload on attention, taxing working memory.

This paper relies on the aforementioned models to examine the cognitive impact of media multitasking within the frame of a theoretical foundation as well as to highlight existing data that confirm or oppose the discussed theories.
Academic Performance

Empirical studies firmly establish a significant drop in academic performance caused by media multitasking. Students who do not multitask generally outperform students who multitask. Heavy media users (those who consumed more than 16 hours of media content in a typical day) report receiving C’s or lower in school, getting in trouble often, frequently feeling sad or unhappy, and often being bored (Roberts et al., 2010). Survey data examining the impact of technology-based multitasking behaviors both within and outside the classroom found that those who multitask frequently in-class have lower current college GPAs (Bellar, Nowak, & Hull, 2015).

In-class multitasking. Mobile phone multitasking during class is a heavily researched medium, as it is the technology of choice for the majority of university students and the most prevalent. Rosen and colleagues (2011) examined the impact of mobile phone usage during class lecture on student learning, specifically on test performance. In one study, participants viewed a 30-minute videotaped lecture during which they replied to text messages (Rosen, Lim, Carrier, & Cheever, 2011). Participants in four classrooms were randomly assigned to three groups: receiving no text messages, receiving four text messages, or receiving eight text messages. Thus, the three groups were labeled as having ‘no-interruption’, ‘moderate-interruption’, and ‘high-interruption’. The study asked students to respond to text messages sent out at even intervals throughout the lecture by the researchers. Following the lecture, participants completed a recall assessment. Students in the high text messaging group performed worse by one letter grade on an information post-test than the low text messaging group (10.6% lower
score). However, the moderate text messaging group showed no difference on the post-test comparative to the other two groups. Results indicated elapsed time between receiving and sending text messages as a mediating factor for performance effects. Participants who received and sent more words in their texts performed worse on the test; however, this was moderated by elapsed time between receiving and sending a text, with longer delays resulting in better performance. Student metacognitive self-reports reflected test results. Nearly three-fourths of participants felt that receiving and sending text messages during class was disruptive to learning. Despite this, 40% felt it was acceptable to text in class.

A replication study found similar results (Kuznekoff & Titsworth, 2013). Participants in three different groups (non-multitasking, low-distraction, and high-distraction) watched a video lecture while taking notes on the lecture. After the video lecture, participants completed two learning assessments on lecture content. Students in the non-multitasking control group wrote down 62% more information in their notes, took notes with more details, were able to recall more detailed information from the lecture, and scored a full letter grade and a half higher on the assessment than students in the low-distraction and high-distraction groups. Further analysis of the study found that message content influenced effect of texting on class performance. In addition to participants who did not text, participants who sent texts related to the lecture earned a 10-17% higher letter grade, scored 70% higher on information recall, and scored 50% higher on note-taking than students sending texts unrelated to lecture content (Kuznekoff, Munz, & Titsworth, 2015). These results point to the purpose of usage, rather than
multitasking itself, as the culprit for the negative effects of media multitasking on classroom performance. Thus, distinguishing on-task from off-task multitasking redefines the pragmatics of the in-class technology debate.

A similar experiment examining in-class, media multitasking with classroom performance expanded the experimental variables to reflect individualized preferences for both media use and notetaking (Wood, Zivcakova, Gentile, Archer, Pasquale, & Nosko, 2012). The study compared multitasking activities of various mediums to three methods of notetaking. Participants were randomly assigned to one of seven conditions. Technological mediums assessed included texting using a cell phone, emailing, Instant Messaging (IM), and Facebook. All media use was for off-task purposes. Note-taking conditions were paper-and-pencil, word-processing, and a natural use of technology condition in which participants were allowed to use any technology they wished. The natural use of technology condition served to determine whether students choose to multitask during lectures, what technologies students tend to use, and how the choice to multitask affected learning. Across all three sessions, only 7 participants did not use technology at all. Almost half of participants used technology for every class when permitted. The experiment was conducted over three consecutive lectures. Results indicated that participants who did not use any technologies outperformed students who did multitask—regardless of medium—on a 15-item multiple-choice test. Participants in the Facebook and Instant Messaging conditions performed more poorly than those in the paper-and-pencil use control. Wood and colleagues (2012) surmised that this was because Facebook and IM were more likely to serve as distractors that yield negative impact on
learning. Repeated practice with the various technologies did not improve performance over time in any condition. This presents evidence against the trained attention hypothesis, which states that repeated practice media multitasking will improve performance over time (Van dur Schuur et al., 2015). Similar studies comparing test performance found the non-texting group outperformed regardless of gender and G.P.A. (Ellis, Daniels, & Jauregui, 2010; Froese, Carpenter, Inman, Schooley, Barnes, & Brecht, 2010). This again suggests that attempting to attend to lectures and engage in technologies simultaneously can have a detrimental impact on learning, likely due to inattention to course information.

Like mobile phone use, laptop use is commonplace in the university setting, yet presents unique issues concerning multitasking. Laptops provide a convenient means to connect with the lecture while simultaneously providing a major source of distraction. Self-report data by Fried (2008) of attendance, laptop use, and aspects of the classroom environment showed that students using laptops in class spent considerable time multitasking. Laptop use negatively related to multiple learning outcomes including course grade, focus on lectures, reported clarity of lectures, exam performance, and comprehension (Fried, 2008; Wood et al., 2012). Using a survey of 176 college students and a path analysis investigating learning variables, in-class laptop multitasking was found to have a negative impact on course grade (Zhang, 2015). In a study by Hembrooke & Gay (2003), laptop use during a lecture resulted in significantly lower recall and recognition test scores. Students in two conditions (laptop multitasking condition or no multitasking condition) listened to a lecture and completed a
comprehension exam. Exam results indicated that students in the laptop multitasking condition suffered memory decrements.

Students habitually using laptops in class report low satisfaction with their education, are more likely to multitask in class, and are more distracted (Wurst, Smarkola, & Gaffney, 2008). Laptops, for example, serve as a major source of distraction, negatively affecting academic performance. According to information processing theory, humans process stimuli, rather than merely responding, employing attention mechanisms such as working memory. Thus, laptops provide additional stimuli for students to process, distracting them from the academic task. This accounts for the decrements in performance seen as a result of in-class laptop multitasking. Because most technological mediums serve as a gateway to both productive and unproductive tasks, students are likely to engage in both over the course of a class period and struggle to resist temptation to utilize the technology for tasks that distract from in-class activities. These distractions cause students to switch attention to non-class tasks, preventing processing and learning of material. This affirms ideas purported by the bottleneck theory of attention as well as the scattered attention hypothesis.

Multitasking outside of class. Laptops and mobile phones are particularly distracting, as they easily access alternate media source such as email, Facebook, or Instant Messaging (IM). A survey study of 1839 students at a large, urban university revealed that using Facebook while doing college schoolwork was negatively predictive of overall semester G.P.A. (Junco, 2012). Further survey of the same sample found that Instant Messaging while preparing for class showed no relationship to G.P.A. (Junco &
Cotton, 2012). However, participants in this study reported using Instant messaging the least of the tested mediums, with 67% of respondents reporting that they never IMed. Junco & Cotten (2012) surmised that Facebook or texting while trying to complete schoolwork may tax students’ capacity for cognitive processing, inhibiting deeper learning. According to one experimental study, the more time participants reported spending on IM in class, the lower self-reported G.P.A. (Fox, Rosen, & Crawford, 2009).

Outside of the classroom, mobile phone use is also negatively associated with academic performance. Texting while studying was significantly and negatively associated with college GPA after controlling for demographic variables, self-efficacy for self-regulated learning, self-efficacy for academic achievement, and actual high school GPA (Lepp, Barkley, & Karpinski, 2015; Junco, 2012; Junco & Cotton, 2012). Five-hundred and thirty-six undergraduate students from 82 majors at a large, public U.S. university completed self-report questionnaires regarding the relationship between cell phone use and academic performance (Lepp et al., 2015). Hierarchical regression demonstrated that cell phone use was significantly and negatively related to actual college GPA and that increased cell phone use was associated with decreased academic performance. Similar survey research of 1839 college students by Junco & Cotten (2012) found that texting while doing schoolwork was negatively associated with overall college GPA. Junco and Cotten (2012) suggested that this media multitasking might overload students’ capacity for cognitive processing and preclude deeper learning.

Hence, it appears that these effects are not limited to learning while just attending class but that media multitasking has harmful effects as students engage in learning
activities outside the classroom, too. Multitasking outside of class requires task-switching. As in bottleneck theory, incoming information arrives at a processing bottleneck, at which only one item can be processed at a time. The consequence of this is diminished performance. As in Van dur Schuur and colleagues (2015) scattered attention hypothesis, media multitasking negatively affects cognitive control through distraction from the primary activity. Engaging in multiple tasks highly demands attentional capacity, resulting in deficits in performance. Multitasking reduces performance by causing interference, distraction, and errors. Thus, effects of multitasking outside of class parallel those of multitasking within the classroom as do the theories guiding the responses.

Effects on Peers

Research involving undergraduate students indicate that laptop multitasking hinders class learning for both users and nearby peers (Fried, 2008; Sana, Weston, & Cepeda, 2013). Fried (2008) administered surveys of various aspects of class such as class attendance, classroom experiences, and laptop use to an existing university class, finding that students frequently cited personal and external laptop use as major sources of classroom distractions and hindrances of learning. Experimental evidence affirms this. Sana and colleagues (2013) simulated a classroom with 40 undergraduate students in which students were asked to view a 45-minute PowerPoint lecture in either a multitasking or no multitasking condition and then take a four-option multiple-choice comprehension test with 20 questions evaluating simple knowledge and 20 questions evaluating application of knowledge. Participants who multitasked on a laptop during
lecture scored lower on the test than those who did not multitask. Moreover, participants who were in direct view of a multitasking peer scored 17% lower than those who were not. Distractions due to movement of images and laptop screen lighting, as well as multitasking activities, may cause involuntary shifts of attention among students in close proximity to laptop users (Sana et al., 2013). Thus, proximity to a multitasker—and not solely active multitasking—can be detrimental to academic performance.

**Efficiency**

Multitasking reduces efficiency when performing academic tasks; students take longer to complete tasks. Survey data of 361 college students who reported texting while doing homework, also reported spent more time studying outside of class, as multitasking contributes to inefficient study habits (Bellur et al., 2015). Participants who IMed while completing a reading task took significantly longer to complete the task (12.56 minutes compared to 8.23 minutes by non-multitasking participants) (Fox et al., 2009). In a similar study of the same experimental design, participants who instant messaged while reading took 22%-59% longer to complete the task than those who instant messaged before reading or did not instant message at all, even after deducting the time spent on instant messaging (Bowman, Levine, Waite, & Gendron, 2010).

Although multitasking reduces efficiency, comprehension is not always affected. Participants may re-read certain parts of the article after interruption by the instant message; although this increases reading time, it can make up for deficits in comprehension (Bowman et al., 2010; Fox et al., 2009). In both of the above studies, although statistically significant differences were found in student time to complete the
reading passage, comprehension was not harmed. Thus, students who are particularly metacognitive can overcome the effects of media multitasking on comprehension through self-awareness and taking additional time to complete tasks. This is suggestive of the trained attention hypothesis, which postulates that frequent task switching with multiple streams of information could improve an individual’s ability to determine relevant information from irrelevant (Van dur Schuur et al., 2015). This view holds that frequent media multitasking could have a positive effect on cognitive control via eventual training and improvement of control processes.

The primary differential distinguishing the influence of media multitasking on academic performance out of class versus in-class is that the lack of time contingencies or instructional proctorship heighten the mediating influence of metacognition and self-awareness. As seen in research examining the effect of media multitasking on reading comprehension, students can account for deficits in performance due to multitasking by re-reading or re-doing a task when working outside of the classroom. This cannot occur in the classroom due to time constraints. However, these repetitive behaviors ultimately diminish efficiency.

Self-Regulation

Self-regulation requires conscious personal management and guiding of one’s thoughts, behaviors, and feelings to achieve goals. Although there is some evidence that students adjust reading time, adolescents do not effectively self-regulate their media multitasking. Despite students readily acknowledging multitasking divides attention, the
media multitasking persists. Furthermore, while students recognize that multitasking divides their attention, they do not accurately predict its impact on task performance.

Multitasking students typically predict lower scores on academic performance than on-task students (Elder, 2013). Questionnaire data examining 88 college students' cell phone use and beliefs indicates an acceptance of use in class and neutral beliefs about whether multitasking affected their study time. Experimental data of 34 students failed to indicate any difference in quiz scores of those who used devices while listening to a lecture and those who did not. However, when asked to predict scores prior to taking a comprehension quiz, students who used their cell phones during lecture anticipated lower scores than students who did not. A separate study of 536 undergraduate students from 82 areas of study at a large, public university found cell phone use to be significantly and negatively related to actual college GPA (Lepp et al., 2015). Increased cell phone use was associated with decreased academic performance.

A similar mixed-methods study combining survey with experimental methods found that participants predicted losing close to 30% accuracy on a quiz when using cell phones and indeed lost close to 30% when texting (Froese et al., 2010). Non-multitasking students feel more confident in their ability to predict scores accurately (Gingerich & Lineweaver, 2014). In an experiment asking lecture-only and lecture-texting groups to predict their performance on a quiz assessing lecture content retention, the lecture-only group had higher scores on the quiz and felt more confident in their predictions. This, coupled with data regarding multitaskers' metacognitive beliefs, indicates that students are poor at recognizing and regulating inhibitors of performance.
Wei, Wang, and Klausner (2012) examined the impact of texting on students' cognitive learning, placing particular emphasis on the effect of students' self-regulation on sustained attention to classroom learning and the manner in which texting mediated this effect. Survey research of 190 college students at a university in the Northeast United States found that college students' self-regulation was negatively related to their text messaging use during class; text messaging use during class was negatively related to student sustained attention to classroom learning (Wei et al., 2012). Structural equation modeling analysis found texting during class to partially mediate effect of students' self-regulation on their sustained attention to classroom learning. Moreover, students' sustained attention fully mediates effect of in-class texting on experience-oriented learning. Thus, college students with high levels of self-regulation are less likely to text during class and more likely to maintain attention to classroom learning.

Analysis of Cognitive Effects

The literature review supports a negative cognitive view of media multitasking; the primary means by which media multitasking decreases academic performance is via cognitive strain. Media multitasking distracts students from the primary academic task, depleting attention sources much more rapidly for multitaskers than non-multitasking students. Hence, students experience decrements to academic performance. Moreover, the research reviewed supports Van dur Schuur and colleagues' (2015) scattered attention hypothesis. Similar to the cognitive theory of multimedia learning, this hypothesis maintains that media multitasking negatively affects cognitive control by distracting the individual from the primary activity and highly demanding attentional capacity.
The theories of working memory discussed previously are highlighted by research examining the lack of self-regulatory skills in adolescents and early adults when multitasking. Visual working memory theories discuss methods of processing for goal-directed vision. Self-regulation and motivation affect the selection and maintenance for task-related visual targets. For example, research indicating the role of metacognition in mediating the effects of multitasking on reading comprehension point to the intersection of self-regulation and working memory. Visual working memory theories examine the role of self-regulation in selecting and maintaining task-relevant visual targets. This, coupled with literature discussed previously examining self-regulation, point to the important role of self-awareness in mitigating media multitasking.

In academic environments, media multitasking often occurs in the classroom and is a major inhibitor of attention and performance. Such occurrences of media multitasking frequently involves texting or off-task laptop use in class. Media multitasking is detrimental to academic capacities for both those multitasking and classroom peers in the vicinity. These negative effects of multitasking on cognition are not buffered by achievement level. Media multitasking frequently occurs in university classrooms; however, it is not limited to being an academic activity. Outside of the classroom media multitasking can serve to meet social needs and bridge social gaps. Media multitasking in social context is less detrimental because social interactions require less cognitive resources; however, it is not without its negative effect, particularly for mental health and psychological well-being. Still, media multitasking in social contexts can serve to increase prosocial behavior and feelings of closeness as it can occur
as a bridging factor. Theories and research regarding socio-emotional functioning with respect to media multitasking are considered next.

**Socioemotional Well-being**

Besides cognitive effects, multiple studies indicate influences of media multitasking on social-emotional functioning, in particular with respect to psychological distress, social connection, and entertainment/enjoyment. Erikson’s Theory of Psychosocial Development and Socioemotional Selectivity Theory provide a theoretical backbone to research assessing the impact of media multitasking on socioemotional well-being.

**Theoretical Foundation**

**Erikson’s Theory of Psychosocial Development.** Erikson’s Theory of Psychosocial Development identifies a series of eight stages a healthy individual encounters throughout progression from infancy to late adulthood (Erikson, 1950). These stages chart ego development across the lifespan. Stages are successive, building upon the successful completion of earlier phases. Each stage presents new challenges the individual ideally masters. The theory centralizes around the notion of an individual advancing through the eight stages of life via negotiation of biological forces and sociocultural forces. Each stage presents a psychosocial crisis of these two conflicting forces—a biological force and a sociocultural force—that the individual must reconcile. If the individual achieves reconciliation, he or she emerges from the stage with the corresponding virtue. According to Erikson, healthy ego development is dependent on mastery of specific developmental tasks and normative crises associated with each
lifecycle stage. The age brackets for each life stage are fluid; thus, university students experience a mix of both identity versus identity diffusion and intimacy versus isolation.

Adolescence (characterized as ages 13-19 by Erikson) revolves around the contradiction of identity versus role confusion. The adolescent is concerned with how they appear to others and the potential to achieve identity via occupation, gender roles, politics, or religion. The adolescent struggles to achieve superego identity in which the outward self matches the inner identity. Initially, adolescents experience role confusion as they struggle to determine the specific manner in which they will fit into society, and consequently may experiment with various behaviors and activities. However, Erikson proposed that adolescents eventually must achieve a sense of identity and confidently know who they are and the direction their life is headed. According to Erikson, stable identity requires integration of past, formative experiences with anticipations of future experiences (Brandell & Brown, 2015). Erikson identified seven aspects of identity consolidation that serve as critical determinants of success or failure in this stage: (1) a time perspective, (2) self-certainty, (3) role experimentation, (4) anticipation of achievement, (5) sexual identity, (6) acceptance of leadership, and (7) commitment to basic values (Brandell & Ringel, 2007). Failure to achieve identity consolidation might bring considerable developmental diversion or specific forms of psychopathology such as depressive symptoms, characterological disorders, and disturbances of sexual identity (Brandell & Brown, 2015).

Early adulthood (ages 20-39 years) is challenged by a conflict of intimacy versus isolation (Erikson, 1950). Upon established identities from the conflict of adolescence,
individuals begin to seek long-term commitments with other individuals. Individuals become capable of forming intimate, reciprocal relationships in which they willingly make the sacrifices and compromises necessary for intimacy. Conversely, if a young adult is unable to achieve intimacy, isolation occurs. This incites feelings of darkness and angst.

Erikson’s Theory of Psychosocial Development illustrates the profound impact of cultural influences—such as media and technology—on individual development (Brandell & Brown, 2015). The finalized personality of the individual is subject to various influences. These influences are culture specific but could also be derived from complex geographical, economic, and social forces. Whereas psychoanalytic authors prior to Erikson merely hinted at these influences, Erikson’s Theory of Psychosocial Development broadened the scope of personality to include society and culture, not just sexuality. In the case of modern psychosocial development, technology is a pervasive cultural force. Thus, personalities will be formed amidst the influence of technology, media, and a culture which often promotes multitasking with media devices.

**Socioemotional Selectivity Theory.** Socioemotional Selectivity Theory (SST) states that social motivations become more selective across the lifespan (Chang, Choi, Bazarova, & Lockenhoff, 2015). As individuals age, people invest greater resources into emotionally meaningful goals, activity, and people in order to maximize positive emotional experiences. SST impacts the manner in which individuals develop and maintain social networks and technological contacts. According to SST, individuals compose social networks that satisfy their social goals and improve their well-being,
emphasizing characteristics specific to their age group. During adolescence and young adulthood, individuals have open-ended time horizons which permit prioritization of future optimization. This may entail acquisition of new information, pursuit of career goals, and the establishment of new social ties that will potentially offer important future resources. Younger adults’ future-oriented goals yield broad social networks composed of distant and novel acquaintances who may be potentially beneficial to career development and information gathering. On the other hand, older adults (age 65 and older) prioritize quality over quantity. Older adults systematically prune their social networks in order to ensure that social partners satisfy emotional needs. Older adults become increasingly aware of time limitations. This catalyzes prioritization of present-oriented goals which avoid negative emotional states and provide positive states. Goals orient towards satisfying a need for social belonging, finding meaning in life, and maintaining relational intimacy. Older adults develop social networks composed of close social partners and fewer distant acquaintances comparative to younger adults. This is because older adults actively discontinue distant social ties in favor of closer ones. Furthermore, older adults are more likely than younger adults to be satisfied with their current network size and do not want to increase it by including new friends (Lansford, Sherman, & Antonucci, 1998).

Principles of Socioemotional Selectivity Theory are well-supported in the realm of offline social networks; however, their tenets are less researched in online social networks. Pfeil, Arjan, & Zaphiris (2008) found that age differences in online network size parallels patterns observed in offline social networks. A study by Chang and
colleagues (2015) examining the association of age with online social networking yielded findings consistent with the age-related changes in social network size and composition proposed by SST. Network size was negatively associated with age, but the proportion of meaningful online friendships (Facebook friends considered to be actual friends) was positively associated with age. Furthermore, a higher proportion of actual to total Facebook friends was associated with diminished levels of social isolation and loneliness. Therefore, online social networks of older adults are more conducive to well-being than those of younger adults.

Social media and technology are increasingly becoming more integral to development in modern adolescence and young adulthood (Brandell & Brown, 2015). Thus, much of adolescent and young adult social interaction is via online or technological venues such as Facebook and text messaging. Media is widely the primary method through which students interact, communicate, and develop intimacy (Brandell & Brown, 2015). Researchers and clinicians have identified significant issues of concern arising from media multitasking in adolescence and early adulthood. Other studies, however, point to the success of technology in reducing social barriers for some students (Straker, Pollock, & Maslen, 2009). Brandell & Brown (2015) argue that the increasing reliance the modern world places on technology and the pervasive pressure of social media websites complicate navigation of a developmental stage that was already innately challenging. This paper aims to juxtapose the literature reviewed to preceding theoretical foundation in order to determine the manner in which media multitasking aligns—or disrupts—the above components of human socioemotional development.
Psychological Distress

An increasing amount of literature points to the impact of technology on mental health and the manner in which technological use can produce symptoms of psychological distress or disorders, including depression, anxiety, and increased stress levels. Mark, Wang, and Niiya (2014) logged computer activity and used biosensors to measure stress of 48 undergraduates for 7 days for all waking hours. They found a significant positive relationship with stress and daily time spent on computers. Moreover, stress was positively associated with amount of time spent multitasking and negatively associated with Facebook and social media use.

A similar study of undergraduate technology use found maladaptive use of the Internet and mobile phones (i.e., Internet use that has negative effects on behavior, and/or leads to the deterioration of family and social relationships, reduction of other activities, loss of control, tendency to evade problems, and craving more Internet use for satisfaction) to be related to psychological distress (Beranuy, Oberst, Carbonell, & Chamarro, 2009). This study examined the relationship between maladaptive use of the Internet and the mobile phone with psychological distress. The researchers also examined the role of emotional factors in the development of psychological problems related to abuse of information and communication technologies. Maladaptive use was defined as addictive use. In this study, 365 undergraduate freshmen at a university in Spain replied to scales assessing the negative consequences of maladaptive use of the Internet, the mobile phone, a self-report scale on Perceived Emotional Intelligence, and a clinical instrument assessing the presence of psychological distress (Beranuy et al., 2009). These
results affirm those of similar studies; problematic Internet users demonstrate less self-esteem, sleep disturbances, and more loneliness, depression, and anxiety.

The study by Beranuy and colleagues (2009) also pointed to a relationship between the subcomponents of Perceived Emotional Intelligence and maladaptive use. Specifically, the Repair component (degree to which correspondents believe they are able to repair their emotions) is related to less maladaptive use while the Attention (degree to which correspondents pay attention to their moods or emotions) component is related to increased maladaptive use of the Internet and the mobile phone. As indicated in a regression analysis, the subcomponents of Perceived Emotional Intelligence can be predictive of maladaptive use, but to a lesser degree than maladaptive use itself.

Moreover, this study indicated that females show more negative consequences of maladaptive mobile phone use than their male peers. This may be in part due to motivational factors that drive mobile phone use. Females typically use mobile phones to establish and maintain social relationships; males gravitate towards commercial aspects, coordination, and entertainment (Bianchi & Phillips, 2005). Furthermore, women typically score higher than males in the Attention component of the Perceived Emotional Intelligence scale (Beranuy et al., 2009). Maintaining social relationships requires more emotional engagement than entertainment. Thus, females are more vulnerable to experiencing psychological distress due to mobile phone usage. This is because while using mobile phones females tend to engage in more emotionally-loaded issues and consequently in ruminating about these issues.
While some studies focus on a particular technological medium (laptops versus mobile phones), multiple studies examine the effect of media multitasking on mental well-being across broad technological domains, one of the most notable being that of Pea and colleagues (2012). The notoriety of the study derives from the magnitude of the sample (Pea, Nass, Meheula, Rinance, Kumar, Bamford, & Zhou, 2012). They conducted an online survey of 3,461 North American girls ages 8-12 examining the relationships between social well-being and young girls’ media use. The survey link was advertised in the August/September 2010 issue of the bimonthly Discovery Girls magazine, an American publication that targets 8- to 12-year-old girls and regularly conducts similar surveys of readers. Participants completed the survey online in order to be entered into a drawing for a free iPod. The first survey ran for approximately 2 weeks and received 2,301 valid responses. A second survey with several supplemental questions was released for an additional two weeks and obtained 1,160, for a total of 3,461 respondents.

The impressive sample size is offset by the limitations of Internet surveys. By nature, this sample is not representative of the U.S. population of 8- to 12-year-old girls. The study is restricted to readers of Discovery Girls magazine with computer access. 95% of respondents had at-home computer access, which is well above the national average. Although Pea and colleagues (2012) did not obtain parent income, race, or ethnicity data, this suggests a sample potentially limited by a sample without variation of socioeconomic status, race, or ethnicity. However, Pea and colleagues (2012) argued in their paper that the data set is “arguably much richer and broader than most extant research with children examining relationships between variables instead of absolute values” (p. 329). They
continued to state that virtually any classroom research suffers from more serious population constraints, and that the descriptive statistics of their final sample were similar to that of existing studies with more robust sampling criteria. Thus, while they urge caution in interpreting base rates of the variables, Pea and his team (2012) felt “guardedly optimistic” that the relationships between variables were not strongly affected by potential biases (p. 329).

The study focused on the relation of media use and multitasking to feelings of social success, to the developmental task of maintaining feelings of normalcy and not feeling rejected comparative to peers, to how many friends one’s parents think are a bad influence, to hours of sleep, and to the predominant source of girls’ experience of both positive and negative feelings. Media assessed included video, video games, music listening, reading/homework, e-mailing/posting on social media sites, texting/instant messaging, and talking on phones/video chatting. Participants first reported media usage for each variable assessed as well as reporting frequency of multitasking with each pair of medias. Media multitasking was associated with multiple negative socioemotional outcomes in the girls, such as feeling less social success, not feeling normal, having more friends whom parents perceive as bad influences, and sleeping less. Media multitasking was associated with more intense feelings (both positive and negative) toward online friends than in-person friends even when controlled for amount of media use. Internet use and online activities such as Facebook have been shown to predict well-being and health concerns. For tweens, an in-bedroom television or cell phone was associated with less sleep and greater media multitasking.
A similar survey study was carried out in China. A survey of 320 Chinese adolescents (aged 11 to 18 years) of media multitasking with several mediums (texting, instant messaging, emailing, social network sites, non-social text-oriented websites, talking on the phone, video chatting, listening to music, watching TV and movies, and playing video or online games) was also significantly negatively associated with psychological well-being (Yang, Xu, & Zhu, 2015). Participants completed the questionnaires examining media use, mental health, and time management. A structural equation model assessed possible relationships among media multitasking, time management, and psychological well-being. The media multitasking index of the sample was 2.5, meaning that adolescents had access to 2.5 other media tasks when performing a primary media task. Media multitasking was significantly negatively associated with psychological well-being and time management. In participants with a high level of time management, media multitasking was negatively associated with well-being; however, for adolescents with a low level of time management, there was no significant difference between high and low media multitaskers. This indicates that time management disposition can moderate the relationship between media multitasking and psychological well-being. However, this also indicates that individuals with higher time management skills are more sensitive to the negative effects of media multitasking on wellbeing.

Becker, Alzahabi, & Hopwood (2013) conducted a similar study as Pea et al. (2012) and Yang et al. (2015) although studying undergraduate students as opposed to adolescents. Three hundred and eighteen college undergraduates completed online surveys of media use, personality characteristics, depression, and social anxiety.
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Researchers assessed 12 primary forms of media use: television, computer-based video, telephone and mobile phone, instant messaging, SMS (text messaging), email, web surfing, and other computer-based applications (such as word-processing). Poor attentional control (as caused by frequent media multitasking) seemed to maintain and at times cause depression and anxiety. Their research pointed to a correlation of increased media multitasking with higher depression and social anxiety symptoms, even after controlling for overall media use and the personality traits of neuroticism and extraversion. The correlation of media multitasking with psychosocial dysfunction suggests that media multitasking may present a unique risk factor for mental health problems related to mood and anxiety. Cultural influence of technology and the pervasiveness of media multitasking further complicates the innately arduous development stage of adolescence. Navigation of developmental conflicts, such as those represented by Erikson’s Psychosocial Theory of Development, is confounded by the increasing reliance the modern world places on technology and the pressure of social media websites. Inability to successfully negotiate developmental conflicts causes psychological distress, such as those manifested in studies examining the effect of media multitasking on socioemotional well-being.

Social Connection

Students—particularly females—frequently report using technology in order to maintain social connections. A qualitative study by Ames (2013) examined university student iPhone multitasking management through the techno-social perspective. After interviewing 57 students, observing students on-campus for 30 hours, and surveying 177
students, Ames (2013) identified a pecking order resulting from the ubiquity of cell phones and the social pressure for constant connection. Ames (2013) identified three concepts that contributed to college students’ multitasking with iPhone: (a) the social need of constantly connecting with others; (b) the pecking order of who is well connected and who is poorly connected; and (c) the deliberate reduction of mobile phone multitasking to reduce the negative effect (Ames, 2013). This pressure for constant connection—pressure to be present in one’s immediate surroundings and over the technological network simultaneously—created a techno-social pecking order in which students rank people and devices in order of importance.

Media multitasking—during face-to-face communication and classroom lectures—has become a new “norm” (Xu, Wang, & David, 2016). Social success is cultivated through interpersonal conversations, closeness, and connection; thus, the feeling of normalcy closely relates to social and peer norms and the adoption of group behaviors. This often produced feelings of guilt and stress while multitasking. This negative effect incited personal desires of techno-resistance from some students—a reduction of technological use—though students would not go through with this reduction due to social pressure.

Deep engagement in media multitasking is found to result in disengagement from important social functions (Wallis, 2010). Multitasking with mobile phones during face-to-face conversation diverts attention away from one’s present social interactions and orients one’s thoughts to people, places, and activities outside the immediate spatial
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context, which in turn has the potential to strain social interactions and relationships (Xu et al., 2016).

In the self-report study of adolescent girls by Pea et al. (2012) discussed in the previous section, media multitasking in social environments is negatively associated with social success, normalcy, and self-control. Of the tweens sampled, approximately half attributed their negative feelings to online friends, whereas the other half attributed their negative feelings to in-person friends (i.e., “feel judged,” “more stressed,” “hurt feelings”). Still, media multitasking was associated with a greater orientation to finding positive feelings from online friends. However, media multitasking was associated with having more friends whom parents perceive as bad influences. A similar study assessing survey response of an older sample (375 undergraduate and graduate students, ages 18-38 years old) from 59 universities in Beijing, China found media multitasking during synchronous social interactions to be associated with lower social success (Xu et al., 2016). However, media multitasking during entertainment activities was associated with increased social success, normalcy, and self-control.

Experimental studies reinforce the survey results. The mere presence of mobile phones can diminish experience of face-to-face conversation (Przybylski & Weinstein, 2012). Seventy-four participants were randomly assigned to a phone absent or phone present condition for a dual-experiment study. In the phone-present condition, a mobile phone was placed on a nearby desk outside participants’ direct visual field. In the phone-absent condition, a paper notebook was placed on the desk instead. Participants role-played a relationship formation task to emulate a typical real-life conversation. Topics of
various levels of intimacy were presented, i.e. "Discuss an interesting event that occurred to you over the past month," was a moderately intimate topic. Conversations occurred in a private booth with a randomly assigned partner in which conversation pairs spent 10 minutes discussing the topic together. Following the conversation, participants completed measures assessing relationship quality over time and emotional sensitivity in both committed and newly formed relationships. The visual presence of a mobile phone had negative effects on perceived closeness, connection, and conversation quality by conversation participants. Partners in the mobile phone condition felt less close with their partners and reported a lower quality of relationships than conversation partners in the notebook condition. These effects were most apparent when the participants were discussing personally meaningful topics.

Experiment two of the same study used a between-subjects design to explore which relational contexts mobile phones most affected through manipulation of discussion topic (Przybylski & Weinstein, 2012). For this, 68 participants were randomly assigned to the absent or present phone condition and to either a casual or meaningful conversation condition. Participants in the casual conversation condition were instructed to discuss their thoughts and feelings about plastic holiday trees while those in the meaningful condition were instructed to discuss the most meaningful events of the past year. As in the first experiment, mobile phone presence predicted lower ratings of relationship quality and less trust between partners. In both experiments, meaningful conversations marginally encouraged trust. Analyses showed no effect of presence of mobile phone when the conversation was casual, but its presence predicted lower
relationship quality when the conversation was meaningful. Partners who attempted to hold a meaningful conversation in the presence of a mobile phone reported less trust than participants in the notebook condition.

These results demonstrated that the mere presence of mobile phones might interfere with human relationship formation, inhibiting the development of interpersonal closeness and trust and reducing the extent to which individuals felt empathy and understanding from their partners, particularly when discussing a personally meaningful topic. While meaningful conversation topics encourage intimacy and trust in the absence of technology, the presence of technology has the opposite effect, reducing intimacy and trust. The debriefing procedure suggests that these effects occur outside of conscious awareness.

Entertainment and Enjoyment

In spite of potential detrimental socioemotional effects of media multitasking, media multitasking can yield immediate satisfaction of emotional and entertainment needs, even when not consciously sought after. Nineteen undergraduate students at a large university in the Midwestern United States participated in an experimental study examining the relationship between media multitasking and gratification of personal needs (Wang & Tchernev, 2012). Each participant was provided with a cellphone-like device to report their activities, both media- and non-media-related, three times per day for 4 weeks. Participants were reminded to submit their reports at midday, in the evening, and before they went to bed. Media activity were noted by general media type (e.g., computer, radio, print, television, or phone) and by specific subtypes within that medium
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(e.g., for computer-based activities, subtypes included browsing online, social networking etc.). Non media activities were divided into categories such as work, learning, recreation, and housework. For each activity, participants reported the type of activity, the duration, and whether any other activities were performed simultaneously. Participants also provided their motivations for doing the activity from a list of seven potential needs: fun/entertainment, relaxation/killing time, information, study/work, social (personal), social (professional), and habits/background noise. For each need, they reported the strength of their desire to media multitask and gratifications. Data was averaged over the three reporting time periods of the day, resulting in one data point per day and 28 data points in total for each time series.

Data indicated that cognitive needs are not satisfied by media multitasking; however, emotional gratifications are obtained (Wang & Tchernev, 2012). This potentially indicates the driving motivation to multitask at the cost of cognitive needs. Wang and Tchernev (2012) point to Uses and Gratifications theory as an explanation for this phenomenon. Media multitasking increases gratification which consequently reduces needs in real time. Although cognitive needs are not met by media multitasking, emotional needs—such as feeling entertained or relaxed—are met. Thus, emotional gratifications are a bi-product of multitasking and the misperception that multitasking increases efficiency is a result of misplaced gratification. For example, a student watching television while studying might feel satisfied not because they were effective at studying, but because the addition of television made the studying entertaining. Wang & Tchernev (2012) suggest that the emotional gratification associated with multitasking is
similar to the formation of implicit attitudes through classical conditioning. Multitasking is habitual and can be self-reinforcing. Data from this study indicates that habitual needs increase media multitasking and are also gratified by media multitasking. However, emotional gratification itself is a function of emotional needs and multitasking. Multitasking increases emotional gratification when emotional needs are low, but decreases emotional gratification if needs are high.

Multitasking while watching television—when performed as a social activity—can have a positive effect on gratification of prosocial behavior, perceptions of trust and engagement, as well as enjoyment (Xu et al., 2016). For example, interacting with family members while viewing television enhanced children’s prosocial behavior. If mobile devices are used to interact with television programs and advertisements, perceptions of trust and engagement are positively affected as people are able to engage more fully in the content. Multitasking can also mitigate interruption via commercials or advertisements. Wang & Tchernev (2012) surmise that this phenomenon explains why people increasingly multitask at the cost of cognitive needs: when media multitasking emotional gratifications are obtained despite not being actively sought.

In a study examining the effect of multitasking on evaluation of tasks and task content, participants either focused entirely on commercials or performed additional tasks concurrent to the commercial viewing (Chinchanchokchhai, et al., 2015). One-hundred and eighty-six undergraduate students at a Midwestern university participated in this study. The study was a one-factor between-subjects design with three conditions: single task/two tasks/three tasks. In the single-task condition, participants watched nine
commercials on a computer screen and provided an evaluation of the commercials. Each commercial played without sound to ensure the task was visual. In the two-task condition, participants watched the commercials while simultaneously monitoring another window on the computer screen in which an “x” or “z” appeared randomly. Participants were asked to type the respective letters as they appeared. In the three-task condition, participants received an additional task in which they pressed the period key when a black circle appeared in a lower-right hand box on the computer screen. Participants in the two- and three-task conditions performed the additional tasks while simultaneously watching the commercials. The design was meant to simulate several open windows on a computer screen. After completing the tasks participants were asked how time seemed to progress for them during the viewing time, how much they enjoyed the task, and to evaluate the commercials. Results indicated that performance of additional on-screen tasks simultaneously with commercials playing led participants to perceive time as passing more quickly comparative to solely watching commercials and that multi-window multitasking increased overall task enjoyment and increased ad evaluations, mediated by the perception of how quickly time was passing while the ads were playing.

Analysis of Socioemotional Effects

The influence of contemporary technological culture and the ubiquity of media multitasking complicates the negotiation of developmental conflicts, such as those discussed previously as part of Erikson’s Eight Stages of Psychosocial Development (Erikson, 1950). As students strive to achieve identity and intimacy, technology becomes
a means for achieving these goals. Modern technology offers near-infinite opportunity for building social connections; technology and media multitasking can potentially serve as tools to achieve virtues of the ego. However, there is a potential for negative impact such as psychological dysfunction, deterioration of social relationships, or reduction of other activities.

Studies like that of Ames (2013) provide evidence for media multitasking as an extension of the developmental search for identity and intimacy as well as confirming socioemotional selectivity theory. Students media multitask in order to keep up with the social pressure for constant connection, as well as to build relationships. Ames (2013) postulates that this leads students to create a techno-social pecking order in which students rank people and devices in order of importance (Ames, 2013). This techno-social pecking order parallels Socioemotional Selectivity Theory in which individuals prioritize relationships according to age-related motivational goals (Brandell & Brown, 2015). According to Ames’ (2013) techno-social perspective, students must rank people and devices in order of importance due to modern pressure for constant connection. This pressure to be present in one’s immediate surroundings while simultaneously maintaining presence over the technological network simultaneously requires students to create their own pecking order detailing the importance of their social selections. This pecking order is in essence a prioritization of certain social contacts over others, as discussed in Socioemotional Selectivity Theory. As seen in Socioemotional Selectivity, adolescents and young adults struggle to develop and maintain this pecking order, instead desperately striving—and failing—to maintain simultaneous connection in immediate surroundings.
and over online networks. According traditionally, students are less able to do this, instead having a broad yet shallow collection of acquaintances. However, data from Ames (2013) suggests that the pervasive, constant, and rapidly updating nature of media necessitates prioritization of social relationships in adolescence, at least in the online sense. The social pressure for constant connection requires that adolescents and young adults to rank people and devices in order of importance. This creates cognitive strain which incites a plethora of negative socioemotional effect.

**Discussion**

Media multitasking is detrimental to academic capacities for both those multitasking and classroom peers in the vicinity. Facebook and texting are the most heavily researched mediums as they are the technology of choice for students and pose the biggest issues in class. Both Facebook and texting are negatively related to GPA after controlling for demographic variables, self-efficacy for self-regulated learning, and self-efficacy for academic achievement. Furthermore, students not using mobile phones take better notes and score significantly higher than peers using mobile phones. In one study, non-multitasking students wrote down 62% more information and scored a full letter grade and a half higher on a multiple choice test than their multitasking peers (Kuznekoff & Titsworth, 2013). Unfortunately, the effects of media multitasking are not limited to the individual multitaskers. Laptop multitasking in class hinders learning for both users and nearby peers (Fried, 2008; Sana et al., 2013). This illustrates the importance of research examining the relationship of media multitasking and academic achievement. Of the literature reviewed, all cognitive effects of media multitasking are negative. Inside of
the classroom, media multitasking is negatively associated with GPA, test performance, and note-taking. These effects are not mediated by achievement level and impact non-multitasking peers with a multitasker in the visual field. Outside of the classroom, media multitasking is negatively associated with efficiency and reading comprehension. These effects are mediated by self-regulation and metacognition; students may account for deficits in comprehension by rereading, thus improving comprehension but diminishing efficiency. This is indicative of information processing theory, which states that because attention is a limited resource, media multitasking hastens depletion of attentional resources, thus diminishing performance on the primary task.

College students who reported texting while doing homework spent more time studying outside of class, thereby contributing to inefficient study habits (Bowman et al., 2010; Fox et al., 2009). When performed during reading tasks, media multitasking negatively impacts efficiency but does not always affect comprehension. The role of media multitasking on comprehension is dependent on self-regulation and self-awareness. Students who are particularly metacognitive or self-aware recognized deficits in comprehension upon returning to the primary task and subsequently re-read certain parts of the article after interruption. Although this increases reading time, it can make up for deficits in comprehension. While this is acceptable for academic tasks which are not completed under time-constraints such as homework assignments, multitasking during time-contingent academic tasks such as an essay or in-class lecture is problematic; the student cannot make up for deficits in comprehension via repeated exposure to the text without costs to performance. Thus, the type of work matters when examining the impact
of media multitasking on performance. Research on the relationship of metacognition and the effects of multitasking on reading comprehension illustrate the intersection of self-regulation and working memory. Visual working memory theories examine the role of self-regulation in selecting and maintaining task-relevant visual targets. Thus, self-awareness is critical in mitigating the effects of media multitasking.

These effects may be suggestive of the trained attention hypothesis by Van dur Schuur and colleagues (2015). This hypothesis asserts that media multitasking offers some positive effect to cognition, namely that ability to filter irrelevant information could improve through frequent practice multitasking. The vast majority of research does not support this hypothesis, yet in the case of research discussed in this review, students were able to identify a lack of relevant information and adjust by re-reading (Bowman et al., 2010; Fox et al., 2009). Lui and Wong (2012) found that a higher degree of media multitasking is associated with better multisensory integration, particularly for children who have high neural plasticity. Areas for future research include extension of Lui and Wong’s (2012) work to older students. Further research examining the trained attention hypothesis is necessary to determine its validity. For example, research examining its applicability to different academic tasks such as note-taking, essay writing, or listening to lectures is needed. Finally, research should examine whether the positive effects illustrated by the trained attention hypothesis—such as efficient coping with multiple streams of information, improvement of ability to determine relevant from irrelevant information, and improved multisensory integration—are outweighed by the deleterious
effects discussed in theories such as bottleneck theory, the scattered attention hypothesis, and theories of working memory.

Media multitasking results in multiple negative socio-emotional outcomes with respect to usage, psychological distress, diminished sleep, and higher levels of social stress. However, the impact of media multitasking on socioemotional functioning is dependent upon the role of social media in the activity. If media multitasking occurs individually, there is a tendency for negative effects to socioemotional functioning. If media multitasking occurs as a collective group activity--a social activity--then it can yield positive effect. This is perhaps in part due to Erikson's Theory of Psychosocial Development which states that students are actively striving to find identity, and later intimacy. Because of the cultural esteem and universality of technology, media multitasking potentially serves as a means to achieve identity, intimacy, or social connection. Research on the socio-emotional effects of media multitasking should be extended to university students since most of the work has focused on early adolescents or high school students. Are college students better able to handle the potential detrimental effects? If so, could it be due to their maturity or due to experience earlier in development with social media? The association of media multitasking with psychosocial dysfunction suggests that media multitasking may present a unique risk factor for mental health problems related to mood and anxiety. Symptom response to high media multitasking parallels symptoms of many psychological disorders (i.e., deterioration of family and social relationships, reduction of other activities, loss of control, tendency to evade problems, cravings/symptoms of addiction, loss of sleep).
Synchronous social interactions (using media while trying to have a verbal conversation) is negatively associated with social success, connection, normalcy (feeling normal comparative to peers), and self-control. These effects are not limited to phone usage; visual presence of a phone has negative effects on perceptions of closeness, connection, and conversation quality (Przybylski & Weinstein, 2012). These effects are most pronounced when discussing personally meaningful topics.

However, media multitasking has a positive effect when done for entertainment purposes if both activities are related. This is because multitasking while watching television can be a social activity. For example, using mobile phones to interact with family members or friends while watching television, or to engage with the program, can incite an increase in social success, feelings of normalcy, self-control, pro-social behavior, trust, engagement, and enjoyment. Media multitasking can mitigate interruptions via commercials or advertisements. Media multitasking can serve to transform individual activities into group activities (watching television by oneself can become a social activity if the individual texts other individuals who are also watching the show, or engages in online chatrooms or live-tweets discussing the show, for example). Furthermore, media multitasking while watching television can bring immediate satisfaction of emotional and entertainment needs, even when not consciously sought after (Wang & Tcherney, 2012).

Self-regulation

Self-regulation is an important skill in addressing media multitasking. Students do not effectively self-regulate their media multitasking and are poor at recognizing and
regulating inhibitors of performance. Despite students readily acknowledging
multitasking divides attention, the behavior persists. Furthermore, while students
recognize that multitasking divides their attention, they do not accurately predict its
impact on task performance. Media multitasking reduces both accuracy and confidence in
prediction. Self-regulation is an important skill in addressing multitasking and is an area
of interest for future research, as students are not successful in managing their
multitasking to avoid inhibiting performance or efficiency. Several of the studies
reviewed employed an experimental design in which students listened to a lecture, some
in a texting condition and others in a non-texting condition, and then took an assessment
of lecture content. Elder (2013) found no difference in quiz scores of those who used
devices during lecture and those who did not; however, Gingerich and Lineweaver (2014)
found that students in the non-multitasking group in an experiment of a similar design to
have higher scores on the quiz. These studies were conducted with students of different
courses. Further research examining the types of examinations and assignment formats,
levels of difficulty, and grading methods is needed. These may be factors that account for
variations in the relationship between students’ sustained attention and measured
academic performance. For example, Elder (2013) used 16 short answer and matching
items to assess lecture comprehension, while Gingerich and Lineweaver (2014) used a
multiple choice quiz. Future studies might examine the role of type of assessment.

Students are not metacognizant of their abilities to multitask nor the effects of
multitasking. There is a tendency of people to overestimate their multitasking ability.
Zhang (2015) found that self-regulation behaviors are negatively associated with in-class
laptop multitasking. In-class multitasking is related to a lack of self-regulation, indicating the need for educators and parents to encourage students' self-regulation of laptop multitasking behaviors through increases student self-efficacy and learning motivations. Research on methods to foster student recognition of the deleterious effects of media multitasking, as well as development of self-regulation skills, offer insight to classroom technology policy and instruction.

**Implications**

**Implications for teachers.** Research establishes that technology does offer benefits to the educational experience. In balancing these benefits with the negative effects of media multitasking it comes to an issue of appropriate implementation of technology in the classroom as well as the development of self-monitoring skills in students. The effect of media multitasking is dependent upon appropriate implementation of technology. Studies analyzing laptop use in the classroom reveal effects dependent upon classroom environment (structured vs. unstructured use of technology) and the manner in which the laptop was used (on-task vs. off-task multitasking). Clearly stated mobile phone policy on syllabus decreases student mobile phone use in the classroom (Chen & Yan, 2016). Complex tasks emphasizing project-based learning and construction of knowledge encouraged on-task laptop use rather than recitation or drill-and-practice tasks that resulted in off-task usage (Mouza, 2008). Class observation indicated that laptops enhances student-centered, hands-on, and exploratory learning and student-to-student and student-to-instructor interactions (Barak, Lipson, & Lerman, 2006).
Suggested methods include employing classroom curriculum in which laptops are incorporated into curriculum as opposed to a laptop-free classroom or laptop ban.

**Implications for parents.** Because research indicates that student media multitasking extends to outside of the classroom, and because studies establish the negative impact of multitasking on academic performance, parents should be advised to carefully monitor their child's technology use when working on school assignments. Limiting technology use to be only when school assignments are complete, keeping technology in communal areas of the house, or providing other measures to discourage off-task multitasking helps facilitate learning and efficient studying.

Furthermore, parents should be especially aware of their child's predisposition to socioemotional issues such as psychological distress or mental health issues brought on by media multitasking. Students of adolescent or young adult age are at a heightened risk to experience multiple negative socioemotional outcomes such as depression, anxiety, increased stress, psychological distress, less self-esteem, sleep disturbances, or increased loneliness due to media multitasking. While monitoring and limiting technology usage can potentially moderate these effects, parents should be mindful that modern students utilize technology and media multitasking to achieve critical components of adolescent development such as identity, intimacy, and social connection. Females typically use technology to establish and maintain social relationships while males tend to gravitate towards commercial aspects, coordination, and entertainment. Social media and technology are increasingly becoming fundamental elements of development in modern adolescence and young adulthood (Brandell & Brown, 2015). Media is widely the
primary method that students interact, communicate, and develop intimacy. Media multitasking and technology use can positively affect social development, facilitating social connection and reducing social barriers for some students (Straker et al., 2009). Furthermore, technology can serve as a tool to achieve other aspects of psychosocial development, such as identity and intimacy, as discussed in Erikson's Psychosocial Theory of Development. Parents must be aware that while technology and social media websites complicate navigation of a developmental stage that was already innately challenging, these are tools critical to modern development. Balancing appropriate technology usage with potential negative effect requires careful parental consideration.

Implications for students. Students do not recognize the negative impact of media multitasking on academic performance. College students commonly report that multitasking increases productivity (Lin et al., 2015). Student education on the impact of media multitasking on academic performance will potentially foster self-awareness and perhaps self-regulation of multitasking habits. Because the collegiate education system highly relies on the independence and self-regulation of the student, classroom policy accounting for off-task technology use may fail to fully address issues of media multitasking. Self-regulation of multitasking habits is a necessary skillset for the modern student, and upon graduation, the modern professional. Developing self-regulation skills and positive technology use habits while in school prepares the student for balancing the modern workplace. Furthermore, awareness of the contexts during which media multitasking develops and diminishes healthy socioemotional development provides students guiding principles with which to use technology as a means to optimize social
connection and socioemotional well-being. These results may redefine the problematic variables of the educational technology debate, shifting the criticism from technology implementation to the manner in which usage is proctored.
References


MEDIA MULTITASKING


