A MIXED-METHODS STUDY INVESTIGATING THE RELATIONSHIP BETWEEN MEDIA MULTITASKING ORIENTATION AND GRADE POINT AVERAGE

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Dissertation Prepared for the Degree of

DOCTOR OF PHILOSOPHY

UNIVERSITY OF NORTH TEXAS

August 2012

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The intent of this study was to examine the relationship between media multitasking orientation and grade point average. The study utilized a mixed-methods approach to investigate the research questions. In the quantitative section of the study, the primary method of statistical analyses was multiple regression. The independent variables for the study were media multitasking orientation, gender, age, and income. The dependent variable for the study was grade point average. Three out of four independent variables, namely, media multitasking orientation, gender and age were statistically significant predictors of grade point average. In the qualitative section of the study, seven participants were interviewed to determine how individual differences in media multitasking orientation manifest themselves in academic settings.
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ACKNOWLEDGEMENTS

I am thankful for the guidance of my dissertation committee: Dr. Lin Lin, Dr. Demetria Ennis-Cole, and Dr. Greg Jones. Most importantly, I am grateful for the support of my family and friends. This dissertation is dedicated to my brother, Dennis (1974-2002).
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CHAPTER 1

INTRODUCTION

Many people believe that multitasking is a way of life for the 21st century (Klingberg, 2009; Small & Vorgan, 2008). We live in a wired world where the boundaries between work and play; social and professional; public and private spheres are blurred. The blurred connections between these spheres would not have been possible without technology. Because of new technologies, we can connect to work from home; talk to a friend in Sydney, Australia while we read the latest news headlines on the web; or participate in a massively multiplayer online role-playing game. Many of the new technologies have enabled us to perform more than one task at a time. As a result of this, multitasking specifically with media and technologies has been on the rise. The phenomenon is especially prevalent among young Americans (Rideout, Foehr, & Roberts, 2010).

Technology has long been identified as the catalyst that allows us to do more with less effort. “Today, technologies are no longer tethered to one location and this leads workers to multitask in work contexts previously not possible” (Kleinman, 2010, p. 15). As a direct result of new technologies and media in the last fifty years, we have gradually moved away from a linear work model to one that thrives on task concurrency. The impacts of multitasking are also being felt outside the realm of work and the effects of multitasking are multigenerational. For example, employees often check their work emails after office hours. Many teenagers send hundreds of text messages throughout the day while they are engaged in school and social activities. It is clear that for many of us, multitasking is a socially acceptable and even desirable
trait. Time-related pressures in the professional, social, and academic domains have forced us
to be more productive and creative with the limited time that we have.

At the core of our busy world, “computer multitasking is the epicenter of media
multitasking” (Rideout, Foehr, & Roberts, 2010, p. 24). Some researchers posit that our abilities
to multitask have created a new wave of technologies designed to help us improve our
productivity. For example, Hembrooke and Gay (2003) contend that,

The ubiquity, pervasiveness and mobility of new technologies encourage a simultaneity
of activities that goes beyond anything our culture has heretofore ever known. Indeed,
the ability to engage in multiple tasks concurrently seems to be the very essence or core
motivation for the development of such technologies. (p. 1)

Consumers have all but embraced new technologies that allow users to perform multiple tasks.
Rask (2008) argues that the average consumer has little time to devote to one medium at a
time. She believes that, “busy lives and new and improved gadgets give consumers ample
reasons to effectively multitask both daily life and entertainment options” (p. 1). In a consumer-
driven, time-starved, and technology-rich economy, it comes as no surprise that Americans
especially our youth are avid users of various technologies and media.

Roberts and Foehr (2008) describe the American youth as being “awash in electronic
media” (p. 12). The word “awash” aptly describes a generation that grew up on a steady stream
of technological breakthroughs, newer and cheaper devices, and “wireless-everything.” Media
ownership and media consumption in the 16-24 age group are higher than ever before. In two
studies conducted by the Kaiser Family Foundation, researchers reported that young adults are
packing more media content into their daily lives through media multitasking (Rideout, Foehr,
& Roberts, 2010; Roberts, Foehr, & Rideout, 2006).
In 2010, the Kaiser Family Foundation conducted a large-scale media study in the United States. Over two thousand youths, ages 8 to 18, participated in the research on media use. Kaiser researchers, Rideout, Foehr, and Roberts, (2010), found that young people spent an average of 7 hours 38 minutes hours on media consumption. In terms of media exposure for the 7 hours 38 minutes of use, the young people surveyed packed an average total of 10 hours 45 minutes of media content daily by using various media simultaneously.  In contrast, when the researchers conducted a similar study in 2006 with 695 participants, they found that on the average media consumption among young adults stood at 6 hours 21 minutes a day. In the span of four years (2006-2010), we have seen a significant increase in media use. Today, media exposure in this age group accounts for 43.5% of the time spent in a day excluding school and sleep. American youth spent a substantial amount of time pairing audio and/or visual media with homework, eating, grooming, and traveling (Jeong & Fishbein, 2007).

The 2006 and 2010 Kaiser Foundation studies did not include data on time spent on the phone or texting, and computer use associated with school. If texting and phone conversation data were incorporated into Kaiser’s media surveys, the number of hours reported on media consumption would certainly rise significantly. Pew Internet researchers found that two out of three young people were cell phone owners (Lenhart, Purcell, Smith, & Zickuhr, 2010). Lenhart, Purcell, Smith, and Zickuhr (2010) reported that 20% of the media consumption in the 13-19 age group occurs on mobile devices. In addition, this group sends and receives more text messages than any other age group. According to Nielsen Wire (2010), an average American teen sends and receives 3339 text messages a month. That translates into 111 text messages per day.
Ironically, many young adults underestimate the time spent using and switching between media. Brasel and Gip (2011) conducted a study where 45 participants were allowed to watch television and use a computer for 30 minutes. The researchers taped the media multitasking habits and tracked the number of times the participants switched their attention between media. On the average, the participants switched their attention 120 times between the two media in the span of 30 minutes. Brasel and Gip (2011) reported that younger participants switched their attention between both media more frequently than the older participants.

The data tell us what we have already observed in our daily lives. We have a generation of young adults who is at ease tweeting and texting while simultaneously typing a term paper. They perceived multitasking as a part of their busy lives. What exactly is the cost of media multitasking? Gardner (2008) believes that media multitasking is “an area of concern to educators, technology leaders, instructional designers and consumers as it impacts the media environment and shapes the way media is consumed” (p. 3). This is because multitasking does not fit into our current understanding of how our brains function in a task-rich and time-sensitive environment.

Questions about how we allocate resources when it comes to handling multiple tasks simultaneously have been a subject of interests among researchers in many disciplines as we try to understand the phenomenon of media multitasking. Many young adults would even argue that multitasking actually helps them to concentrate (Roberts, Foehr, & Rideout, 2005). Some researchers support the view (Jenkins, Clinton, Purushotma, Robison, & Weigel, 2006; Prensky, 2001; Rosen, 2008; Small & Vorgan, 2008; Watson & Strayer, 2010) while other
researchers believe that we can only perform one task at a time (Pashler & Johnston, 1998; Salvucci & Taatgen, 2008).

Statement of Problem

Despite the growing body of research and attention on multitasking, studies on how media multitasking impacts learning habits have been far and few in between (e.g. Brasel & Gip, 2011; Fried, 2007; Gardner, 2008; Hembrooke & Gay, 2003; Ishizaka, Marshall, & Conte, 2001, Lee, Lin, & Robertson, 2011; Levine, Waite, & Bowman, 2007; Lin, Robertson, & Lee, 2009). In the last few years, there has been an undeniable need for greater understanding of the multitasking phenomenon as we surround ourselves with media and technology in all aspects of our lives. Applied to the context of this study, we need to address the research gap to understand the implications of multitasking in the learning environment. Anderson and Hanson (2009) argued that, "compared to reading research and theory, there is relatively little understanding of the cognitive, social, and emotional processes underlying media use or its short- and long-term implications" (p. 1205). Recent studies have focused on areas such as Multitasking Preference Inventory (Poposki & Oswald, 2010), gender differences in multitasking (Buser & Peter, 2012), and mental workload and task interruptions (Salvucci & Bogunovich, 2010). However, few researchers have examined the relationships between multitasking and academic performance.
Purpose of Study

The goal of this study is to examine the relationship between media multitasking orientation, gender, age, employment, living arrangement, income, and grade point average of undergraduate students. Additionally, the purpose of the study was to identify which, if any, multitasking orientation group, tended to have higher GPAs in undergraduate students at a major public university in Texas.

Research Questions

The study addresses the following research questions:

1. To what extent do media multitasking orientation, gender, age, employment, living arrangement, and income affect grade point average? In the study, media multitasking orientation is defined as a participant’s media multitasking index score. In a normally distributed sample, heavy media multitaskers are those whose standardized media multitasking index scores are 1.0 standard deviation or more above the mean. Conversely, in a normally distributed sample, light media multitaskers are those whose standardized media multitasking index scores are 1.0 standard deviation or more below the mean. Moderate media multitaskers have standardized scores that are 1.0 standard deviation within the mean.

2. How do individual differences in media multitasking orientation manifest themselves in academic activities?
Significance of the Study

This study will be significant in four ways. First, the study provides a framework and an understanding of the relationship between multitasking preferences and academic performance. Little is known about the impact of multitasking on college students. Overall findings have been mixed. Second, the study will expand the nascent literature in the areas of multitasking, new media, and attention in the learning environment. Current literature has not adequately addressed the impact of multitasking on the scholarship of teaching and learning (Brooks-Gunn & Marx, 2008; Levine, Waite & Bowman, 2007; Lin, Lee, & Robertson, 2009). Third, the study examines the implications on college students spending so much time on media. Many experts believe that media multitasking comes at the expense of reading (Anderson & Hanson, 2009), focused attention (Hallowell, 2005), and even driving fatalities (Watson & Strayer, 2010). The researcher hopes to further the understanding of media multitasking among college students. Fourth, educators need to have a better understanding of how students use technology in order to engage them in the classrooms and understand the impacts of multitasking on learning.

Delimitations

This study is delimited to the data collected from undergraduate students at the institution where the study was conducted. The results of this study cannot be generalized to undergraduate students in all colleges and universities. The study limits multitasking to the learning environment.
Limitations of the Study

Due to the unique sample available for the study, the results will not be generalized beyond the population from which the sample was collected. Additionally, the survey used in this study relies on self-reported data from the participants. Since this is a non-experimental study, the lack of random assignment to experimental and control groups raises threat to reliability and validity. As with all research models, there were limitations associated with the use of a mixed-method approach in the study.

Definition of Terms

- Attention: Sustained attention is defined as the ability to maintain attention on a specific stimulus to a high degree (concentration) over a long time period (Coull, Frackowiak, & Frith, 1998).

- Classification: Students are classified on the basis of term/semester hours passed. Semester hours passed are computed by adding transfer hours accepted, pass/no pass hours passed, graded hours passed and non-traditional credit accepted. Undergraduate classifications are: freshmen, those who have completed less than 30 semester hours of college credit; sophomores, 30 to 59 hours completed; juniors, 60 to 89 hours completed; seniors, 90 or more hours completed but who have not received a bachelor’s degree (University of North Texas, 2012).

- Grade point average: The overall grade point average is used to determine student class loads, eligibility for admission to the university and certain programs, and eligibility for
graduation. It is calculated by dividing the total number of grade points by the total number of semester hours attempted (University of North Texas, 2012).

- **Heavy media multitasker (HMM):** In a normally distributed sample, heavy media multitaskers are those whose standardized media multitasking index scores are 1.0 standard deviation above the mean.

- **Light media multitasker (LMM):** In a normally distributed sample, heavy media multitaskers are those whose standardized media multitasking index scores are 1.0 standard deviation below the mean.

- **Media layering:** Media layering refers to the simultaneous use of and/or exposure to multiple sources of disparate electronic and non-electronic media, some of which are interactive (Gardner, 2008, p.1)

- **Media multitasking:** Media multitasking as "engaging in multiple media activities simultaneous, including multiple windows on a single media platform and/or multiple media (Vega, 2009, p. 3)

- **Moderate media multitasker (MMM):** In a normally distributed sample, moderate media multitaskers are those whose standardized media multitasking index scores fall within 1.0 standard deviation of the mean.

- **Task switching:** Rapid task switching involving information technologies - in situations involving co-location and interpersonal interactions, such as checking emails during a meeting or instant messaging during group work (Bell, Compeau, & Olivera, 2005).
- Threaded cognition: Multitasking behavior can be represented as the execution of multiple task threads, coordinated by a serial cognitive processor, and distributed across multiple processing resources (Salvucci & Taatgen, 2008).
CHAPTER II
REVIEW OF LITERATURE

The purpose of this chapter is to present a review of literature relevant to the study. The chapter starts with a methodological review on media multitasking studies followed by a brief discussion on the various definitions of multitasking. The third section traces the history of media multitasking. The fourth section covers the theoretical perspectives related to the study. The fifth section focuses on the history of assessment and roles of GPA in higher education followed by a discussion on studies related to media multitasking and academic performance. In the last three sections, methods used to gather and analyze mixed-methods data, validity, and triangulation are be presented.

Methodological Review

In this study, research methodologies were analyzed to “identify key variables, measures, and methods of analysis and inform outcomes-oriented research” (Randolph, 2009, p. 2). According to Randolph (2009), a methodological review is “helpful to identify methodological strengths and weaknesses in a body of research, and examine how research practices differ across groups, times, or settings” (pp. 2-3). He adds that, “a methodological review may also lead to sound rationale that can justify proposed dissertation research, if it turns out that the previous research has been methodologically flawed” (p. 3).

Studies that examined the relationship between media multitasking and learning were included in the methodological review. Two different academic search engines were used to locate existing research: (a) WebFeat®, a federated search engine, a composite of fifty
educational databases; and (b) Google Scholar™ search engine. The keywords used to search for studies in the area of multitasking were: “multitasking,” “dual-tasking,” “interleaving,” “media multitasking,” “task-switching,” and “polychronicity.” The words were paired with two other words, “technology” and “education” to narrow the literature to areas related to this study. In many instances, the search results from WebFeat® and Google Scholar™ found similar publications. An extensive search of reports, white papers, and books was also conducted to identify key areas and contributions related to the scope of the study.

Studies that were included in the methodological review met four selection criteria (a) scholarly nature (b) theoretical relationships of interest (c) relevance (d) empirical in terms of quantitative and qualitative evidence or data. After an extensive literature review in various fields, five major weaknesses were identified:

a) Definitions of multitasking.

The definition of multitasking itself posed a problem because there were several definitions and interpretations about the nature and structure of multiple tasks (Benbunan-Fich, Adler, & Mavlanova, 2009). Multitasking has been described in a variety of ways. It has been described as polychronicity (Bluedorn, Kalliath, Strube, & Martin, 1999), metatasking (Zimmerman, 2007), interleaving (Salvucci, Taatgen, & Kushleyeva, 2006), media layering (Gardner, 2008), media multitasking (Roberts & Foehr, 2008), task switching (e.g. Baddeley, 1996; Gopher, Armony, & Greenspan, 2000; Roger & Monsell, 1995), and dual-task performance (Meyer & Kieras, 1997).

Although there were several definitions of multitasking from various fields such as (but not limited to) neuroscience, information science, education, psychology and computer science,
there was little consensus on what multitasking was. Salvucci and Taatgen (2008) observed that, "in some situations, multitasking can seem nearly effortless (e.g., walking and talking); for other situations, it can seem extremely difficult if not impossible (e.g., reading and listening to two distinct sentences); for still others, multitasking performance depended heavily on the individual and/or the environment (e.g., singing while playing an instrument or dialing a phone while driving)” (p. 101).

b) The use of media diaries

Two of the most cited works in the area of multitasking were the Kaiser Foundation’s studies on “Media Multitasking Among American Youth: Prevalence, Predictors, and Pairings” (2006) and “Generation M² Media in the Lives of 8-18-Year-Olds” (2010). Both studies utilized activity-based diaries extensively. Participants were asked to track their media use over a period of time. Crosbie (2006) defines activity-based diary research as the “recording of a detailed log of how people allocate their time during the day, often focusing on particular activities pertinent to the research.” (p. 2). There are drawbacks associated with the use of diaries as a method to study time use especially in terms of accuracy (Anderson & Hanson, 2008; Crosbie, 2008). Anderson and Hanson (2008) elaborate on the concerns:

Consider the traditional instrument for collecting data on media exposure: the diary. Traditionally, the diary is a booklet in which respondents enter their own or someone else’s (e.g., preliterate children) media use, including times and program name. Over time, there have been many methodological critiques of the diaries. For example, it is possible that respondents may fill them out at some later time, consequently making errors of recall. In addition, respondents may fill them out according to perceived social desirability of media use. (p. 1208)

Other criticisms of media diaries include biases, poor recall, accuracy, and within-person reliability (see Bolger, Davis, & Rafaeli, 2003, for discussion).
c) Lack of consensus on operationalizing and measuring multitasking

The methodological review revealed that there was a lack of consensus on how researchers measured multitasking. Benbunan-Fich, Adler, and Mavlanova (2009) argue that current multitasking studies suffer from a lack of “precise operationalization.” Researchers have used a variety of methods to study multitasking including rapid task switching, parallel and interleaved tasks, and self-reported diaries to investigate the phenomenon.

In addition, many educational researchers grappled with the dual issues of creating an authentic environment and the means to reliably measure students on their ability to perform more than one task at a time. Konig, Buhner, and Murling (2005) believe that “choosing a good multitasking measure is difficult” (p. 6). Many researchers shared their views. Brooks-Gunn and Donahue (2007) argue that, "the high prevalence of multitasking and the growth of new media technologies complicate the measurement of media use: traditional time-use surveys were not designed to measure two, three, and even more activities being conducted simultaneously" (p. 9). Similarly, Robinson and Martin (2009) observe that media studies typically reported tasks in a serial manner even though multitasking activities occurred at the same time.

(d) Past research has focused on involuntary nature of multitasking

Past studies on multitasking often focused on the involuntary and unpredictable nature of tasks as triggers for the execution of multiple tasks (e.g., Bluedorn, Kalliath, Strube, & Martin, 1999; Conte, Rizzuto, & Steiner, 1998). As such, many traditional research settings used simplified and artificial tasks in laboratories to study reaction times or performances on the involuntary nature of multitasking. Until recently, very few researchers have studied multitasking as a voluntary activity rather than an involuntary one.
(e) Paucity of qualitative research on the topic of multitasking

To date, studies on multitasking have used quantitative inquiries. The extensive methodological review found no previous qualitative or mixed-methods studies.

What is Media Multitasking?

We have many labels to describe our attachment to technology. Labels such as (but not limited to) multitasking, dual task, technology multitasking, have been bandied around to describe the phenomenon that surfaced in the mid-nineties with the introduction of new media. One researcher even describes the activity of multitasking as a symptom of attention deficit disorder. Hallowell (2005) believes that multitasking interferes with our ability to think, create, and produce. He writes:

People find that they're not working to their full potential; when they know that they could be producing more but in fact they're producing less; when they know they're smarter than their output shows; when they start answering questions in ways that are more superficial, more hurried than they usually would; when their reservoir of new ideas starts to run dry; when they find themselves working ever-longer hours and sleeping less, exercising less, spending free time with friends less and in general putting in more hours but getting less production overall. (p. 3)

The impact on American youth is clear. Richtel (2010) argues that, “technology has created on campuses a new set of social types — not the thespian and the jock but the texter and gamer, Facebook addict and YouTube potato. “ As a result of media multitasking, Anderson (2010 cited by Richtel) believes that, “young, developing brains are becoming habituated to distraction and to switching tasks, not to focus.” Stone (2009) describes the multitasking lifestyle as living in the state of continuous partial attention.
For the purpose of this study, media multitasking refers to the engagement of simultaneous multimedia activities, which include the use of multiple applications on a single medium or multiple applications on various media (Vega, 2009).

The focus of the literature review is on complex multitasking. It is useful to clarify the definition of complex multitasking at this point to facilitate subsequent in-depth discussions on the issues of media use, attention, and academic performance effectively. There are two types of multitasking, simple and complex (Stone, 2009). According to Stone, attentional strategies are what separate complex multitasking from simple multitasking. For example, simple multitasking occurs when we eat lunch and talk to our friends at the same time. Both activities require little attention because we have automatically mastered the tasks. When a process or a task is mastered without conscious monitoring, the phenomenon is described as automaticity (Tzelgov, Yehene, & Naveh-Benjamin, 1997).

Complex multitasking, on the other hand, requires more cognitive resources. Learning is an example of a complex task. Young adults often pair learning tasks with heavy media use. Many students believe that they can do two things at the same time without cost (Willingham, 2010). We know that “one of the major costs associated with multitasking has to do with brain resources” (Foehr, 2006, p. 3). Studies have found that learning is disrupted when we have two or more tasks competing for our brain resources at the same time (Foerde, Poldrack, & Knowlton, 2007). That is because “a fundamental characteristic of human cognition is our limited capacity for processing information. We cannot see, attend to, remember, or react to everything that we encounter in our environment” (Strayer & Drews, 2008, p. 29).
Are some students better at complex multitasking than others? This study will examine the question by analyzing the relationship between media multitasking orientation and grade point average.

History of Media Multitasking

Literature on media multitasking did not appear until the early 1930s. According to McDonald and Meng (2008), one of the earliest systematic studies of how people use their time in the 20th century was Sorkin and Berger’s publication, Time Budgets of Human Behavior (1935). In Sorkin and Berger’s study, one hundred participants recorded their daily activities for two to four weeks. Although the researchers asked participants to record only one activity at a time, media multitasking emerged as one of the themes in the study. Sorkin and Berger found that participants often paired activities such as auto repair or reading with radio.

In the same year, another team of researchers, Cantril and Allport (1935) conducted a survey on the radio listening habits of Americans. They found that over two-thirds of listeners engaged in other activities while listening to the radio. Among the 200 college students surveyed, 66% of the students said that they listened to the radio while studying. Over 65% of the students admitted to being distracted during announcements between musical numbers. An overwhelming 92% of the students turned the radio off for tasks that they considered important. Although students listened to the radio when they studied, Cantril and Allport did not find any correlation between media use and academic performance. Cantril and Allport’s work was important because it was one of the earliest studies that examined the relationship between media and society particularly on the impact of radio on academic performance.
By 1950s, television became a popular source of entertainment for American households. Two-thirds of American families owned a television set (Spigel, 1992). As with the radio, researchers found that television viewers were pairing the activity with eating, sewing, or reading (e.g., Bogart, 1956). Spigel (1992) describes the American public’s response to television as ambivalent. She notes that, “[i]n many popular sources, television was depicted as a panacea” for family togetherness and capitalism” (p. 2). However, critics of television blamed the medium for the erosion of constructive thinking among American youth. For example, believed that television viewing inhibited reading abilities of children. Despite the criticisms leveled at television and learning, several studies conducted in the 1950s failed to corroborate the assertion (e.g., Greenstein, 1954; Himmelweit, Oppenhenheim, & Vince, 1958).

In the early years of television, experts believed that the shift from audio to audio-visual media caused people to pay more attention (McDonald & Meng, 2008). Viewers replaced radio with television as a primary source of entertainment. Eventually, the novelty effect of television wore off. By the late 1970s, television became entrenched in the background of American households and as a result of that, it blared at all hours of the day in many homes. Educators, parents, and researchers were justifiably concerned about the effects of watching television and doing homework or studying at the same time. Several studies were conducted during that time period to examine the effects of television on learning. Researchers like Morgan and Gross (1983) found that higher amount of television viewing time correlates negatively to academic performance. More recent studies have reported negative association between television and reading as well as television and homework (Koolstra & van der Voort, 1997; Pool, Koolstra, & van der Voort, 2003).
In addition to the popularity of television, ownership of personal computers skyrocketed as a result of lower prices in the second half of 1970s. By 1979, approximately 15 million personal computers were in use worldwide (Wolfe, 2011). Personal computer ownerships continued its exponential growth in the next two decades. By the early 2000s, we witnessed the complete transformation of old media to new media, passive media to interactive media. From wireless Internet to smartphones, millions of consumers embraced mobile computing; thus giving rise to the phenomenon of media multitasking. The shift from passive to interactive media helped create what Jenkins, Clinton, Purushotma, Robison, and Weigel (2006) described as participatory culture where teens and young adults create and consume media as forms of affiliation, expression, collaboration, and circulation of thoughts, ideas, and views.

One of the emerging themes in the new culture was the acceptance of media multitasking as a way of life for many young Americans. Rosen (2010) surveyed 1300 participants to examine their multitasking behaviors. Rosen’s participants ranged from Baby Boomers (born 1946 to 1964), Generation X (born 1965 to 1981), Net Generation (born 1982 to 2000), and iGeneration (born 2001 to current). Rosen found that Net Generation and iGeneration participants indulged in more multitasking activities than the previous generations. Participants in these two groups reported juggling up six tasks at the same time. Unlike Baby Boomers and Generation X, these two new generations have a distinct preference for balancing more than one activity at a time.

Small and Vorgan (2008) suggest that new media may have rewired the brains of our students. They note that:

the bombardment of digital stimulation on developing minds has taught them to respond faster, but they encode information differently than the older minds do. Digital
natives tend to have shorter attention span, especially when faced with traditional forms of learning. This young high-tech generation often finds conventional television too sluggish and boring when simply watched on its own. (p. 25)

Their assertion may not be far off. In a recent study, Watson and Strayer (2010) describe a group of students who exhibit extraordinary multitasking skills without impairment. The researchers coined the word “supertasker” to describe these students. In this study, Watson and Strayer recruited two hundred undergraduate students. The students were assigned two conditions: dual-task condition and single task condition. Participants in both conditions were trained to use a driving simulator for 15 minutes. Those in the dual-task condition were asked to drive and perform a second task concurrently. The second task required the drivers to answer “true” or “false” when prompted to recall a series of words. In the control group (single task condition), participants performed two tasks separately.

The researchers found that the performance of the participants in the dual task condition was consistent with the limited capacity theory. Those who were assigned to the single task condition performed better than those who were assigned to the dual task condition. However, Watson and Strayer (2010) found a small group of participants where there was “no performance decline from single to dual task across all independent measures” (p. 481). In other words, these participants were able to perform both tasks successfully without incurring significant performance cost. The researchers classified the participants as “supertaskers.” Only 3% of the participants were classified in this group.

The findings of the study posed an interesting question as to why the overwhelming majority of us are not supertaskers. Watson and Strayer (2010) postulate that the supertaskers are a small minority because “environmental and technological demands that favor this ability
are relatively new, and any selective advantage for being a supertasker has yet to propagate throughout the population” (p. 483). Watson and Strayer’s findings are significant because the existence of a group described as supertaskers challenges the very notion of the bottleneck theory. Proponents of the theory believe that our brains can only process one task at a time (Pashler, 1994; Salvucci & Taatgen, 2008; Welford, 1952). Certainly, further studies need to be conducted to examine the traits of supertaskers.

Do we perform better in a multitasking environment or do we perform better in a state of flow when we are fully immersed and focused on a single activity? Csikszentmihalyi (1990) describes the flow as “the mental state of operation in which a person in an activity is fully immersed in a feeling of energized focus, full involvement, and success in the process of the activity”. This is a question that this study attempts to answer. As new and sometimes contradictory findings about media multitasking continue to emerge, a careful examination of current research methodologies and literature in the field will help fill the gaps on what we know and what we do not know about multitasking, attention, and media in the learning environment.

In the next section, theories on multitasking will be discussed to address the need for a greater understanding of phenomenon and its impact on our social and academic spheres. Studies that were included in the literature review represent major theoretical frameworks in various fields in the last one hundred years.

Theoretical Perspectives on Multitasking

Although multitasking is a relatively new area of research in education, cognitive
psychologists have long been interested in how we divide our attention when we perform more than one task at the same time. In this section, theoretical and historical perspectives on attention and its relationship to multitasking will be examined, particularly the extent to which the literature in various fields have contributed to our understanding of the phenomenon of multitasking.

In 1890, William James devoted a chapter to the topic of attention in his book called *Principles of Psychology*. His views on attention have influenced earlier works and research on the areas of psychology and philosophy. When writing about attention, James states, "my experience is what I agree to attend to. Only things I notice shape my mind - without selective interest, experience is an utter chaos" (p.1). In answering the most important question on the pedagogical benefits of studying attention in learning, James believes that it will help us “strengthen attention in children who care nothing for the subject they are studying and let their wits go to wool-gathering” (p. 29). From the teacher’s perspective, “a teacher who wishes to engage the attention of his class must knit his novelties on to things of which they already have perceptions” (p 30). The pedagogical benefits still remain relevant today as technology vie with learning for attention inside and outside the classroom.

James (1890) believed that, "Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought" (p. 4). When we concentrate on things, people, or events, we “withdraw our attention from some things in order to deal with others” (p.4). In other words, selective attention helps us to filter distractions. James believes that when we add more ideas or things to our consciousness, we lose our ability to automate processes.
Because our interests guide our attention, James believed that we cannot sustain voluntary attention for a long period. We have to make repetitive efforts to focus on a specific topic. When we pay attention, we perceive, conceive, distinguish, remember, and react to a stimulus. Subsequent studies on attention specifically related to multitasking often use reaction time to a stimulus as a way to measure attentiveness.

James’ work continues to be relevant to current research on multitasking. It is almost impossible to discuss the subject of media multitasking without a firm understanding of various theories of attention. After all, “we cannot deny that an object once attended will remain in memory, whilst one inattentively allowed to pass will leave no traces behind” (James, 1890, p. 17). The underlying construct of multitasking is the belief that we can train ourselves to focus our attention on multiple tasks at the same time. Some researchers believe we can, while others dismiss the notion as a myth. In the next section, major theories in the twentieth century that support or do not support multitasking are discussed in the context of the study.

*Early Selection Theory*

Between 1900s-1950s, the behaviorism movement dominated various fields of research such as education and psychology. The behaviorism school of thought “focused on empirical relations between stimulus and response” (Calfee, 1981, p. 4). Its emphasis on observable human behavior left little room for studies on introspection and attention (Atkinson & Shiffrin, 1971; Calfee, 1981; Posner, 1982). It was not until the second half of the twentieth century that the subject of attention became a topic of interest in the research community. After World War Two, Posner (1982) describes the rise of what he calls "information processing." Information
processing united various ideas related to attention and gave researchers a general way to describe act of "processing a series of letters into meaning and the processes occurring at individual synapses" (p. 169).

Broadbent led the first wave of research in 1950s by proposing the single channel theory or early selection theory. Broadbent (1957) believes that the "human perceptual system has a limited capacity" (p. 205). He postulates that attention cannot be divided because humans do not have the capacity to process more than one stimulus at a time. To support the assertion, Broadbent created a simple single model of attention, Y shaped tube. When we drop two balls at same time, one on each end, the first ball to reach the bottom was analogous to the first stimulus delivered or registered. Broadbent believes the best way to deliver information is asymmetrically to one branch of the Y shaped tube. When we load both ends of the tube at the same time, we run the risk of clogging up the system with too much information/stimuli.

The early selection theory was significant because it was one of the earliest theories that argue our limited ability to perform two activities at the same time. Broadbent’s findings greatly influenced subsequent development of theories involving cognitive processing.

Cherry (1953) and the Cocktail Party Problem

To examine if people can attend to two stimuli at the same time, researchers investigated the phenomenon of simultaneously spoken messages. Described as the cocktail party problem, researchers examined how listeners filtered different conversations going on at the same time. One of the earliest cocktail party problem studies was in conducted in 1953. Cherry (1953) conducted four experiments. In his first experiment, Cherry presented the
participants with two separate spoken messages using both ears. Participants were asked to
describe the two mixed speeches without writing any one of the messages down. They were
allowed to play these messages as needed. Cherry found that listeners were able to separate
both messages at the same time. In the second experiment, participants were given pencil and
paper to write down phrases and words they heard. Cherry found that participants were able to
recall the words and phrases far more quickly than the first group who were not allowed to jot
down their thoughts on paper.

For his third experiment, Cherry asked the participants to listen to messages that “could
not be separated by the listening subjects” (p. 977). In this experiment, Cherry used clichés on
both messages to determine how well the participants were able to listen to both messages
successfully. He found that the participants encountered no significant difficulties in picking up
both messages at the same time. In his fourth experiment, Cherry asked the participants to
listen to two recorded messages in English by the same speaker. The participants were able to
listen to both messages and reject the one that they were supposed to reject. Additionally
when Cherry switched the speaker of the message on rejected ear from English to German, the
listeners did not detect the change as expected. When Cherry switched the gender of the
speaker on both ears, some participants noticed the changed while others did not. Similarly,
when participants were asked to listen to similar messages with time delay between them, they
noticed that the messages were identical on both ears.

Cherry’s study was important because his findings weakened Broadbent’s assertion that
humans can only attend to one stimulus at a time. Participants in Cherry’s study were able to
understand and filter speech in a noisy setting. Subsequent studies conducted in the 1960s and

**Late Selection Theory**

In 1960, Treisman published an influential study on contextual clues in selective listening. Unlike Broadbent, Treisman believes that we do not filter competing messages. Instead, she argued that listeners focus on the target message and attenuate the rejected message. In Treisman’s study, she recorded four passages (50 words each) (a) narrative passage (b) technical discussion on language (c) “eighth order of statistical approximation in English and (d) second order approximation to English” (p. 78). Participants were instructed to listen on a specific ear and repeat what they heard. Treisman recorded their responses and examined words that were repeated in the unassigned ear. During the experiments, the target message was switched to the other ear. Treisman found that some participants repeated words from the unassigned ear. They were more likely to repeat the wrong words after a brief pause when they listened to the prose rather than the statistical approximation. Treisman concluded that, “when two ears are used as the two channels in a selective listening task, subjects remained almost completely unaware of the rejected passage” (p. 82). Her findings contradicted Broadbent’s single-channel model because participants in her study were able to recall words or messages from the rejected ear.

In the wake of criticisms against the early selection model, Deutsch and Deutsch (1963) proposed a late selection model. Deutsch and Deutsch (1963) believe that we process information “whether we pay attention to it or not” (p. 90). They disagreed with Broadbent’s assertion that information is filtered at an early stage. Deutsch and Deutsch hypothesize that
we process all incoming information but we only select important signals that require our attention or action. The selection of these signals depends on our degree of arousal. The higher the degree of arousal, the more likely we will pay attention to the signal. The debate between researchers who believed in early and late selection theories lasted several years until the late 1970s when Johnston and Heinz published their study on attentional bottleneck (Strayer & Drews, 2008).

**Early Selection Theory versus Late Selection Theory**

Johnston and Heinz (1978) were known for their work on selection efficacy. They defined selection efficacy as “the effort or capacity expended on attention” (p. 422). Johnston and Heinz (1978) believe that, “attention requires capacity and that the amount of capacity required increases from early to late modes” (p. 420). While previous theories of attention argued that processing occurred at the early or late stage, Johnston and Heinz believed that attention bottleneck was flexible. It can occur at the early or late mode, depending on the type of information we need to process. For example, we use the early selection mode to focus our attention on an individual in a crowded room. On the other hand, we use the late selection mode to gather information from multiple sources at the same time. It is common for us to switch between the two modes during a single activity.

By the early eighties, research focused on the idea of attention as resource (Strayer & Drews, p. 31). This was a marked shift from earlier studies that emphasized mental activities in the 1950s and 1960s. Researchers like Allport (1980), Corteen and Wood (1972), Gopher and Kahneman (1971), Keele (1973), Lewis (1970), and Lindsay (1970) firmly established empirical
evidence to support the argument that people could attend to more than one task at a time. These findings fueled many important discussions on media multitasking in the late 1990s and 2000s. Of importance to this study is how various theoretical frameworks have been used to support the arguments for and against media multitasking.

In the next section, five major theories on multitasking that have gained support since 1990s are examined. They are (a) task switching (b) theory of threaded cognition (c) psychological refractory period (d) limited capacity information processing model (e) cognitive load theory. Many of the studies reviewed in the next section cover a wide range of subject areas (e.g., education, psychology, cognitive science, and neuroscience).

**Task Switching**

Studies that focus on task switching examine the completion of processes associated with a task before the next task begins. Task switching can either be voluntary or involuntary. Altmann and Gray (2008) discussed two unique situations where it is useful to define what the term task switching means. In the first situation, the researchers describe an example of a task interruption where an individual is working on a project and being interrupted by a phone call. They note that:

> Such interruptions make an attractive conceptual frame for task-switching studies (e.g., Monsell, 2003), yet the costs of switching between tasks that involve some reasonable amount of cognitive state, such as working on a manuscript and talking to someone, may be driven by operations on fairly rich knowledge representations (2008, p .602)

In the second situation, Altmann and Gray (2008) describe multitasking that is evoked by task switching. The researchers argue that, “the representations that support performance are much leaner, and the interruptions are much more frequent, such that behavioral measures
may index rather than different mechanism” (p.602). In such situations, the critical element is the fact that “neither task starves for attention” (p. 602).

Applied to the context of this study, the second situation described by Altmann and Gray (2008) is of interest because learning involves complex cognitive processing and attentional resources. When a learning task and a non-learning task compete for attention, some researchers believe that the non-learning task can disrupt crucial encoding process associated with the learning task (Bergen, Grimes, & Potter, 2005; Philipp, Kalinich, Koch, & Schubotz, 2008).

According to Rubin and Meiran (2005), early studies in the task-switching paradigm focused on the performance of participants within the mixed-tasks blocks while more recent studies have compared the performance of participants who repeated a single task (pure block) against participants who switched between two tasks (mixed blocks). Of the two costs associated with task switching, researchers have paid more attention to switching cost than mixing cost (Rubin & Meiran, 2005).

Allport, Styles, and Hsieh (1994) conducted seven experiments to investigate the effects of switching cost. The researchers compared how participants performed in three conditions: two similar, two different, and two related tasks. All three conditions were found to incur time costs when participants shifted from one task to another. Results indicated that there were no significance differences in performance when participants switched from: (a) perceptual task variables to cognitive task variables (b) easy tasks to more difficult tasks (c) uniform lists to mixed lists. The researchers reported that alternation costs were reduced through practice.
Rogers and Monsell study (1995) corroborated Allport, Styles, and Hsieh’s findings on the relationship between practice and switch cost.

In contrast, Rubin and Meiran (2005) found that significant differences in performance mixing cost when participants performed (a) a single task (b) unrelated mixed-blocks tasks (c) related mixed-blocks tasks. Mixing cost was significantly higher in related mixed-blocks tasks than unrelated mixed-blocks tasks or single block task. The researchers posit that related tasks with “bivalent stimuli (stimuli that contain features that are relevant to both tasks)” trigger competition for the same resources and they have to be resolved for the relevant task to be completed.

**Dual-task Theory**

Verbruggen, Schneider, and Logan (2008) classified dual-task research into two paradigms: (a) stop-signal (b) stop-change. The first paradigm involves inhibition of responses on cue while the second paradigm involves the switch to a secondary task on cue. Unlike task switching, dual-task procedures involve two stimuli where the second task appears before the first task is even completed (Verbruggen, Schneider, & Logan, 2008). Dual-task researchers examine how people perform in simple to complex tasks. Although people tend to assume it is easy to perform multiple activities at the same time, Pashler (1994) notes that, “many pairs of tasks interfere with each other quite drastically, even though they are neither intellectually challenging nor physically incompatible” (p. 220).

In the dual-task performance, the psychological refractory period (PRP) is used to measure observable behaviors that involve response time for two tasks presented in rapid
succession with overlapping processes. Researchers use PRP to measure simple tasks such as pushing a button in response to a stimulus to complex tasks such as driving and talking on the phone at the same time.

One of the earliest studies on PRP was conducted by Telford in 1931. Telford (1931) investigated reaction times "to determine the effect of the length of the interval between stimuli (1) simple reaction time, (2) on accuracy of judgment and (3) on tendencies to repeat (p. 7). Telford found that "simple reaction time to an auditory stimulus is considerably lengthened when the stimulus follows a preceding one at less than a certain interval of time" (p. 27).

In dual-task literature, there are three theoretical approaches to explain dual-task interference (Pashler, 1994). They are (a) capacity sharing (b) bottlenecks (task switching) (c) crosstalk. According to Pashler, capacity sharing in the most popular way to explain the phenomenon. The core belief in capacity sharing is that we have a finite amount of resources to perform one or many activities. Some capacity theorists believe that we have a single mental resource while others believe we have multiple resources (Pashler, 1994). Theorists on both sides agree that complex tasks require more resources than simple tasks.

The bottleneck model assumes that we cannot process parallel tasks at the same time. When we attempt to perform two tasks at the same time, “a bottleneck results, and one or both tasks will be delayed or otherwise impaired” (Pashler, 1994, p. 221). There can be a single or multiple bottlenecks that interfere with our ability to complete two or more tasks at the same time.

The third explanation on dual task interference is crosstalk. In crosstalk, theorists believe it is more difficult to perform tasks that use similar inputs than tasks that use different
outputs (Pashler, 1994). For example, we find it difficult to follow two speakers who are talking on two different phones at the same time. Similarly, composing an email and reading a newspaper article at the same time is next to impossible.

Research on psychological refractory period has been criticized for the lack of free choice in the experiments. Pashler, Harris, and Nuechterlein (2008) argue that:

The large literature on the PRP effect has to our knowledge – been restricted to tasks in which subjects were pre-instructed about what response to make to each possible stimulus, or given some other rules that pre-specified every action the individual would make throughout the experiment. For that reason, it would seem that none of the studies examining bottlenecks in decision making have examined anything that would, in common parlance, even be described as a decision (p. 312)

To address the research gap, Pashler, Harris, and Nuechterlein (2008) conducted a study where thirty participants were required to perform two tasks that involved decision-making. In the first task, participants were given the choice to press one of three keys based on the pitch of the tone that was played. In the second task, participants played a computer card game where they accepted or rejected cards from one of three different-colored decks to win money. Results indicated that reaction time for Task 2 increased when the stimulus time between Task 1 and Task 2 were shortened.

Applied to the study of multitasking, Sigman and Dehaene (2006) believe that we cannot perform two tasks at the same time. When participants in their study were asked to perform two tasks: number comparison and tone comparison, Sigman and Dehaene tested the response time for the first and second tasks. They concluded that the tasks were executed sequentially.

Theory of Threaded Cognition

From a threaded cognition prospective, Salvucci and Taatgen (2008) posit that
multitasking is driven by the exclusive use approach where the "resources can execute only one process at a time" (p. 109). Like Salvucci and Taatgen (2008), Borst, Taatgen, and Van Rijn (2010) believe that serial processing means that only a single rule can be processed at a given time. "The core idea of threaded cognition is that multitasking behavior can be represented as the execution of multiple task threads coordinated by a serial processor and distributed across multiple processing resources" (Salvucci & Taatgen, p.102). In this theory, conflicts are created "when multiple tasks require the same peripheral resource" (p.103).

Salvucci and Taatgen believe that "human processing resources include cognitive, perceptual, and motor resource" (p. 104). Tasks are stored in a goal buffer until before they are executed. When we have more than one task, the goal buffer will assign the order of the tasks accordingly. New tasks are added to the buffer when current tasks have been executed or removed from the buffer. They defined a thread as "all processing through firing of rules and other resource processing initiated by these rules firing " (p. 107). Salvucci and Taatgen argue that a thread "represents a particular stream of thoughts associated with some currently active task (p. 108)." A simple task may only have a single thread while a complex task may involve a series of task threads. They believe that "all resources - cognitive, perceptual, and motor - execute processing requests serially, one request at a time“ (p. 108).

Although Salvucci and Taatgen's theory allow the inclusion of parallel resources, they make a strong argument that at the individual resource level, processing occurs sequentially. Borst, Taatgen, van Rijn (2010) suggest that, “one potential criticism of threaded cognition is that it allows for an unlimited set of goals that are not susceptible to decay” (p. 379).
In Lang’s limited capacity information-processing model, there are two major assumptions. Lang (2000) believes that “people are information processors” (p. 47). However, our ability to process information is limited. We can only process a limited amount of information before our cognitive resources are tied up. When messages are transmitted, they may not be processed if too few resources are allocated. Similarly, messages that consume more resources than available share the same problem. The limited capacity information-processing model has three major components of information processing (a) encoding (b) storage (c) retrieval.

During the encoding process, Lang (2000) believes the initial step is to determine which pieces of information need to be transformed into mental representations. The selection processes are driven by automatic and controlled mechanisms. According to Lang, the content of the information gathered at this point is short-lived unless it is transferred into a more permanent storage in working or short-term memory. Transfer of information occurs when the information is deemed relevant to the individual’s goals and needs or the individual’s environment.

In the next stage called storage, Lang (2000) suggests that the newly encoded information is associated with other information that is active in the short-term memory. According to Lang, “associative network models conceptualize individual memories as being connected to other memories by associations (or links)” (p. 49). Thus, when a person thinks about a new message, the association between old and new information occur. Lang argues
that the stronger the association between the old and new memory, “the better that information is stored” (p. 49).

The final component of information processing is retrieval. The model conceptualizes retrieval as an “ongoing process during message reception” (p. 50). Lang (2000) defines retrieval as “the process of searching the associative memory network for a specific piece of information and reactivating it in working memory” (p.50). It is easier to retrieve a piece of information when there are stronger associative links in our long-term memory compared to one that have weaker links. Although Lang’s research was rooted in cognition and media, researchers from various disciplines (e.g., Hembrooke & Gay, 2003; Jeong, Hwang, & Fishbein, 2007) have used the model to discuss the limitations of multitasking.

Cognitive Load Theory

Atkinson and Shiffrin (1971) believe that the human memory consists of short-term memory and long-term memory. They credited Broadbent (1957) and Miller (1956) as pioneers in research on short-term versus long-term memory. The Atkinson-Shiffrin memory model describes the overall memory system in terms of information flow. “Information from the environment is accepted and processed by the sensory registers in the various sensory modalities (Atkinson & Shiffrin, pp. 3-4). In order to retain the information in the short-term memory, we have to rehearse the unit of information. However, the short-term memory has a limited ability to store the information indefinitely. Information retained in the short-term memory has to be transferred to the long-term memory for permanent storage.
In terms of long term memory, Sweller, van Merrienboer, and Pass (1998) characterize the human cognitive system as “one that places its primary emphasis on the ability to store seemingly unlimited amounts of information” (p. 254). They believe that human intellect draws from this pool of “large, complex interactions, and procedures” in the long-term memory. According to Sweller, van Merrienboer, and Pass, knowledge is stored in the long-term memory as schemas. Schemas help us categorize and store information to reduce the load on working memory.

With sufficient practice, some schemas become automated. Sweller, van Merrienboer, and Pass (1998) believe that automation frees up cognitive resources because the process consumes less mental effort. In other words, familiar tasks are performed with ease and accuracy, whereas unfamiliar tasks require more memory capacity. In the context of this study, it can be argued that college students, who grew up with various technologies, are able to perform more than a single task at a time. Their familiarity and ease with technology may free valuable cognitive resources that can be used for the primary task of learning.

Pass, Renkl, and Sweller (2003) identified three categories of cognitive load that affect learning: intrinsic, extraneous, and germane. Intrinsic cognitive load “cannot be altered by instructional manipulations” (Pass, Renkl, & Sweller, 2003, p. 1). The difficulty of the material taught determines the amount of intrinsic cognitive load placed on the working memory. Simply put, the more difficult the learning materials are, the more burdens are placed on the intrinsic cognitive load. Extraneous cognitive load is the next category. As the name implies, extraneous cognitive load interferes with the learning process because it uses up unnecessary resources. In learning situations, extraneous cognitive load drains valuable mental resources.
that could be used toward schema building. The third category, germane cognitive load, “encourages learners to engage in conscious cognitive processing that is directly relevant to the construction of schemas” (Sweller, van Merrienboer, & Pass, 1998, p. 264).

In relation to multitasking, college students are taking courses with unfamiliar content. Cognitive load theorists believe that new learning materials pose a heavier cognitive load on the learner. Any effort at multitasking during the process will interfere with the absorption of new ideas and knowledge.

Discussion on Theoretical Perspectives

The major theories presented in the previous section have attempted to explain the phenomenon of multitasking. One of the problems with multitasking literature is that it is so diverse. Researchers in various disciplines have focused on different aspects of multitasking. For example, Broadbent (1956) used a simple Y-shaped tube to describe his single channel theory while Salvucci and Taatgen (2008) described multiple tasks as a series of threads that are executed from a goal buffer. On the other hand, cognitive load theorists believe that different types of cognitive loads affect how we acquire knowledge and skills. Despite the differences in approaches, there are similarities in these theoretical frameworks as well. Table 2.1 presents a summary of the key ideas in the theoretical framework.

From the discourse on the theoretical frameworks in this study, four key strands emerged as result of the review. First, there are many theories on multitasking. However, no one theory has been able to fully explain the nature of complex multitasking. In fact, Foehr (2006) suggests that, “there is little agreement in the neurological and psychological literature
on how our brains actually function when we try to process more than one message, or accomplish multiple tasks simultaneously” (p. 3).

Table 2.1

*Summary of the Key Ideas in Each Theory*

<table>
<thead>
<tr>
<th>Theory</th>
<th>Key ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Selection Theory</td>
<td>Single channel theory. We can only process one task at a time.</td>
</tr>
<tr>
<td><em>Broadbent (1956)</em></td>
<td></td>
</tr>
<tr>
<td>Late Selection Theory</td>
<td>We process all incoming information and we select important signals that require our attention or action. The selection of these signals depends on our degree of arousal.</td>
</tr>
<tr>
<td><em>Deutsch &amp; Deutsch (1963)</em></td>
<td></td>
</tr>
<tr>
<td>Task Switching</td>
<td>Complete processes associated with a task before the next task begins. Task switching can either be voluntary or involuntary.</td>
</tr>
<tr>
<td><em>Allport, Styles, and Hsieh (1994); Rogers &amp; Monsell (1995)</em></td>
<td></td>
</tr>
<tr>
<td>Dual-task</td>
<td>Classified into two paradigms: (a) stop-signal (b) stop-change. The first paradigm involves inhibition of responses on cue while the second paradigm involves the switch to a secondary task on cue.</td>
</tr>
<tr>
<td><em>Pashler (1994); Pashler, Harris, &amp; Nuechterlein (2003)</em></td>
<td></td>
</tr>
<tr>
<td>Theory of Threaded Cognition</td>
<td>Resources can execute only one process at a time</td>
</tr>
<tr>
<td><em>Salvucci &amp; Taatgen (2008)</em></td>
<td></td>
</tr>
<tr>
<td>Limited Capacity Information Processing Model</td>
<td>Our ability to process information is limited. We can only process a limited amount of information before our cognitive resources are tied up.</td>
</tr>
<tr>
<td><em>Lang (2000)</em></td>
<td></td>
</tr>
<tr>
<td>Cognitive Load Theory</td>
<td>Cognitive load that affect learning: intrinsic, extraneous, and germane.</td>
</tr>
<tr>
<td><em>Sweller, van Merrienboer, &amp; Pass (1998)</em></td>
<td></td>
</tr>
</tbody>
</table>

Second, despite the theoretical differences, most theories share the same underlying premise that humans have limited capacity for processing information. Third, because of our limited
capacity, multitasking (such as the use of instant messaging) can interfere with academic performance through (a) displacement of time available for study, (b) direct interference while studying, and (c) development of a cognitive style of short and shifting attention (Levine, Waite, & Bowman, 2007, p. 6). Fourth, none of the theories have examined individual differences in multitasking. This is an important research gap that has yet to be addressed. Konig, Buhner, and Murling (2005) suggest that, “cognitive psychologists rarely study individual differences in attention (or attentional capacity; cf. Cohen, 1993) because researchers tend to focus on experiments that test different theories by manipulating experimental conditions among groups. This is probably the reason no researchers have yet tested whether individual differences in multitasking performance can be predicted by individual differences in attention” (p. 4).

The goal of this study is to fill the research gap by studying individual differences in media multitasking. Why do we need to study individual differences in media multitasking? First, there are costs associated with multitasking. Young adults voluntarily saturate themselves with more and more technology, have little time to reflect and think critically. Small and Vorgan (2008) believe that “when paying partial continuous attention, people may place their brains in a heightened state of stress. They no longer have time to reflect, contemplate, or make thoughtful decisions” (p. 18).

Second, some researchers believe that new media and technologies have slowly rewired the brains of young adults. Small and Vorgan (2008) believe that “the bombardment of digital stimulation on developing minds has taught them to respond faster, but they encode information differently than the older minds do” (p. 25). As a result of this, they question the
conventional wisdom that we cannot perform two or more tasks without incurring cost. Instead of viewing the relationship between multitasking and attention as antagonistic, Jenkins, Clinton, Purushotma, Robison, and Weigel (2006) advocate a collaborative approach:

Multitasking and attention should not be seen as oppositional forces. Rather, we should think of them as two complementary skills, both strategically employed by the brain to intelligently manage constraints on short-term memory. Whereas attention seeks to prevent information overload by controlling what information enters short-term memory, successful multitaskers seek to reduce demands on short-term memory by mapping where different information is externally stored within their immediate environment. (p. 37)

Additionally, researchers like Kleinman (2010) believe that people can regulate their own multitasking behavior. In a 2010 study, Kleinman found that, “people seemed to self-regulate their use of technology to fit the social and task needs of the group as appropriate” (p. 31). When his participants perceived a topic of conversation as important, the majority of them stopped multitasking and devoted their entire attention to the message being relayed. He observes similar patterns of behavior with complex tasks. Participants were more likely to devote their full attention to tasks that require complex decisions or skills.

In the next section, a brief discussion on the history of assessments and the significance of GPAs in institutions of higher learning will provide justifications on why GPA was selected as an important indicator of academic performance in this study.

History of Assessments and the Roles of GPA in Higher Education

Assessment and learning are inextricably connected. They are such a part of education that we seldom question their origin (Ward & Murray-Ward, 1999). According to Ward and Murray-Ward (1999), assessment traces its roots as far back as four thousand years ago. In
China, public servants were required to sit for formal examinations to test their knowledge and skills in five areas: music, archery, horsemanship, writing, and arithmetic. The system lasted well into the early part of the twentieth century.

In contrast, many European universities used oral examinations to assess their students (Murray & Murray-Ward, 1999). The practice provided teachers with opportunities to determine how much their students had learned. However, critics of the oral examination system believed that it was too subjective and argued for a more vigorous testing model (Murray & Murray-Ward). Beginning 1860s, written essay examinations gradually replaced oral examinations at European universities. The Reverend George Fisher of Greenwich, England, created one of the earliest standardized systems of scoring (Murray & Murray-Ward, 1999; Nitko, 1980). Murray and Murray-Ward (1999) describe Fisher’s method:

Fisher collected samples, or “specimens,” of students’ academic performance in writing, spelling, mathematics, and grammar and composition. He arranged these specimens in a “scale” book and assigned values to each specimen using a scale ranging from 1 (the best) to 5 (the worst) (p. 46).

During the same period, Yale University and Harvard University in the United States, implemented various grading systems to measure student learning (Durm, 1993). It was not until 1897 that the modern grading system was introduced at Mount Holyoke College, Massachusetts, in the United States (Durm, 1993). The college created the system of associating letter grades A, B, C, D, and E with numeric values:

<table>
<thead>
<tr>
<th>Letter</th>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
<td>95-100%</td>
</tr>
<tr>
<td>B</td>
<td>Good</td>
<td>85-94%</td>
</tr>
<tr>
<td>C</td>
<td>Fair</td>
<td>76-84%</td>
</tr>
<tr>
<td>D</td>
<td>Pass</td>
<td>75%</td>
</tr>
<tr>
<td>E</td>
<td>Fail</td>
<td>Below 75%</td>
</tr>
</tbody>
</table>
The current GPA system has stayed close to its Mount Holyoke roots. Grade Point Average is the average grade earned by a student, figured by dividing the total grade points earned by the total number of credit hours. The hours assigned to a course are called credit hours. “Grades represent the extent to which a student has successfully met the faculty member’s requirements and expectations for a course” (Rogers, 2003). Guskey (1994) believes that grades not only allow teachers to check how their students are doing, but they also help them to judge the adequacy of their learning. At many institutions of higher learning in the United States, students are assigned grades of A through D as empirical evidence of content mastery in various subject areas. Each institution lists its own grading system in the course catalog and academic policies. Table 2.2 presents the common labels or definitions and numerical values associated with grade levels.

Table 2.2

<table>
<thead>
<tr>
<th>Course Grade</th>
<th>Description</th>
<th>Numerical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
<td>4.0</td>
</tr>
<tr>
<td>B</td>
<td>Good</td>
<td>3.0</td>
</tr>
<tr>
<td>C</td>
<td>Fair</td>
<td>2.0</td>
</tr>
<tr>
<td>D</td>
<td>Poor</td>
<td>1.0</td>
</tr>
<tr>
<td>F</td>
<td>Fail</td>
<td>0.0</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Grade point average has become the de facto method of measuring academic performance before and after admission at the post-secondary education level. Many post-secondary institutions in the United States rely on admission tests and academic performance in high school to evaluate applicants (Cabrera & Burkum, 2001). In 2011, members of the National Association for College Admission Counseling (NACAC) consistently cite high school cumulative grades as one of the four most influential criteria for selecting students. Similarly, Zwick and Sklar (2005) note that surveys conducted by the Association for Institutional Research (ACT), the College Board, the Educational Testing Service (ETS), and National Association for College Admission Counseling (NACAC) in 1979, 1975, 1992, and 2000 found that high school GPA was one of the most important factors in college admission. Zwick and Sklar’s own study confirmed the importance of high school GPA as a college admission tool. They found that high school GPA along with SAT score explained 22% of the variance in freshman-year college GPA.

Across disciplines, college grades and grade point averages matter for a variety of reasons. GPA is one of the most widely used criteria for academic success (Ridgell & Lounsbury, 2004), graduation, professional licensure (Mehrens & Philips, 1989), admission, retention, and completion tools for colleges. Other areas where GPA is an important factor include:

a) Selectivity in competitive majors such as medicine, law, pharmacy, veterinary school. Blue, Gilbert, Elam, and Basco (2000) found that undergraduate GPA was a predictor for medical school performance. In another study, Unni, Zhang, Radhakrishnan, Smith, Bridgen, DeYoung, and Metzger (2011) found that pre-requisite GPA was a significant predictor of academic performance for students pursuing Doctor of Pharmacy degrees.
b) Selectivity by Carnegie Classification of Institutions of Higher Education such as Harvard, Yale, MIT, University of Chicago, and Stanford University. Top universities in the United States typically use GPA as a factor in admission criteria. For example: In 2010, Harvard University lists the average GPA for medical school admission as 3.8, along with other criteria.

c) Many prestigious scholarships for undergraduate students such as Barry M. Goldwater Scholarship, Rhodes scholarship, and Harry S. Truman Scholarship Programs are very competitive and high GPAs are an expectation or a requirement.

d) Although FAFSA (Federal Student Aid) does not specify minimum GPA for awards, states require students to maintain satisfactory academic progress, which is typically defined as having a 2.0 or higher GPA.

e) For admission into graduate programs, states like California and Texas require undergraduates to have at least a 2.0 GPA. Graduate students are expected to maintain a 3.0 GPA or higher to demonstrate good standing in their programs.

f) Many programs use GPA as one of the criteria for internships. Maynard (2000) found GPA to be a meaningful measure of student performance in Internship. Students with higher GPAs performed better than their peers with lower GPAs in internship assignments.

g) GPA data are routinely collected and reported to federal (e.g. National Center for Education Statistics) and state agencies (e.g. Texas Education Agency), professional organizations (e.g. National Collegiate Athletic Association) and accreditation boards.

Poor grade point averages have been associated with punitive academic actions such as academic probation, academic suspension, ineligibility to practice and play under the National Collegiate Athletic Association (NCAA)’s guidelines, loss of financial aid for failing to maintain
satisfactory academic progress, and even termination from academic programs.

Critics have identified drawbacks when GPA is used to measure student learning. Rogers (2003) argues that, “one reason why course grades are not appropriate for program assessment is that course content for any given subject may vary among faculty members teaching the same course.” Additionally, Johnston and O’Neill (1973) note that, “a student’s academic performance is “influenced by the teacher’s definition of criteria for the various course grades” (p. 261).

Despite criticisms against the use of GPA, Soh (2011) notes that, “the current GPA system is an off-shoot of a clever innovation which pre-dated modern knowledge and technology of educational assessment by two centuries. It is so prevalent the world over that it is difficult to imagine the day when GPA did not exist” (p. 33). For many researchers, the solution to the problem is to find better and more effective measures of learning. We have a large body of literature to address the issue at hand. Recent efforts such as the use of student portfolios (Baeten, Dochy & Struyven 2008; Tiwari & Tang, 2003; Zubizarreta, 2009), targeted research on teacher effectiveness (Gordon, Kane, & Staiger, 2006), and the introduction of problem-based learning in the classroom (Hmelo-Silver, 2004) are some of the strategies being used to create a more robust system of assessing learning.

In the next section, recent studies examining the relationship between multitasking and academic performance are reviewed in the context of this study.

The Relationship between Media Multitasking and Grade Point Average

Kaiser Family Foundation researchers, Rideout, Foehr, and Roberts (2010), noted that
heavy media users reported lower grades and lower levels of personal contentment. The study grouped 8-18 years olds into three categories of media users: heavy (16 hours of media use or more in a day), moderate (3-16 hours a day), and light (3 or less hours a day). In the heavy media user group, 47% percent of the participants reported fair to poor grades. In contrast, only 23% of the light media use group reported similar grade issues. Heavy media users in one medium tend to be heavy media users in other media.

Other studies have examined the use of social media and instant messaging on student grades. Kirschner and Karpinski (2010) found that heavy Facebook users have lower GPAs than non-users. In another study, Fox, Rosen, and Crawford (2008) reported that students who spent more time on instant messaging scored lower on their reading comprehension scores than their counterparts who spent less time on instant messaging.

While many experts claimed that multitasking has a negative effect on academic performance, recent studies conducted by Kraushaar and Novak (2010), and Banai, Ortiz, Oppenheimer, and Wright (2010) found a different set of results. In the first study, Kraushaar and Novak (2010) conducted a study to examine multitasking in the classroom: frequency, duration, time spent on productive and distractive multitasking. Ninety-seven undergraduate business students participated in the study that relied on self-reported data and spyware (computer tracking) data. The researchers categorized multitasking into two groups: distractive multitasking and productive multitasking. Kraushaar and Novak defined distractive multitasking as “tasks or activities where cognitive resources are used to process information that is not directly related to the course material.” They defined productive multitasking as “tasks or
activities that are directly related to completing a primary task associated with the course material” (p. 242).

In this study, Kraushaar and Novak (2010) found limited support for their first hypothesis that, students with higher frequency of software multitasking “exhibit lower academic performance than students with a low frequency of software multitasking” (p. 246). Similarly, they were not able to find any statistical difference in terms of academic performance between those who spent more time on software multitasking and those who spent shorter durations. Kraushaar and Novak noted that instant messaging was the only application where academic performance was inversely related to disruptive multitasking. The researchers concluded that there was “limited and mixed support for the hypothesis that a higher frequency of multitasking is correlated with lower academic performance levels” (p. 249).

In the second study conducted by Banai, Ortiz, Oppenheimer, and Wright (2010), the researchers found that learning was disrupted when participants had to interleave one listening activity with another. Banai, Ortiz, Oppenheimer, and Wright conducted a series of training sessions with three groups to determine if learning occurs in two stages: initial acquisition and consolidation. All participants completed pre and post-tests sessions. Participants were assigned the task of listening to two tones at different intervals on a set of seven conditions. Training was provided to the two groups (single condition and interleave conditions) while the control group received no training. The first group (single condition) had to listen to the tones consecutively while the second group (interleave condition) had to switch between the listening task and a symbol-to-number matching task. The third group was assigned as the control group for the experiment. All three groups did not show any significant difference in
performance during the pre-tests. Banai, Ortiz, Oppenheimer, and Wright found the interleave group resulted in “no learning between the pre- and post-tests on any condition” (p. 438) while single condition group demonstrated that learning had occurred during the post-test sessions. The researchers concluded that, “consecutive-trained but not interleaved trained listeners benefited from training received further support from the analyses of the learning curves of the two groups” (p. 440). They noted that the consecutive training group “demonstrated significant improvement of both average performance and performance consistency” (p. 440) while the interleaved training group failed to show any improvement. The sample population for Banai, Ortiz, Oppenheimer, and Wright study was small. The study needs to be replicated with a larger sample population. What we do not know at this point is whether the disruption causes negative impact on academic outcomes.

What are the implications of the findings? Considering that media multitasking is a way of life for many college students, it is becoming increasingly important for researchers to examine the ramifications on how (and if) the phenomenon impacts the way we learn. Recent research findings have been mixed at best. Some researchers believe that our brains may be adapting to the multi-sensory, multi-task learning environment. Others believe that it interferes with knowledge acquisition.

Media Multitasking Index Survey

An exhaustive review of methods and instruments used to measure polychronicity, task switching, dual-task, and multitasking orientations was conducted to determine if an existing instrument could be used for purpose of this study. To this end, the researcher evaluated
several instruments such as TABP (Type A Behavior Pattern) designed to measure the relationship between multitasking and personality type (Ishizaka, Marshall, and Conte, 2001); SIMKAP designed for hiring purposes (Simultaneous capacity/Multi-tasking, Bratfisch & Hagman, 2003); MMI (Media Multitasking Index; Ophir, Nass, & Wagner, 2009); TAP (Test Battery for Attentional; Zimmerman & Fimm, 2002), and IPV (Inventory of Polychronic Values; Conte & Jacobs, 2003).

Switzer, Wisniewski, Bell, Dew, and Schultz (1999) recommend using two primary criteria when selecting an instrument for a study: context and psychometrics. They define context as “factors exogenous to the assessment tool itself, such as characteristics of individuals to be assessed, the goals of the research endeavor, and constraints on data gathering capabilities” while “psychometrics refers to the properties of the instrument as it functions within the context” (p. 399). Reliability and validity are two key psychometric considerations for selecting and evaluating research instruments (Switzer, Wisniewski, Bell, Dew, & Schultz, 2009). At the conclusion of the instrument review process, the researcher selected Ophir, Nass, and Wagner’s Media Multitasking Index. First, the instrument satisfied the research goals of the study. Second, the instrument met the criteria for reliability. According to Field (2009), “reliability refers to whether an instrument can be interpreted consistently across different situations” (p. 11). In terms of reliability, “scores from an instrument are reliable and accurate if they are internally consistent” (Creswell, 2002, p. 182). A reliability analysis was conducted on Ophir, Nass, and Wagner’s instrument. The analysis produced a Cronbach alpha value of 0.922. A Cronbach coefficient value of over 0.7 implies high internal consistency/reliability (DeVellis, 1991). Third, the instrument met the criteria for validity.
“Validity refers to whether an instrument can measure what was designed to measure” (Field, 2009, p. 11). In terms of validity, group differences can be used as a method to establish construct validity (Cronbach & Meehl, 1955). Simply put, group differences cause groups of individuals to score differently on the measured construct. For example, when we use gender as the measured construct, males and females should score differently on the scale. Similarly, when we use media multitasking orientation as the measured construct, group differences would cause heavy and light media multitaskers to score differently on the scale. Failure to find a difference in the individuals would hurt the validity of the instrument (Cronbach & Meehl, 1955). Past research has established that Ophir, Nass, and Wagner’s instrument reliably measured media multitasking orientations (e.g., Anderson, 2010).

**Ophir, Nass, and Wagner’s Instrument**

Ophir, Nass, and Wagner (2008) used the Media Multitasking Index instrument in their study to identify participants as heavy or light media multitaskers. The operational definition for a heavy media multitasker is a participant with a Z-score that is 1.0 standard deviation or above the mean on the Media Multitasking Index survey. Conversely, the operational definition for a light multitasker is a participant with a Z-score that is 1.0 standard deviation or more below the mean on the Media Multitasking Index survey. The operational definition for a moderate media multitasker is a participant with a Z-score within 1.0 standard deviation of the mean. The term “media multitasking orientation” (MMO) refers to a participant’s media multitasking preference or affinity based on how the participant scored in the Media Multitasking Index survey. A high media multitasking index score corresponds to a high media...
multitasking orientation. Conversely, a low media multitasking index score correspond to a low media multitasking orientation.

The Ophir, Nass, and Wagner study is discussed briefly in this section. A total of 262 participants took the Media Multitasking Index survey. Participants were asked to rate their secondary media consumption while using a primary medium. The ratings were assigned weighted numerical values: “Most of the time” (=1.0), “Some of the time” (=.67), “A little of the time” (=.33), and “Never” (=0.0). Ophir, Nass, and Wagner added the total score across 12 media and measured the mean of secondary media use. The scale was developed to identify low, moderate, and heavy media multitaskers.

There were two significant findings in the study. First, Ophir, Nass, and Wagner found that heavy media multitaskers (HMMs) were more likely to be negatively affected by the distractors than light media multitaskers (LMMs). Second, Ophir, Nass, and Wagner found no significant difference in terms of performance accuracy between HMMs and LMMs. However, the HMMs had a slower response compared to their LMMs counterparts. Ophir, Nass, and Clifford argue that the data “demonstrated that HMMs are not only less capable of filtering out irrelevant stimuli from their environment, but also less capable of filtering out irrelevant representations in memory” (p. 15585). In other words, Ophir, Nass, and Wagner found that external and internal factors affected our ability to perform more than one task at a time.

Semi-Structured Interviews

Diefenbach (2009) believes that “interviews can reveal ideas and deliver insights no other method can provide” (p. 882). Many researchers are often surprised by the “richness and
diversity of the data found as well as emerging patterns of opinions, clashing cosmologies, and multiple realities” (Diefenbach, p. 892). There are three types of interviews: structured, unstructured, and semi-structured (Creswell, 2002). In structured interviews, researchers ask questions with close-ended responses. Closed-ended responses have pre-determined choices. In contrast, unstructured interviews rarely have interview guides. Instead, researchers ask questions that lead to the desired information (Gall, Gall, & Borg, 2003).

In semi-structured interviews, researchers ask both close-ended and open-ended questions to gather information to support theories, concepts, and personal experiences (Creswell, 2002). Carspecken (1996) recommends using concrete lead-off questions to introduce the topics that the researchers would like to address before guiding participants toward a more general discussion. During the interviews, researchers should play the role of facilitators to provide the participants a safe environment to “help them explore with their own vocabulary, their own metaphors, and their own ideas” (Carspecken, 1996, p. 155). Semi-structured interviews are often used in mixed-method studies.

Mixed-Methods Analysis

Quantitative research is based on positivism (Tashakkori & Teddlie, 2003). Quantitative researchers believe that scientific inquiries should be objective (Johnson & Onwuegbuzie, 2004). In contrast, qualitative research is based on interpretivism and constructivism (Johnson & Onwuegbuzie, 2004; Sale, Lohfeld, & Brazil, 2002). Qualitative researchers believe that there are multiple-constructed realities (Johnson & Onwuegbuzie, 2004). According to Johnson and Onwuegbuzie (2004), the “quantitative versus qualitative debate has been so divisive” that
many researchers believe that they have to choose one method over another (p. 14). Despite the different paradigms, Johnson and Onwuegbuzie argue that there are similarities between the qualitative and quantitative paradigms. They believe that researchers from both paradigms use empirical evidence and incorporate safeguards to reduce biases.

The alternative research paradigm draws richly from the quantitative and qualitative traditions. It is known as pragmatism. According to Creswell (2009), pragmatists do not see the world in absolute terms. They use both quantitative and qualitative methods that best suit the research problems. Thus, they are open to “multiple methods, different worldviews, and different assumptions” (p. 11). Proponents of mixed-method studies believe that the approach provides a richer set of findings. For example, Yin (2006) argues that mixed-methods studies are valuable because they produce “converging evidence, presumably more compelling than might have been produced by any single method alone” (p. 41).

Mixed-methods designs should “include at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words), where neither type of method is inherently linked to any particular inquiry paradigm” (Greene, Caracelli, & Graham, 1989, p. 256). While it is tempting to describe mixed-methods as a new approach, Tashakkori and Teddlie (2003) remind us that, “eminent social and behavioral scientists conducted mixed-methods research throughout the 20th century, but it was only during the last decade of that century that researchers began giving unique names to their designs” (p. 4).

The choice of research paradigm should be driven by the research question(s). In this study, the two research questions were:

1. To what extent do media multitasking orientation, gender, age, employment, income, and
living arrangement affect grade point average?

2. How do individual differences in media multitasking orientation manifest themselves in academic activities?

The purpose of the study necessitated the use of a mixed-methods approach. Specifically, quantitative research methods were used to answer the first research question. In order to strengthen the validity of the quantitative results and provide a richer level of details, the study utilized qualitative techniques to offset biases associated with a single method. Mixed-methods proponents believe that data triangulation with multiple methods helps address any inherent bias in the data collection and data analysis process (Barbour, 2001; Greene, Caracelli, & Graham, 1989).

Although several mixed-methods strategies have been established in the field, a sequential explanatory design was used in the study (Figure 3.1).

![Figure 3.1. Sequential explanatory design](image)

According to Ivankova, Creswell, and Stick (2006), there are two distinct phases in the mixed-methods sequential explanatory design. The two phases are quantitative and qualitative. They observe that, “in this design, a researcher first collects and analyzes the quantitative (numeric) data.” In the next stage, “the qualitative (text) data are collected and analyzed second in the sequence and help explain, or elaborate on, the quantitative results obtained in the first phase” (p. 5). In the final stage, the two phases are connected to provide an understanding of the
research problem(s) (Ivankova, Creswell, & Stick, 2006). The research design in this study called for the researcher to analyze the quantitative data from the survey and use the results to interview a representative sample of low, moderate, and heavy media multitaskers. For the semi-structured interviews, the researcher used purposive sampling to collect the data. Tedlie and Yu (2007) define purposive sampling as the selection of “units (e.g., individuals, institutions) based on specific purpose associated with answering a research study’s questions” (p. 77). Purposive samplings are non-random or judgmental (Hesse-Biber & Leavy, 2010). The sampling technique is used to achieve representativeness through contrasting cases (Tedlie & Yu, 2007).

Validity and Triangulation

Denzin and Lincoln (2008) noted that, “terms such as credibility, transferability, dependability, and confirmability replace the usual positivist criteria of internal and external validity, reliability, and objectivity” (p. 35). There are several ways to ensure that qualitative data meet scientific standards before, during, and after data collection (Diefenbach, 2009). Before data collection, Diefenbach (2009) recommends that researchers “make their own (implicit) assumptions, interests, and objectives concerning the research as well as social practice as explicit as possible” to reduce concerns about unconscious bias, (p. 891). During data collection, researchers should “treat interview statements always quite critically and with some distance, since at least the possibility that an interviewee did not tell what he or she really thinks cannot be excluded” (Diefenbach, p. 881). After data collection, “there is a definite
need for further checking and additional information” through triangulation (Diefenbach, p. 882).

In this study, the researcher used triangulation to “increase the validity of constructs and inquiry results” (Greene, Caracelli, & Graham, 1989, p. 259). Gall, Gall, and Borg (2003) describe triangulation as the “process of using multiple data-collection methods, data sources, analysts, or theories to check validity” (p. 464) of any research project. They add that, “triangulation helps eliminate biases that might result from relying exclusively on any data-collection methods, source, analysts, or theory” (p. 464). Similarly, Miles and Huberman (1984) believe that triangulation helps to “support a finding by showing that independent measures of it agree with it or, at least, don’t contradict it” (p. 235). Simply put, triangulation ensures the validity of research findings.

Summary

In this chapter, the literature reviewed revealed methodological challenges in studies related to multitasking. In addition, none of the studies examined attempted to look at individual differences in multitasking preferences. The relationship between media multitasking and academic performance has yet to be fully explored and explained. Furthermore, there is a pressing need to examine multitasking from a mixed-methods perspective to help us understand the phenomenon among college students. The literature reviewed also covered methods used to gather and analyze mixed-methods data followed by a discussion on the issues of validity and triangulation.
CHAPTER III

METHODOLOGY

This chapter is divided into four sections. The first section starts with a discussion on research permission. The next section discusses the strategy for inquiry followed by methods and procedures for data generation, collection and analysis. The final section deals with steps taken to ensure rigor and trustworthiness.

Research Permission

The researcher submitted an Institutional Review Board (IRB) application to request approval to conduct the study. The application packet was submitted electronically. The content of the packet included a Full Board Review Application explaining the purpose of the study, recruitment procedures for participants, and data collection methods. Additional information such as the Media Multitasking Index survey, participant consent forms, and letters of invitations were submitted. Two separate informed consent forms were developed for Phase 1 and Phase 2 of the study. Approval for the study was obtained in January 2012. Because the participation rate was lower than expected, a modified IRB application was submitted in March 2012 to request permission to expand the data collection. Approval for the modified IRB was obtained at the end of March. Data collection started on Feb 17, 2012 and ended on May 10, 2012.

Strategy for Inquiry

The mixed-methods study consists of two phases. The study utilized a sequential
explanatory design. In the first phase, the Media Multitasking Index survey was used to
determine the media multitasking scores of participants. Besides media multitasking scores,
additional data such gender, age, living arrangement, classification, employment, income, and
grade were collected to answer the research questions. In the second phase, semi-structured
interviews were used to elaborate on individual differences in terms of academic performance
and learning.

Methods and Procedures for Data Generation, Collection, and Analysis

In this section, methods and procedures for data generation, collection, and analysis
described below reflect a mixed-methods design, where quantitative and qualitative data were
collected and analyzed within a single study. The first method of data collection and analysis
was a web-based survey while the second method of data collection and analysis was semi-
structured interviews.

Method 1: Media Multitasking Index Survey

Determining Sample Size through Power Analysis

Power is defined as the probability of rejecting a false null hypothesis. Field (2009) notes
that Type I error occurs “when we believe that there is a genuine effect in the population
where there really isn’t” (p. 57). In Type I error, researchers conventionally accept Fisher’s
criterion that the probability of committing such an error is 5%, alpha = 0.05 (Cohen, 1992,
Fields, 2009). Conversely Type II error occurs “when we believe there is no effect in the
population, when in reality, there is” (p. 57). Most researchers use Cohen’s recommendation
for setting the power to 80% (0.8). Cohen (1992) argues that the criterion allows researchers a 20% (0.2) chance of failing to detect an effect on the population. Given the guidelines on alpha and power, there is 4:1 ratio of detecting Type I and Type II errors (Cohen, 1992).

For the purpose of determining the minimum sample size for this study, G*Power 3 power analysis software was used. A priori power analysis was computed to determine the sample size necessary for the study. According to Faul, Erdfelder, Lang, and Buchner (2007), “a priori analyses provide an efficient method of controlling statistical power before a study is actually conducted” (p. 176). Priori analyses require three inputs: (a) alpha (b) desired power (c) effect size of the effect for the study. Effect sizes are important because they inform researchers of the magnitude or size of the effect (Field, 2009). Cohen’s guidelines on small, medium, and large effects are widely used to calculate sample size for experimental and non-experimental studies.

The G*Power 3 software was used to determine the minimum sample size required for the study using small, medium, and large effect sizes. Table 4.1 shows a summary of the effect sizes, power, and alpha level using the G*Power software (Buchner, Erdfelder, Faul, & Lang, 2006).

Table 3.1

*Effect Size and Sample Population with a Power of 0.80*

<table>
<thead>
<tr>
<th>Effect Size</th>
<th>$f^2$</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>0.02</td>
<td>652</td>
</tr>
<tr>
<td>Medium</td>
<td>0.15</td>
<td>89</td>
</tr>
<tr>
<td>Large</td>
<td>0.35</td>
<td>40</td>
</tr>
</tbody>
</table>
Typically, a medium effect size is selected because a larger value would result in the demand for a sample size that exceeds a study’s resources (Cohen, 1992, p. 156). Based on Cohen’s recommendation, the researcher decided to use a medium effect size in this study, $f = .15$, $\alpha = .05$, power of 0.80, $df = 5$. For the desired medium effect size, G*Power 3 reports a total minimum sample size required of 89 participants.

Data Collection

During the initial phase, 2800 students were invited to participate in the study. An email was sent to the students to invite them to participate in the study. In the email, the researcher described the purpose, procedures, and the benefits of the study (Appendix D). Participants were informed that they might be contacted after the survey to see if they were willing to participate in a follow-up interview. Two additional email reminders were sent during the period to increase the response rate for the survey. A total of 152 survey responses were received. Because the participation rate was lower than expected, an additional 754 undergraduate students who utilized the services of the university’s learning center, were invited to participate in the survey to increase the response rate. The center provides a variety of services including (but not limited to) tutoring sessions, workshops, and exam preparations to all its students. The director of the learning center agreed to provide a list of students who utilized its services during the semester. A total of three email invitations were sent during the period to increase the participation rate for the survey. Of the 754 students invited, 63 students participated in the survey. During the data collection period, a total of 212 survey responses were collected. The survey response rate was 6.0%.
The survey was hosted on Qualtrics, an online survey software provider. Qualtrics was a service offered to the faculty, staff, and students at the university at no cost. The web address for the survey was included in the email. When students clicked on the link, the browser directed them to the survey. An electronic consent form was displayed on home page of the survey. The results of the survey were encrypted. The survey was designed to allow participants to skip questions they did not wish to answer or withdraw completely from the study at any point. Participants who completed the survey were entered for a chance to win one of four gift certificates as means to increase survey response rate.

Data Analysis

The data were analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. Data cleaning was performed to eliminate missing responses and errors. The goal of data cleaning is to detect and remove errors and inconsistencies to improve data quality (Rahm & Do, 2000). A total of 212 students took the survey during the period. Of the 212 students responses received, 20 responses were removed because they were incomplete. An additional 6 in-progress responses were excluded because no further activity was recorded on the survey after the deadline. As a result of data cleaning, 183 responses were used for the study. The number of responses in the study was well above the minimum sample size recommendation for a medium effect size.

Descriptive statistics were examined to extract background information on the participants. Demographic characteristics such as age, gender, media multitasking orientation, classification, employment, income, and living arrangement were reported. Ophir, Nass, and
Wagner’s Media Multitasking Index (2009) were used to calculate participants’ media multitasking orientation: heavy media multitaskers, moderate media multitasker, and light media multitaskers. Heavy media multitaskers were those whose standardized media multitasking index scores were 1.0 standard deviation above the mean. Conversely, Light media multitaskers were those whose standardized media multitasking index scores were 1.0 standard deviation below the mean. Moderate media multitaskers were those whose standardized media multitasking index scores fell within 1 standard deviation of the mean.

Next, interactions among the independent variables were examined using chi-square analysis. Finally, stepwise multiple regression analyses were used to determine if significant differences existed between high, moderate, and light media multitaskers in terms of grade point average, gender, income, and age.

Method 2: Semi-Structured Interviews

The primary focus of the semi-structured interviews was to provide a deeper understanding of the behaviors of light, moderate, and heavy media multitaskers. Using the purposive sampling technique, semi-structured interviews of participants were conducted after the quantitative data from the survey were analyzed. A total of 14 participants were purposefully selected from the three media multitasking orientation groups. In each group, the researchers contacted high GPA students (GPA > 2.75) and low GPA students (GPA < 2.75) to request follow-up interviews. Eight participants agreed to be interviewed. However, only 7 participants showed up for the follow-up interviews. Since the minimum sample size for a case study is 3 to 5 participants, the researcher met the requirement recommended by
Onwuegbuzie and Collins (2007). Table 3.2 represents the number of participants who were interviewed for the study.

Table 3.2

**Number of Participants Who were Interviewed**

<table>
<thead>
<tr>
<th>Media multitasking orientation</th>
<th>GPA – below 2.75</th>
<th>GPA – 2.75 and above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light media multitaskers</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Moderate media multitaskers</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Heavy media multitaskers</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Data Collection

The interviews took place in April and May 2012. Participants were interviewed one time. The interviews lasted between 10-20 minutes. At the beginning of the interview, the researcher asked the participants about themselves and how they were doing in their courses. Next, the researcher reminded the participants that they took a survey and the interview was a follow-up as a result of the survey. Participants were informed of their media multitasking index scores and they were asked if they agreed with the outcome of the scores. Each participant was asked to describe a recent study session and what media (if any) were used during the session. The goal was to gather details on the participant’s media use while studying or working on homework or a project for school. In addition, each participant was asked whether he or she thought media multitasking helped or interfered with learning. At the conclusion of the interview, each participant was given $15.00 incentive to compensate for his or her time. The interview questions included:

1. Do you agree with the assessment of your media multitasking scores?
2. How frequently do you multitask while studying?

3. How do you multitask?

4. Do you find it easy to switch from one activity to another while studying? Why or why not?

5. Do you think media multitasking helps or interferes with learning?

6. What do you think are the benefits of media multitasking?

7. What do you think are the drawbacks of media multitasking?

8. If there anything about media multitasking that I have not asked, that you would like to share with me?

Transcription Process

The interviews were recorded using an Olympus digital voice recorder (model VN-5200PC) and Garage Band, an application on a 2010 Mac Pro Laptop. At the start of the interview, participants were asked to sign a form acknowledging that they agreed to be interviewed. They were informed that they could choose to end the interview at any point during the meeting. Once the permission was granted, the researched asked the participants if they objected to being recorded.

Upon the conclusion of the interview, the audio files were saved to the laptop and pseudonyms were used to protect the identity of the participants. Each interview was transcribed in a single session. The digital audio recording was compared to the text for accuracy at the end of the transcription process. The text was then transferred to Dedoose®, a qualitative and mixed-method online software analysis tool used to facilitate the process of open-coding and discourse analysis.
Data Analysis

According to Miles and Huberman (1994), there are three major phases of data analysis: data reduction, data display, and conclusion drawing and verification. In the first phase, "data reduction refers to the process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in written up field notes or transcriptions" (Miles & Huberman, 1994, p. 3). During the first phase, the researcher transcribed the interviews. The interviews were coded using Carspecken’s coding procedures. Carspecken’s model (1996) involves three stages: low-level coding, high-level coding, and dialogical data generation. Raw codes were first transformed into low-level codes. Next, the researcher examined the low-level codes and selected segments of these codes for intensive analysis to generate high-level codes. Finally, the low-level and high-level codes were pulled together to generate themes and consolidate codes. Two peer reviewers were given access to the interview data on Dedoose® for coding purposes. The reviewers independently coded and analyzed the transcripts.

Rigor and Trustworthiness

There are several strategies to strengthen rigor and trustworthiness in qualitative research (Barbour, 2001; Carspecken, 1996; Diefenbach, 2009; Lincoln & Guba, 1995). In this study, the researcher used three strategies to enhance the rigor of the study. The strategies were:

a) Non-leading interview questions and peer debriefers were used to check for possible leading questions (Carspecken, 1996). Leading questions are not a reliable source of information because of unconscious bias (Diefenbach, 2009). The researcher used low-
inference questions to limit any leading questions. Additionally, peer reviewers were invited to review the transcripts to ensure that non-leading questions were used.

b) Triangulation to improve the quality of data. The researcher used more than one data collection method to address the issue of validity. Data from the survey and interviews were compared to conduct consistency and confirmatory checks. For example, the researcher verified participants’ media multitasking index scores through the survey and interviews. At the beginning of each interview, the researcher informed the participant of his or her media multitasking index score. The participant was then asked if the score reflected his or her multitasking preference or affinity.

c) Peer debriefing sessions were conducted to review emerging themes, organize codes, and establish inter-coder agreement to enhance the validity of the study. The consensus among coders was approximately 92%. It was well above the 80% guideline recommended by Miles and Huberman (1994).

In terms of trustworthiness, the researcher used three methods compiled by Onwuegbuzie and Leech (2007) to assess the value of truth in qualitative research:

a) Prolonged engagement “involves conducting a study for a sufficient period of time to obtain adequate representation of the voice under the study” (Onwuegbuzie & Leech, 2007, p. 239). The researcher spent one and a half years planning, conducting, and evaluating the study. As a result of time spent on literature review, research design, data collection, and data analysis, the researcher obtained adequate representation by gaining knowledge on the topic, building trust among participants, and checking for misinformation.
b) Generated an audit trail by providing extensive documentation of records and data from the study ranging from raw data to data interpretations.

c) Checked for representativeness by “increasing the number of participants, looking purposively for contrasting participants, stratifying the sample, and obtaining a random sample” (Onwuegbuzie & Leech, 2007, p. 241).

Limitations

Although this study suggests important considerations for understanding the relationship between media multitasking orientation and grade point average, there are also limitations. First, responses of participants in the study may not be representative of undergraduate students at other institutions of higher learning. Second, because of the small sample size, the results from the study cannot be generalized to the larger population. Third, self-reported GPAs may increase the random sampling error because students may not recall their GPAs accurately. Fourth, the semi-structured interviews were transcribed without member checking, a process where the participants reviewed the statements for accuracy and completeness (Gall, Gall, & Borg, 2003).

Summary

In this chapter, the procedure for securing research permission was discussed. Next, the strategy for inquiry was introduced into the discussion followed by methods and procedures for data generation, collection, and analysis. The chapter concludes with strategies implemented to ensure rigor and trustworthiness of the data and the limitations of the study.
CHAPTER IV
RESULTS

In this chapter, the results of research analysis from the survey and semi-structured interviews are presented. The first section of the chapter covers results from the media multitasking survey. Demographic information, chi-square analysis, multiple regression analysis, and the interactions among independent variables are included in the discussion. In the second section, data from the semi-structured interviews are presented to provide a rich descriptive and narrative understanding the phenomenon of media multitasking among college students.

Method 1: Media Multitasking Index Survey

In the first phase of the study the research question asks, “to what extent do media multitasking orientation, gender, age, employment, income, and living arrangement affect grade point average?” The dependent variable for the study was grade point average. The independent variables for the study were media multitasking orientation, gender, age, employment, income, and living arrangement.

Demographic Results

In this section, participants in the study are compared on the following demographic information: gender, classification, age, employment, living arrangements, income, and grade point average.
Gender

Out of 183 participants, 74.7% of the participants were female while 25.3% were male.

Table 4.1

<table>
<thead>
<tr>
<th>Gender</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>25.3</td>
</tr>
<tr>
<td>Female</td>
<td>74.7</td>
</tr>
</tbody>
</table>

Classification

In terms of classification, seniors were the largest group of participants in the study (39.9%), followed by freshmen (15.8%), sophomores (23.0%), and juniors (21.3%).

Table 4.2

<table>
<thead>
<tr>
<th>Classification</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>15.8</td>
</tr>
<tr>
<td>Sophomore</td>
<td>23.0</td>
</tr>
<tr>
<td>Junior</td>
<td>21.3</td>
</tr>
<tr>
<td>Senior</td>
<td>39.9</td>
</tr>
</tbody>
</table>

Age

The largest age group, 20-24 year olds, accounted for 58.2% of the survey takers. In contrast, 13.7% of the survey responses came from students who were 25 or older.
Table 4.3

Age

<table>
<thead>
<tr>
<th>Age group</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-19 year olds</td>
<td>28.1</td>
</tr>
<tr>
<td>20-24 year olds</td>
<td>58.2</td>
</tr>
<tr>
<td>25 and older</td>
<td>13.7</td>
</tr>
</tbody>
</table>

Employment

The majority of the participants worked part-time (49.2%). Table 4.4 shows that only 11.6% of the participants reported that they worked 40 or more hours a week.

Table 4.4

Employment

<table>
<thead>
<tr>
<th>Hours worked</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 hours or more</td>
<td>11.6</td>
</tr>
<tr>
<td>&lt; 40 hours</td>
<td>49.2</td>
</tr>
<tr>
<td>Not working</td>
<td>39.2</td>
</tr>
</tbody>
</table>

Income

In Table 4.5, 47.5% of the participants reported income of $50,000 or less per annum. In contrast, 31.8% of the participants reported income between $50,000-$99,999 while 20.7% of the participants reported income of $100,000 per annum.
Table 4.5

*Income*

<table>
<thead>
<tr>
<th>Income level</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $50,000</td>
<td>47.5</td>
</tr>
<tr>
<td>$50,000- $99,999</td>
<td>31.8</td>
</tr>
<tr>
<td>$100,000 or more</td>
<td>20.7</td>
</tr>
</tbody>
</table>

Living Arrangement

In Table 4.6, 58.6% of the participants reported that they live with roommates. A total of 12.2% of the participants were married while 15.4% reported that they lived with their immediate families. Another 13.8% participants lived alone.

Table 4.6

*Living Arrangement*

<table>
<thead>
<tr>
<th>Living arrangement</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner/Spouse</td>
<td>12.2</td>
</tr>
<tr>
<td>Family</td>
<td>15.4</td>
</tr>
<tr>
<td>Alone</td>
<td>13.8</td>
</tr>
<tr>
<td>Roommate(s)</td>
<td>58.6</td>
</tr>
</tbody>
</table>

*Media Multitasking Orientation Index*

Participant media multitasking index scores were calculated using Ophir, Nass, and Wagner’s formula (2009).

\[ \text{MMI} = \sum_{i=1}^{11} \frac{m_i \times h_i}{H_{total}} \]
where $m_i$ is the number of media typically used while using primary medium $i$, $h_i$ is the number of hours per week reportedly spent using primary medium $i$, and $h_{\text{total}}$ is the total number of hours per week spent with all primary media. To check the assumption that the sample distribution was normally distributed, a P-P plot (probability-probability plot) was used. The technique is used to plot the cumulative probability of a variable against the cumulative probability of a normal distribution (Field, 2009). Simply put, P-P plot compares data in the sample distribution against the expected data in a normal distribution. Figure 4.1 shows the P-P plot for Media Multitasking Index scores among participants. The expected scores and observed scores showed the sample population Media Multitasking Index scores were normally distributed.

![Figure 4.1. P-P Plot for Media Multitasking Index scores.](image-url)
Additionally, a frequency distribution graph was plotted to examine if the media multitasking index scores were distributed normally. The histogram in Figure 4.2 showed a fairly normal distribution with a mean of 5.939, a standard deviation of 2.5333, skewness value of 0.30 and kurtosis value of -0.709.

![Histogram](image)

**Figure 4.2.** Distribution of Media Multitasking Index scores.

Participants were assigned Media Multitasking Index scores based on their responses of primary and secondary media use in the survey. Table 4.7 shows the media multitasking orientations of the participants.

**Table 4.7**

<table>
<thead>
<tr>
<th>Orientation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>33</td>
</tr>
<tr>
<td>Moderate</td>
<td>116</td>
</tr>
<tr>
<td>Heavy</td>
<td>34</td>
</tr>
</tbody>
</table>
Interactions among Independent Variables

In this section, interactions among the independent variables were examined using chi-square statistic. A chi-square analysis compares observed frequencies of occurrence with expected frequencies between categorical data (Hinkle, Wiersma, & Jurs, 2003). It is used to test the hypothesis of no association between two or more groups. According to Robson (1994), “a statistically significant chi-square is evidence for association” (p.94).

The six independent variables used in the study were tested for associations between the categories. The researcher subjected the independent variables to chi-square testing to determine if the observations in each category were independent of one another. The critical value was set at .05. According to Ary, Jacobs, and Razavieh (2002), there are three basic assumptions for chi-square statistics (a) observations must be independent (b) categories must be mutually exclusive (c) observations are measured in frequencies that are no smaller than 5. The first two assumptions were met with the existing data sets. The third assumption was met only after some of the categories for age, income, living and arrangement, were pooled because they had fewer than 5 responses. Table 4.8 presents the summary of the results of chi-square analyses examining the inter-correlations between the six independent variables.
Table 4.8

Results of Chi--Square Analyses Examining the Differences the Independent Variables (N = 183)

<table>
<thead>
<tr>
<th></th>
<th>MMO</th>
<th>Gender</th>
<th>Age</th>
<th>Income</th>
<th>Employment</th>
<th>Living arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\chi^2$</td>
<td>df</td>
<td>alpha</td>
<td>$\chi^2$</td>
<td>df</td>
<td>alpha</td>
</tr>
<tr>
<td>MMO</td>
<td>10.910</td>
<td>2</td>
<td>0.220</td>
<td>3.310</td>
<td>4</td>
<td>0.507</td>
</tr>
<tr>
<td>Gender</td>
<td>7.631</td>
<td>2</td>
<td>0.220</td>
<td>1.539</td>
<td>2</td>
<td>0.463</td>
</tr>
<tr>
<td>Age</td>
<td>3.310</td>
<td>4</td>
<td>0.507</td>
<td>1.539</td>
<td>2</td>
<td>0.463</td>
</tr>
<tr>
<td>Income</td>
<td>8.158</td>
<td>4</td>
<td>0.860</td>
<td>0.260</td>
<td>2</td>
<td>0.878</td>
</tr>
<tr>
<td>Employment</td>
<td>10.597</td>
<td>4</td>
<td>0.310</td>
<td>0.240</td>
<td>2</td>
<td>0.887</td>
</tr>
<tr>
<td>Living Arrangement</td>
<td>10.071</td>
<td>6</td>
<td>0.122</td>
<td>4.940</td>
<td>3</td>
<td>0.176</td>
</tr>
</tbody>
</table>
Of the six independent variables examined, the chi-square analysis revealed that the relationship between age and living arrangement was statistically significant, \( \chi^2 (6, N = 183) = 55.908, p < 0.001 \). Similarly, the relationship between age and employment was also statistically significant, \( \chi^2 (4, N = 183) = 21.960, p < 0.001 \). Because these two independent variables showed a strong evidence of association, they were subsequently removed from the multiple regression analysis to reduce the risk of multicollinearity.

The chi-square results for the four remaining independent variables showed that media multitasking orientation, age, gender, and income were unrelated, or independent of one another. As a result of this, these four independent variables will be included in the multiple regression analyses.

**Multiple Regression Analysis**

In multiple regression, we assume that “each IV [independent variable] can potentially add to the prediction of the dependent variable Y” (Cohen, 2003, p. 419). Multicollinearity occurs when an independent variable is highly correlated with another independent variable, causing the regression coefficient to be unreliable or difficult to interpret (Cohen, 2003). Pedhazur (1973) sounded a similar warning. He warns that, “collinearity may cause devastating effects on regression statistics rendering them useless, even highly misleading” (p. 295).

One of the most common methods to diagnose the problem of highly correlated independent variables is to use the collinearity tests in SPSS. In this study, the variance inflation factor (VIF) and tolerance statistics were used to ensure that the no multicollinearity assumption was met. Variance inflation factor (VIF) indicates whether “a predictor has a strong relationship with the other predictor(s) (Field, 2009, p. 224). Pedhazur (2006) notes that, “a
relatively large VIF indicates that the estimation of the regression with which it is associated is adversely affected” (p. 302). Typically, any VIF that is higher than 10.0 presents a strong collinearity issue (Cohen, 2003). In addition to VIF, tolerance (a reciprocal of VIF), tells us how much a variable is independent of other variables. Cohen (2003) suggests that a tolerance value below .10 or less is indication of a serious problem of collinearity. Both tests were run in SPSS. Table 4.9 indicates that there were no multicollinearity issues with the independent variables used in the study.

Table 4.9

Collinearity Diagnostics

<table>
<thead>
<tr>
<th></th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMO</td>
<td>.959</td>
<td>1.043</td>
</tr>
<tr>
<td>Gender</td>
<td>.927</td>
<td>1.024</td>
</tr>
<tr>
<td>Age</td>
<td>.972</td>
<td>1.029</td>
</tr>
<tr>
<td>Income</td>
<td>.973</td>
<td>1.027</td>
</tr>
</tbody>
</table>

A stepwise multiple regression analyses were used to examine the relationships between the dependent variable and independent variables. Under this method, variables were entered step-by-step to determine “how much ‘new variance’ in the outcome can be explained by each remaining predictor” (Fields, 2009, p. 213). According to Field (2009), the stepwise method retains a predictor only when it makes a significant contribution to the predictive power of the model.

Before running any regression analyses, four independent variables were coded based on their level of measurements. Table 4.10 is summary of the treatment of dependent and independent variables in SPSS.
Table 4.10  
*Treatment of dependent and independent variables in SPSS*

<table>
<thead>
<tr>
<th>Variable type</th>
<th>Description</th>
<th>Level of Measurement</th>
<th>Level of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent</td>
<td>GPA</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>MMO</td>
<td>Categorical</td>
<td>Effect coding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1=HMM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0=MMM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-1=LMM</td>
</tr>
<tr>
<td>Independent</td>
<td>Gender</td>
<td>Categorical</td>
<td>Dummy coding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1=Female</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0=Male</td>
</tr>
<tr>
<td>Independent</td>
<td>Age</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>Income</td>
<td>Continuous</td>
<td></td>
</tr>
</tbody>
</table>

To determine the contribution of each independent variable to the dependent variable, the stepwise method was followed. In Step 1, four regression models were generated to analyze how each independent variable contributed to $R^2$. Step 2 examined how an independent variable fared in relations to $R^2$ with the addition of a new independent variable. In Step 3, three independent variables were entered into the Stepwise regression program to determine how well they fit into the regression model. Finally in Step 4, all four independent variables were tested for their effects on the dependent variable. The stepwise regression method removes an independent variable if that variable does not add any statistical significant effect to $R^2$. 
Step 1: Regression models with 1 independent variable

a) Model A with 1 Independent variable = Gender

The results of the regression indicated gender explained 5.3% of the variance ($R^2=.053$, $F(1,183)=8.818, p < .05$).

Table 4.11

*Model with Gender*

<table>
<thead>
<tr>
<th></th>
<th>Unstandardized β</th>
<th>Standardized β</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.700</td>
<td>23.660</td>
<td>23.660</td>
<td>.000</td>
</tr>
<tr>
<td>Gender</td>
<td>.392</td>
<td>.217</td>
<td>2.969</td>
<td>.003</td>
</tr>
</tbody>
</table>

b) Model B with 1 Independent variable = Age

The results of the regression indicated age explained 5.3% of the variance ($R^2=.053$, $F(1,183)=10.079, p < .05$).

Table 4.12

*Model with Age*

<table>
<thead>
<tr>
<th></th>
<th>Unstandardized β</th>
<th>Standardized β</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.455</td>
<td>13.720</td>
<td>13.720</td>
<td>.000</td>
</tr>
<tr>
<td>Age</td>
<td>.291</td>
<td>.231</td>
<td>3.175</td>
<td>.003</td>
</tr>
</tbody>
</table>

c) Model C with 1 Independent variable = Income

The results of the regression indicated income explained 1.8% of the variance ($R^2=.018$, $F(1,183)=3.263, p > .05$). Income was the only independent variable that did not have statistically significant relationship with the dependent variable.
Table 4.13

*Model with Income*

<table>
<thead>
<tr>
<th></th>
<th>Unstandardized β</th>
<th>Standardized β</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.767</td>
<td></td>
<td>19.566</td>
<td>.000</td>
</tr>
<tr>
<td>Gender</td>
<td>.134</td>
<td>.135</td>
<td>1.806</td>
<td>.007</td>
</tr>
</tbody>
</table>

d) Model D with 1 Independent variable = Media Multitasking Index

The results of the regression indicated media multitasking orientation explained 5.6% of the variance ($R^2=.056$, $F(1,183)=-10.536$, $p<.05$).

Table 4.14

*Model with MMO*

<table>
<thead>
<tr>
<th></th>
<th>Unstandardized β</th>
<th>Standardized β</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.436</td>
<td></td>
<td>23.212</td>
<td>.000</td>
</tr>
<tr>
<td>MMO</td>
<td>-.074</td>
<td>.236</td>
<td>-3.246</td>
<td>.001</td>
</tr>
</tbody>
</table>

Step 2: Model E with 2 independent variables = Gender, Age

The addition of a new independent variable, age, caused the $R^2$ to increase .104. The results of the regression indicated Gender and Age explained 11.1% of the variance ($R^2=.104$, $F(2,183)=10.349$, $p<.05$).

Table 4.15

*Model with Gender and Age*

<table>
<thead>
<tr>
<th></th>
<th>Unstandardized β</th>
<th>Standardized β</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.073</td>
<td></td>
<td>10.017</td>
<td>.000</td>
</tr>
<tr>
<td>Gender</td>
<td>.433</td>
<td>.242</td>
<td>3.405</td>
<td>.001</td>
</tr>
<tr>
<td>Age</td>
<td>.321</td>
<td>.255</td>
<td>3.587</td>
<td>.000</td>
</tr>
</tbody>
</table>
Step 3: Model F with 3 independent variables = Gender, Age, Income.

The stepwise regression excluded income from its predictive model because income did not contribute to explaining the differences in the dependent variable.

Step 4: Model G with 4 independent variables = Gender, Age, Income, MMO

The results of the regression indicated Gender, Age, and MMO explained 16.0% of the variance ($R^2 = .160$, $F(4,183)=8.320$, $p < .001$). Income was once again excluded from the predictive model. It was found that media multitasking orientation significantly predicted grade point average ($\beta = -.254$, $p < .05$), as did gender ($\beta = .483$, $p < .001$), and age ($\beta = .254$, $p < .001$).

Based on the results presented in the table, the following regression equation was derived: that is, Grade Point Average predicted = $1.810 - 0.254$ HMM + 0.483 Female + 0.251 Age

Table 4.16

* Model with Gender, Age, and MMO

<table>
<thead>
<tr>
<th></th>
<th>Unstandardized $\beta$</th>
<th>Standardized $\beta$</th>
<th>$t$</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.810</td>
<td></td>
<td>10.334</td>
<td>.000</td>
</tr>
<tr>
<td>Gender</td>
<td>.483</td>
<td>.268</td>
<td>3.829</td>
<td>.000</td>
</tr>
<tr>
<td>Age</td>
<td>.251</td>
<td>.254</td>
<td>3.164</td>
<td>.001</td>
</tr>
<tr>
<td>MMO</td>
<td>-.254</td>
<td>-.195</td>
<td>-2.774</td>
<td>.006</td>
</tr>
</tbody>
</table>

* Excluded variable – Income

A summary the regression results for Model 1, 2, and 3 is presented in Table 4.17.
Table 4.17

*Regression Results for Model 1, 2, and 3*

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.7000</td>
<td>2.073</td>
<td>1.810</td>
</tr>
<tr>
<td>Gender</td>
<td>.372</td>
<td>.438</td>
<td>.483</td>
</tr>
<tr>
<td>Age</td>
<td>.321</td>
<td>.251</td>
<td></td>
</tr>
<tr>
<td>MMO</td>
<td>-.254</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>.053</td>
<td>0.104</td>
<td>.160</td>
</tr>
<tr>
<td>F</td>
<td>8.818</td>
<td>11.134</td>
<td>11.042</td>
</tr>
</tbody>
</table>

The results of the regression indicated three out of four independent variables explained 16.0% of the variance ($R^2 = .160$, $F(4,183)=8.320$, $p < .001$). It was found that media multitasking orientation significantly predicted grade point average ($\beta = -.253$, $p < .001$), as did gender ($\beta = .480$, $p < .001$), and age ($\beta = .294$, $p < .001$). The effect size was small.

The predictive regression model indicates that undergraduate female students have higher GPAs than male students in the study. A one-way analysis of variance (ANOVA) confirmed the findings with female students ($M=3.092$, $SD=0.804$) performing better than male students ($M=2.700$, $SD=0.677$), $t(183)=-0.2969$, $p < 0.05$) academically. The mean GPA for the sample population was 2.9927 with a standard deviation of .791.

In the regression model, effect coding was used for MMO (HMM = 1, MMM = 0, and LMM = as -1). The coefficient of -.254 for Media Multitasking Orientation (MMO) indicates that Heavy media multitaskers have lower GPAs than Light media multitaskers in the study. Simply put, HMMs have an average GPA of -.254 below the mean while the LMM have an average GPA score of .254 above the mean. Figure 4.3 shows the mean plot for the GPA-MMO interactions.
In terms of age, the coefficient of .251 suggests that there is a positive correlation between GPA and age. A one-way analysis of variance (ANOVA) confirmed that the youngest group age, 16-19 year olds (M=2.661, SD=1.087), had lower GPAs than those in the 20-24 age group (M=3.117, SD=.609) and 25 and older age group (M=3.148, SD=0.540), $t(183)=6.641$, $p < 0.05$. Figure 4.4 shows the mean plot for the GPA-Age interactions.

Figure 4.4. Mean plot for the GPA-Age.
Interaction Effects

a) Media multitasking orientation and gender

A chi-square test of independence was performed to examine the relationship between two categorical data, media multitasking orientation and gender. The relationship between these variables was statistically significant, $\chi^2 (2, N = 183) = 7.631, p < 0.05$. Female students were far more likely to be moderate media multitaskers (MMMs). Male students on the other hand were far more likely to be light media multitaskers (LMMs).

Table 4.18

Chi-Square Analysis - MMO and Gender

<table>
<thead>
<tr>
<th></th>
<th>LMM</th>
<th>MMM</th>
<th>HMM</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>30%</td>
<td>50%</td>
<td>20%</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>50%</td>
<td>20%</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>50%</td>
<td>20%</td>
<td>46</td>
</tr>
<tr>
<td>Females</td>
<td>13%</td>
<td>68%</td>
<td>18%</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>13%</td>
<td>68%</td>
<td>18%</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>13%</td>
<td>68%</td>
<td>18%</td>
<td>136</td>
</tr>
<tr>
<td>All</td>
<td>18%</td>
<td>64%</td>
<td>19%</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>18%</td>
<td>64%</td>
<td>19%</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>18%</td>
<td>64%</td>
<td>19%</td>
<td>183</td>
</tr>
</tbody>
</table>

b) Media multitasking orientation by GPA

The chi-square test of independence performed to examine the relationship between two categorical data, media multitasking orientation and GPA. The relationship between these variables was statistically significant, $\chi^2 (2, N = 183) = 15.494, p < 0.05$. Heavy media multitaskers tend to have weaker GPAs than light media multitaskers and moderate media multitaskers.
Table 4.19

*Chi-square - Media Multitasking Orientation and GPA*

<table>
<thead>
<tr>
<th>GPA &lt; 1.0</th>
<th>GPA 2.0-2.99</th>
<th>GPA 3.0—3.99 GPA=4.0</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5%</td>
<td>12.5%</td>
<td>43.8%</td>
<td>6.2%</td>
</tr>
<tr>
<td>23.5%</td>
<td>10.4%</td>
<td>60.9%</td>
<td>5.2%</td>
</tr>
<tr>
<td>55.9%</td>
<td>2.9%</td>
<td>41.2%</td>
<td>0.0%</td>
</tr>
<tr>
<td>32.0%</td>
<td>9.4%</td>
<td>54.1%</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

**c) MM0 and Living Arrangement**

A chi-square test of independence was performed to examine the relationship between two categorical data, media multitasking orientation and living arrangement. The relation between these variables was not statistically significant, $\chi^2 (6, N = 183) = 15.351, p > 0.05$. Simply put, living arrangement does not affect media multitasking orientation.

**d) MMO and Income**

A chi-square test of independence was performed to examine the relationship between two categorical data, media multitasking orientation and income. The relation between these variables was not statistically significant, $\chi^2 (4, N = 183) = 8.158, p > 0.05$. Simply put, living income does affect media multitasking orientation.

**Method 2: Semi-Structured Interviews**

The qualitative interviews provided rich details of how low, moderate, and heavy media multitaskers juggle their academic commitments in media saturated environments. The interviews revealed various facets of how media and media multitasking preferences influenced
where the students studied, how they studied, and how well they studied as evidenced by their media use, gender, age, and grade point averages. Table 4.20 displays the demographic information on the participants. Pseudonyms were used to protect the confidentiality of the participants.

Table 4.20

*Participants Selected for Case Study Analysis*

<table>
<thead>
<tr>
<th>Media Multitasking Index</th>
<th>GPA</th>
<th>Gender</th>
<th>Age</th>
<th>Marital Status</th>
<th>Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rob</td>
<td>LMM</td>
<td>3.863</td>
<td>Male</td>
<td>20-24</td>
<td>No</td>
</tr>
<tr>
<td>Jake</td>
<td>LMM</td>
<td>2.461</td>
<td>Male</td>
<td>16-19</td>
<td>No</td>
</tr>
<tr>
<td>Laura</td>
<td>LMM</td>
<td>3.667</td>
<td>Female</td>
<td>35-44</td>
<td>Yes</td>
</tr>
<tr>
<td>Amy</td>
<td>HMM</td>
<td>1.153</td>
<td>Female</td>
<td>16-19</td>
<td>No</td>
</tr>
<tr>
<td>Geri</td>
<td>MMM</td>
<td>3.554</td>
<td>Female</td>
<td>25-25</td>
<td>Yes</td>
</tr>
<tr>
<td>Alan</td>
<td>HMM</td>
<td>1.200</td>
<td>Male</td>
<td>16-19</td>
<td>No</td>
</tr>
<tr>
<td>Cara</td>
<td>HMM</td>
<td>3.625</td>
<td>Female</td>
<td>20-24</td>
<td>No</td>
</tr>
</tbody>
</table>

*Rob*

Rob was a double major in music and mathematics. He described himself as a light media multitasker. His Media Multitasking Orientation score put him firmly in the low media multitasking category. Rob’s GPA was 3.863.

*Jake*

Jake was a kinesiology major. Like Rob, he described himself as a light media multitasker. He was an avid video game player. Jake’s GPA was 2.461.
Laura

At the age of 34, Laura was the oldest participant in the interview. She was a non-traditional student with two young kids. Laura majored in Spanish. Her career goal was to become a high school Spanish teacher. Laura described herself as a light media multitasker who does not have time to use multiple media. Her GPA was 3.667.

Amy

Amy majored in art. She was 19. She lived on the campus dormitory. Her Media Multitasking Index score showed her as a heavy media multitasker. Amy’s GPA was 1.153.

Geri

Geri was a senior. Her major was sociology. At 25, Geri has 2 year-old and she was expecting a second child. Geri has been married to her husband for 5 years. Geri worked full-time through college. Her media multitasking index score placed Geri in the moderate media multitasking group. Geri’s GPA was 3.500.

Alan

Alan was a computer science major. He had second thoughts about his major because the courses were challenging. His media multitasking index score indicated that he was a heavy media multitasker. Alan’s GPA was 1.200.
**Cara**

Cara was a history major. She worked three jobs to support herself through college. She scored high on the media multitasking index. Cara’s GPA was 3.620.

**Findings**

Based on the analyses of the interviews, there were similarities and differences in how low, moderate, and heavy media multitaskers viewed the effects of media multitasking on learning. When asked if they found it easy or difficult to switch from one task to another while studying, the high multitaskers indicated that they preferred to work on multiple activities at the same time.

(Alan, heavy media multitasker, low GPA)

I will turn the TV on or something to just hear the voices in the room so that I am not like all quiet by myself. At the same time the music is playing but the volume is at a moderate level so that it does not distract or coincide with each other.

On the other hand, light media multitaskers emphatically said they preferred to focus on one activity at a time.

(Laura, light media multitasker, low GPA)

No, not while studying. I lose my train of thoughts and it is difficult to get back on track. I believe because I want to get a good grade, I put all my energy, all my thoughts into it. If I am distracted, I just lose it. I have to start all over again.

Unlike the heavy media multitaskers and light media multitaskers, Geri who was a moderate media multitasker, noted that she prioritized her multitasking based on what was important to her while she was studying.
(Geri, moderate media multitasker, high GPA)

Yes. I am a parent. I am usually studying while I am watching my daughter or while she is running around the house. So I have to take breaks from studying to accommodate her needs. If she needs a cup of juice, I get her a cup of juice. My husband needs food. I will make him food. So I am constantly I might be doing my homework but when things pop up, I have to ... whatever takes precedence or priority at the time.

During the interviews, the participants were asked to describe their typical study session. As expected, the heavy media multitaskers expressed strong preferences for media use while studying. When asked why he preferred to study with media, Alan said that he could not concentrate without listening to music or television in the background. In addition, he noted that he would be distracted if he studied in a quiet room or location.

(Alan, heavy media multitasker, low GPA)

I had to especially in high school but I do not like it. To me, my imagination starts taking me away. I start to think of other things. I start to daydream, I don’t start paying attention, and I start dozing off. It is just like I am not in the room anymore. So when it is quiet, I will not to think about what I am doing and it kind of strays from actually doing work.

Geri, a moderate media multitasker, supported Alan’s assertion that music helped tuned out other distractions for her when she studied at the library:

Geri (moderate media multitasker, high GPA)

I get distracted by seeing people walking around and I am curious about what they are doing, so I have to look at what they are doing. Music kind of makes it a distraction that I can focus on because I am usually trying to figure out what music is playing in the background, like do I recognize this, is this you modern or is this classical? I think about those things while I am studying. Sounds really bad, I probably shouldn’t.

In contrast, the light media multitaskers believed that multitasking was detrimental to their academic activities. John expressed a strong preference for a quiet place to study. He noted that when he studied at the campus library, he was often distracted by the conversations
around him. According to John, he ended up listened to the conversations instead of working on his project or studying on various occasions. Similarly, Laura noted that she could not juggle more than a single activity at the same time.

(Laura, light media multitasker, high GPA)

I have to do homework that is due the following week, I finish my homework. Until I finish my homework, then I stop and relax and do something else. For example, this week I am studying for a test, and it is computerized, then I focus all my attention on that.

Although the heavy media multitaskers loved to listen to music or watch television when they studied, the choice of music or television was important to them.

(Alan, heavy media multitasker, low GPA)

I have certain songs. They have to be very like moderate tone, mostly like alternative music or indie pop or pretty much any that speaks but goes with the rhythm of the song.

(Cara, heavy media multitasker, high GPA)

The TV is usually going on in the background. It does not matter what show is going on. It is not super loud to where I can’t pay attention to it. I listen to music. I don’t listen to anything upbeat. I listen to more like Otis Redding, something that’s more like I guess you could say chill that allow me to concentrate more.

Geri, the Moderate media multitaskers, echoed similar sentiments about the type of music she preferred:

(Geri, moderate media multitasker, high GPA)

Music with lyrics because that is a real distraction for me. I used to be able to just listen to any kinds of music, it didn’t matter but then I find myself singing along with the songs and I find myself too distracted and have to re-read passages and have to re-do a math problem. I have to do this and that. I prefer music that does not have any lyrics because it is less obtrusive. So that I can kind of tuned out things at times when I am trying to concentrate a passage or something that I am reading.

In contrast, Rob, a Music and Mathematics major, believed that his interest in music, made him
susceptible to being distracted.

(Rob, light media multitasker, high GPA)

I think ... in effect of being in the music classes and just kind of studying Jazz in general ... When I do listen to music, I really like to focus my attention on the music. You know when it is kind of in the background, I can’t help but sort of pay attention to it. I think I kind of get pretty deep into the music and sort of pick up on you know ... maybe not just like the sound or groove but what each individual person is doing because that’s something that I have to do for a lot of my classes. I have gotten into the habit even when I am not doing something for class. So if I try to listen to something and doing Math homework, one of them is going to suffer.

While he understood why many students on campus walked and listened to music at the same time, Rob believed that the most of the students used music as background sounds.

During the interviews, participants were asked if they felt that media use interfered or helped them with learning. The two heavy media multitaskers, Cara and Alan, felt that using media while studying helped them to focus their attention on their projects, exams, or assignments.

(Cara, heavy media multitasker, high GPA)

Multitasking definitely helps me. It helps me get things done faster and I am doing what I have to do without I would say focusing completely on the homework to where that’s like I have to do the homework, I am staring at the computer screen, there is nothing else going around me. That to me is more distracting than there weren’t music, TV on the background.

In contrast, Geri and Rob felt that media use interfered with their studying activities.

Geri noted that her studying sessions lingered longer when she used media while she read a book or completed a project.

(Geri, moderate media multitasker, high GPA)

(My) studying session may linger for an hour when it probably could be done just in 40 minutes. You know, I spend 5 minutes on Facebook, 5 minutes checking my email, 5 minutes answering text messages, and 5 minutes calling people. I am doing research for
something else on top of the homework I am doing multiple things. So realistically, if it
never existed … in the perfect world then I was never used to having all these
technology, then I will be able to just sit down and read my text book for example for an
hour rather than it being shortened down to like 40 minutes because I am spending 20
minutes on what have you.

Rob believed that he has to focus on one activity at a time in order for him to put his effort at a
project or homework. He argued that when students tried to accomplish multiple tasks at the
same time, they would not produce the best results.

(Rob, light media multitasker, high GPA)

Certainly if I try to listen to music and type an essay and do math homework and
practice my saxophone all at the same time, it would not turn out well you know. So I
guess for me personally, I think that yeah, you know whatever I am trying to accomplish,
if I am trying to do it well while I am trying to do something else, I probably would put all
of my effort or best shot in whatever I am trying to do.

Next, the participants were asked if they felt there were benefits to media multitasking
as students. Many participants felt that multitasking helped students complete their tasks
sooner. Others believed that multitasking helped students to filter distractions. Alan’s answer
represented the typical response from the participants.

(Alan, heavy media multitasker, low GPA)

For me personally, I get more things done. Like instead of just concentrating on an hour
on being stuck on calculus. If I am stuck on it, I will switch over at that moment or
something else to give my brain a break from the problems. And I will work on a paper
or I will work on a program and try to figure out. If I get stuck on the program or if I get
stuck on the answer for the problem, I will switch back and forth.

During the interview, participants were also asked if they felt there were drawbacks to
media multitasking as students. All the participants felt that there were several drawbacks to
using media while studying. For Alan, he ended up getting his answers for his Chemistry test
wrong.
If any, it would be that sometimes you might get confused. I faced that last semester when I was studying one night for my computer programming class and my chemistry class. I had one question in a test and instead of putting the answers down for Chemistry, I ended up writing stuff from my programming class and I ended up getting the question wrong. But it was because I was studying for both of them instead of studying for one class and then take break and study for the other class.

Cara noted that even though she liked using media while studying, she has had to remind herself what her priorities were because the media could easily distract her.

I feel that when you are multitasking you kind of have to prioritize. Like you may be doing other things at the same time but you need to focus on the main goals and make sure that they can be accomplished. Like there may be music in the background, there could be the TV on. You have to remember that you are not watching TV, you not there to listen to music. You are there to do your assignment, prioritize, get that done before you let everything else tear your focus away.

Both Geri and Jake mentioned missing details as a result of focusing on multiple tasks or media at the same time.

Some people may experience or forget what they were working if they are concentrating on something and then something else becomes a distraction for them or another task becomes distracting. They may forget what they were previously working on. They have to go back and re-read things or whatever. And I also if someone is very detail-oriented, they may overlook some of the details you know when going back to something or they may not be as focused thinking about doing this other task.

I guess if you are doing Math problem for example, you might stop in the middle of it, do something and when you come back to it, you forget where you are. You might miss some minor detail that caused you to get the wrong answer like maybe a negative sign or something.

Summary

The study examined to what extent do media multitasking orientation, gender, age, employment, income, and living arrangement affect grade point average. Results from the
multiple regression analysis indicated that only three independent variables namely; media multitasking orientation, gender, and age were significant predictors of GPA. In addition, semi-structured interviews were conducted to investigate how individual differences in media multitasking orientation manifest themselves in academic activities. The interviews revealed LMMs and HMMs paired and used media differently. In addition, LMMs expressed a strong preference for pure block activities while HMMs gravitated toward mixed block activities when they studied. In Chapter 5, emergent themes are discussed in the context of the findings in this chapter. The research questions will be revisited and the answers will be presented.
CHAPTER V

DISCUSSIONS AND CONCLUSION

In this chapter, three emergent themes will be discussed in relation to their impacts on the academic performance of college students. Next, a summary of the findings will be discussed in the context of the research questions. The chapter concludes with the implication for theory and future research.

Emergent Themes

The results in the study indicate that heavy media multitaskers (HMMs) have lower GPAs than light media multitaskers (LMMs). One possible explanation is that, HMMs are less capable of filtering distractions than LMMs from the environment (Ophir, Nass, & Wagner, 2009). Because HMMs are at greater risks of being distracted by external stimuli, the findings suggest that, heavy media use may be detrimental to their GPAs. Many researchers have offered various explanations on why multitasking exacts a cost on performance. Some researchers believe that task switching incurs cost (Allport, Styles, & Hsieh, 1994; Altmann & Gray, 2008; Philipp, Kalinich, Koch, & Schubotz, 2008; Roger & Monsell, 1995). Others believe that we have limited capacity to process information (Lang, 2000; Sweller, van Merrienboer, & Pass, 1998). The researcher presents three alternative explanations.

Pure Blocks and Mixed Blocks Activities

In the context of this study, the researcher used findings from two studies to explain the concepts of mixing costs and switching costs to frame the discussion on why media multitasking
orientation has an effect on GPAs. Philipp, Kalinich, Koch, and Schubotz (2008) define mixing costs as the “difference between performance in a situation in which one stimulus dimension is relevant (i.e., “pure blocks”) and situations in which people switch stimulus dimensions in “mixed blocks” (p. 406). Simply put, when we perform one activity, that activity is described as a pure block. Conversely, when we perform two or more activities, the activities are described as mixed blocks. Mixed blocks activities involve two scenarios. In the first scenario, Activity 1 and Activity 2 are related. For example, a student is typing a paper and researching the content of the paper on the Internet at the same time. In the second scenario, Activity 1 and Activity 2 are not related. An example of this would be a student who is reading a book and chatting with a friend on Facebook about an upcoming concert they will be attending together.

Rubin and Meiran (2005) found that mixing cost was significantly higher in related mixed blocks tasks than unrelated mixed blocks tasks or single block task. They believe that related tasks compete for the same resources. The competition for the same resources has to be resolved for the relevant task to be completed. Philipp, Kalinich, Koch, and Schubotz (2008) corroborated the findings from Rubin and Meiran’s study. They also found that participants in mixed blocks performed better when the activities were unrelated. In contrast, participants fared worse when the mixed blocks activities were related. Philipp, Kalinich, Koch, and Schubotz (2008) attributed the differences in performance to the carry-over effects. When both activities were related, the carry-over effects were significantly higher. When both activities were unrelated, the carry-over effect was negligible in the second activity.
In this study, the researcher found that LMMs unequivocally preferred a one-stimulus environment in their study sessions. During the interview, Laura the LMM with High GPA, stressed that she liked to focus on one task at a time when she studied:

No, not while studying. I lose my train of thoughts and it is difficult to get back on track. I believe because I want to get a good grade, I put all my energy, all my thoughts into it. If I am distracted, I just lose it. I have to start all over again.

Not surprisingly, when Philipp, Kalinich, Koch, and Schubotz (2008) compared the performance of pure block to related mixed blocks and unrelated mixed blocks, participants in the pure block group performed better than the mixed blocks groups. The finding is consistent with the researcher’s belief that Light Media Multitaskers were less susceptible to distractions because their distinct preference for a one-stimulus environment. Thus, LMMs tend to perform better than HMMs in terms of grade point average.

HMMs, on the other hand, clearly preferred mixed-stimuli environments. Within the HMM group, the research found that 40% of students had GPA scores between 3.00-4.00. Clearly, not all the HMMs in the study were low academic performers. The researcher posits that HMMs with higher GPAs were better at pairing mixed blocks activities than HMMs with lower GPAs. We know from Philipp, Kalinich, Koch, and Schubotz’s findings that students performed better in the unrelated mixed blocks activities condition compared to the related mixed blocks activities condition. Therefore, the researcher believes that HMMs with higher GPAs were pairing unrelated mixed block activities while HMMs with lower GPAs were pairing related mixed blocks activities. The interviews appeared to corroborate the hypothesis. Cara, a HMM with high GPA, described an example of her mixed blocks activity:

The TV is usually going on in the background. It does not matter what show is going on. It is not super loud to where I can’t pay attention to it.
In contrast, Alan, a HMM with low GPA, described his situation when he attempted to study for two tests at the same time:

I faced that last semester when I was studying one night for my computer programming class and my chemistry class. I had one question in a test and instead of putting the answers down for Chemistry, I ended up writing stuff from my programming class and I ended up getting the question wrong. But it was because I was studying for both of them instead of studying for one class and then take break and study for the other class.

Blocks and Fillers

The findings from this study suggest that individual differences account for 16% of the variance in grade point average. In examining individual difference in the study, the researcher believes that one of the least addressed misconceptions is the tendency to think of the college-age generation singularly as heavy media multitaskers. Even within each media multitasking orientation group, individual differences exist too. For example, why were some HMMs better students (as evidenced by their higher GPA scores) than their HMMs peers? Similarly, why did some LMMs perform poorly when they were less likely to be distracted by external stimuli?

The researcher believes that the answers lie in attentional strategies. Good students know how to modulate their attention regardless of their media multitasking orientation. Both LMMs and HMMs modulate their attention differently. Light media multitaskers prefer low or no media to avoid distractions because additional stimuli tend to increase their cognitive load. Rob, the light media multitasker, mentioned that he deliberately leaves his laptop at home in order to eliminate distraction:

If I have my computer with me, you know .... I get distracted by one and a thousand things online or listening to music or whatever. So I try to leave my computer at home when I go to the library unless I am typing a paper.
Additionally, Rob acknowledged that if he tried to listen to music and do his math homework at the same time, “one of them is going to suffer.” Interestingly, the findings from this study suggest that when LMMs chose to use media, their choices were consistent with their preference for low stimulus environments. They often choose soft music, specifically instrumental music, over other media.

In contrast, HMMs prefer mixed stimuli environments. It is not surprising that HMMs in the study reported that they paired media use with other activities throughout the day. To this end, the researcher believes that some HMMs use media as fillers while others use media as blocks in mixed stimuli environments. Fillers are used to supplement or complement a primary activity. Amy, a HMM with low GPA, described her typical study session:

I usually have my laptop in front of me with Skype or maybe Facebook on so that I can talk among my friends. If I am doing Math, I usually have a tablet of paper. More than often, I get caught up in the conversations and spent maybe 4 hours doing a handful of problems.

On the other hand, blocks are used to reduce or minimize distraction on a primary activity. A HMM may listen to music while studying at the library to block conversations around him.

Cara, described how she used music in the background:

Cara, HMM, High GPA:
I listen to music. I don’t listen to anything upbeat. I listen to more like Otis Redding, something that’s more like I guess you could say chill that allow me to concentrate more.

The research posits that HMMs who used media as fillers tend to be weaker students than HMMs who used media as blocks. Cognitive Load Theory provides the support for the argument. When we learn new materials, the intrinsic cognitive load associated with the learning activity cannot be altered (Sweller, van Merrienboer, & Pass, 2006). It exacts a cost on
our memory. When we add an additional activity to the primary activity (learning), we incur extra cost to the memory. The additional activity creates one of two effects. It adds extraneous cognitive load or germane cognitive load to learning. The first effect, extraneous cognitive load should be minimized because it does not add to or support the primary. The second effect, germane cognitive load, on the other hand, enhances the primary activity.

Heavy media multitaskers, who used media as fillers, may inadvertently generate extraneous cognitive load because the secondary activity has to compete for our limited memory resources. In Alan’s case, his heavy media use appeared to have taken a toll on his GPAs. During the interview, Alan mentioned that he was doing poorly in class. He considered changing his major because he was failing some of his courses in that semester. Alan describes a typical study session:

Alan, HMM, Low GPA:
As for Facebook, it is always on my laptop, it is always open and whether I am doing Calculus or I am just writing a paper for my technical writing class, FB is always open. I can always hear the little blip noise from someone talking to me or I will check every interval of like five minutes on Facebook or the website or something

The researcher believes that Alan may be burdening his limited cognitive resources by switching between two activities in rapid successions. Previous research has indicated that extraneous cognitive load interfered with learning (Lee, Lin, & Robertson, 2011; Yeung, Jin, & Sweller, 1998). In contrast, heavy media multitaskers, who use media as blocks, may be generating germane cognitive load because the secondary activity is used to support the primary activity. We return to the example of Cara, the HMM student with high GPA. She used music or television to block the noises when she studied. In other words, Cara appeared to be adept at filtering extraneous cognitive load to help her study better.
Media Pairing

Data from the survey and interviews revealed that heavy, moderate, and light media multitaskers consume media differently. During the interview, Alan, the heavy media multitasker, mentioned that he always had his headphones on so that he could listen to music all the time. Table 5.1 displays the amount of time HMMs reported spending on media per week. The top three reported media use among HMMs were texting (15.23 hours per week), music (14.09 hours per week), and the Internet (10.13 hours per week). Conversely, HMMs used video games the least (1.8 hours per week).

![Figure 5.1. Average hours of media used per week for HMM.](chart)

Average Hours of Media Used Per Week for HMM

Among light media multitaskers, music (7.97 hours per week), the Internet (6.65 hours per week), and texting (5.65 hours per week) were the most popular media. The least favored
medium for LMMs was instant messaging (1.91 hours per week). Not surprisingly, light media multitaskers tend to avoid media when they studied. During the interview, Rob mentioned that he did not bring his laptop with him to the library unless he had to type a paper. Table 5.2 displays the amount of time LMMs reported spending on media per week.

When the researcher compared media consumption between HMMs and LMMs, HMMs spent an average of 14.09 hours a week on music while LMMs spent an average of 7.97 hours a week. Additionally, HMMs reported that they spent 15.23 hours a week on texting compared to LMMs’ 5.65 hours a week. On 11 out of 12 media, HMMs spent more time on the media than LMMs. Interestingly, video games was the only medium where HMMs and LMMs reported spending similar time on. Figure 5.3 shows the disparities in media consumption between HMMs and LMMs.

Figure 5.2. Average hours of media used per week for LMM.
Figure 5.3. Media consumption between HMMs and LMMs.

In terms of media pairings, there were some similarities in how HMMs and LMMs paired primary and secondary media. Both HMMs and LMMs reported identical media pairings for the following primary media: reading, music, non-musical audio, phone, and texting. In contrast, HMMs and LMMs reported different media pairings for the following primary media: video game, IM, email, Internet, other computer applications. Table 5.1 is summary of how a primary medium is commonly paired with a secondary medium.

The data showed that HMMs favor texting as a secondary medium. Overall, texting accounted for 17.0% of all reported media use among HMMs. The researcher believes that the HMMs’ choice of preferred secondary medium is consistent with Sweller, van Merrienboer, and Pass’ cognitive load theory.
Table 5.1

*Primary Medium and the Most Commonly Paired Secondary Medium*

<table>
<thead>
<tr>
<th>Primary medium</th>
<th>HMM Paired secondary medium</th>
<th>LMM Paired secondary medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>Music</td>
<td>Music</td>
</tr>
<tr>
<td>Music</td>
<td>IM</td>
<td>IM</td>
</tr>
<tr>
<td>Non-musical audio</td>
<td>Texting</td>
<td>Texting</td>
</tr>
<tr>
<td>Phone</td>
<td>Internet</td>
<td>Internet</td>
</tr>
<tr>
<td>Texting</td>
<td>TV and Digital video content</td>
<td>TV</td>
</tr>
<tr>
<td>TV</td>
<td>Phone</td>
<td>Phone</td>
</tr>
<tr>
<td>Video game</td>
<td>Texting</td>
<td>Internet</td>
</tr>
<tr>
<td>IM</td>
<td>Digital video content</td>
<td>Texting</td>
</tr>
<tr>
<td>Email</td>
<td>Texting</td>
<td>Music</td>
</tr>
<tr>
<td>Internet</td>
<td>Texting</td>
<td>Music</td>
</tr>
<tr>
<td>Other computer Apps</td>
<td>Texting</td>
<td>Music</td>
</tr>
</tbody>
</table>

Because HMMs are less capable of filtering distractions, they may frequently respond to incoming text messages, check for new text messages, or send text messages. As such, it is not unreasonable to view texting as extraneous cognitive load. In learning situations, extraneous cognitive load drains valuable resources because it does not add value to knowledge or content mastery. In other words, texting can be viewed as a negative stimulus or high cognitive load activity. The researcher posits that texting may be detrimental to HMMs who have poor self-
regulation. Alan’s interview provided an example of why heavy media use may be detrimental to a student’s academic performance. Extreme media use not only displaced time available for study, it is a direct interference for the primary activity.

The data show that LMMs favor music over texting as a secondary medium. Overall, music accounted 16.3% of all reported use among LMMs. The finding is again consistent with the frameworks of the Cognitive Load Theory. Since LMMs distinctly prefer a one-stimulus environment, any additional stimulus added to that environment will certainly increase their extraneous cognitive load. More often than not, the researcher believes that LMMs (and even MMMs) use music to block distractions or stimulus.

Research Questions and Answers

Given that our understanding of how multitasking affects learning is still at its infancy, the findings in the study paint a complex picture of multitasking. The study asks to what extent do media multitasking orientation, gender, age, employment, income, and living arrangement affect grade point average. The quantitative findings in the study showed that there was statistically significant relationship the three independent variables: media multitasking orientation, gender, and age and GPA ($R^2= .160, F(4,183)=8.320, p < .001$). Three other independent variables, employment, income, and living arrangement were not statistically significant predictors of GPA for undergraduate students at a major institution of higher learning in Texas.

The study also sought to investigate how individual differences in media multitasking orientation manifest themselves in academic activities. The results from the interviews found
different study practices, media uses, and media choices in each multitasking group. The study reinforced the fact that light media multitaskers preferred to focus on one activity at a time. This group reported lower media use and media pairings than the other two groups. In contrast, heavy media multitaskers preferred to juggle more than one activity at a time. They paired their daily activities with media use throughout the day. The findings in the study suggest that multitasking is possible when a low cognitive load activity is paired with another low cognitive load activity or when a high cognitive load activity is paired with a low cognitive load activity. However, when two high cognitive load activities are paired together, they appear to interfere with academic activities. The results were consistent with the findings of Lee, Lin, and Robertson (2011) who examined the relationship between reading and multitasking.

Implications for Theory and Practice

The study has extended existing conceptual and empirical understanding of the phenomenon of media multitasking. The findings showed that media multitasking orientation, gender, and age have an effect on Grade Point Averages (GPAs) of undergraduate students at a large public university. In addition, the interviews provided narrative details on the similarities and differences between/among light, moderate, and heavy media multitaskers from an academic perspective. Several useful implications for theory and practice have emerged as from the results of the study.

As media consumption increase, it would not be difficult to extrapolate that we will continue to see similar increase in media exposure and media multitasking among college-age students. We do not know what the long terms effects are for the younger generation,
particularly HMMs who have grown up in media-rich environments as they transition into adulthood, marriage, and careers. Levine, Waite, and Bowman (2007) ask, “Will we think in a different way because of our use of multitasking, interruptive media? Will students find increasing difficulty with traditional modes of learning through reading books and articles? Will depth and intensity of thought be exchanged for speed?” (p. 565). For now, these questions remained unanswered.

What we do know is that, Watson and Strayer (2010) found a group of participants in their study who were able to perform multiple tasks without incurring a significant performance cost. They described the participants as supertaskers. In this study, the researcher found that while HMMs tend to have lower GPAs than LMMs, 41% of the HMMs in the study (n=34) had GPAs between 3.00-4.00. The data showed that within the HMM group, there is a sub-group of participants with high GPA and media multitasking index scores. The sub-group may be similar to the supertaskers that Watson and Strayer found in their study.

Some researchers believe that technology has rewired the brains of our younger generation (Small & Vorgan, 2008; Watson & Strayer, 2010). These students have shorter attention span and regard the traditional form of learning as sluggish or boring (Small & Vorgan, 2008). The presence of new technologies is increasingly felt and seen on campus. By and large, the scholarship of teaching and learning has largely remained the same at many institutions of high learning. In large enrollment courses, it is not uncommon for instructors to lecture hundreds of students. In smaller classes, others ban the use of laptops to force students to pay attention. There is an urgent need for institutions of higher learning to reinvigorate and improve instructional methods to engage a new generation of learners.
The findings in this study offer students some strategies on being successful multitaskers to maximize learning. While this study found that light media multitaskers performed better than heavy media multitaskers, students who prefer mixed blocks activities can still indulge in media multitasking with the right choices. We know that new learning materials place heavier cognitive load on the students. Therefore, efforts to reduce extraneous cognitive load during study sessions should be encouraged particularly among heavy media multitaskers.

Recommendations for Future Research

This study investigated the relationship between media multitasking orientation and academic performance of college students. Future research could be conducted to investigate whether differences exist between high school students and college students. To date, no previous research has examined individual differences among high school students. This is a important research gap because the younger generation is particularly adept at media multitasking. We do not know the full impact of heavy media use during learning activities among young users.

The findings in this study suggest that we need to take a closer look at how we teach and engage students in higher education. There is a ‘disconnect’ between how faculty members teach and how students learn. Students should have first-class access to technology both inside and outside the classroom. Yet, at many institutions of higher learning, students leave their media behind the moment they enter the classrooms and lecture halls. Many instructors still use traditional modes of teaching and view learning as a process of knowledge transmission.
Future research should examine the roles of media in the classroom and how they can be used to improve learning.

The study represents a research opportunity to examine the existence of supertaskers within heavy media multitaskers. Heavy media multitaskers who used media as blocks or paired two unrelated mixed-blocks activities appeared to perform better than their peers who used media as fillers. Future research is needed in the area to determine if we have supertaskers within the group. It would be important to know specifically which characteristics of media multitasking help the students in learning activities and vice-versa.

It is important that future research conducted in this area address the limitations discussed in Chapter 3. As such, the findings may not be generalized beyond the population from which the sample was collected. The study should be replicated at other institutions to determine if the results could be generalized to a larger population.

Conclusion

The study found that only three out six independent variables were important in determining GPA of undergraduate students. The three independent variables were media multitasking orientation, age, and gender. In addition, three themes emerged from the findings to provide insights on individual differences in terms of multitasking orientation. Based on these findings, various strategies to help students study effectively with media should be considered. In addition, further research is recommended to examine the variations within each multitasking orientation group.
APPENDIX A

INSTITUTIONAL RESEARCH BOARD APPROVAL
January 19, 2012

Supervising Investigator: Dr. Lin Lin
Student Investigator: Jennifer Lee
Department of Learning Technologies
University of North Texas

Re: Human Subjects Application No. 12014

Dear Dr. Lin:

As permitted by federal law and regulations governing the use of human subjects in research projects (45 CFR 46), the UNT Institutional Review Board has reviewed your proposed project titled "An Examination of the Relationship between Multitasking Orientation and Grade Point Average." The risks inherent in this research are minimal, and the potential benefits to the subject outweigh those risks. The submitted protocol is hereby approved for the use of human subjects in this study. Federal Policy 45 CFR 46.109(e) stipulates that IRB approval is for one year only, January 19, 2012 to January 18, 2013.

Enclosed is the consent document with stamped IRB approval. Please copy and use this form only for your study subjects.

It is your responsibility according to U.S. Department of Health and Human Services regulations to submit annual and terminal progress reports to the IRB for this project. The IRB must also review this project prior to any modifications.

Please contact Sheila Bourns, Research Compliance Analyst, or Boyd Herndon, Director of Research Compliance, at extension 3940, if you wish to make changes or need additional information.

Sincerely,

Patricia L. Kaminski, Ph.D.
Associate Professor
Department of Psychology
Chair, Institutional Review Board

PK: sb
APPENDIX B

MODIFIED INSTITUTIONAL BOARD APPROVAL FOR STUDY
March 21, 2012

Supervising Investigator: Dr. Lin Lin
Student Investigator: Jennifer Lee
Department of Learning Technologies
University of North Texas

Institutional Review Board for the Protection of Human Subjects in Research (IRB)
RE: Human Subject Application #12014

Dear Dr. Lin,

The UNT IRB has received your request to modify your study now titled “An Examination of the Relationship between Multitasking Orientation and Grade Point Average.” As required by federal law and regulations governing the use of human subjects in research projects, the UNT IRB has examined the request to recruit undergraduate students in other colleges not just College of Education at UNT. The modifications to this study are hereby approved for the use of human subjects. Federal Policy 45 CFR 46.109(e) stipulates that IRB approval is for one year only, January 19, 2012 to January 18, 2013.

The IRB must review this project prior to any other modifications.

Please contact Sheila Bourn, Research Compliance Analyst, at (940) 565-3940, or Boyd Herndon, Director of Research Compliance, at (940) 565-3941, if you wish to make changes or need additional information.

Sincerely,

Patricia L. Kaminski, Ph.D.
Associate Professor
Chair, Institutional Review Board

PK/3b
APPENDIX C

INFORMED CONSENT FORM FOR THE SURVEY
University of North Texas Institutional Review Board
Electronic Informed Consent Form

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose and benefits of the study and how it will be conducted.

Title of Study: An Examination Of The Relationship Between Multitasking Orientation And Grade Point Average

Principal Investigator: Lin Lin, Ed.D., UNT, Dept. of Learning Technologies
Student Investigator: Jennifer Lee, UNT, Dept. of Learning Technologies

Introduction
The goal of this study is to examine the relationship between multitasking orientations and Grade Point Average, an important indicator of academic performance among college students. Additionally, the study sought to identify which, if any, multitasking orientation group, perform better in their coursework.

Procedures
You will be asked to complete a set of questionnaire about your multitasking habits and preferences. The questionnaire is made up of 41 questions and will take approximately 20 minutes or less. Questions are designed to determine your multitasking orientation. This questionnaire will be conducted with an online Qualtrics-created survey.

You may be asked if you are willing to be interviewed for the study to help the researchers understand how young adults multitask.

Risks/Discomforts
Risks are minimal for involvement in this study.

Benefits
We expect the project to benefit you by giving you a better understanding of your multitasking orientation and academic performance. This study is expected to provide baseline information on learners’ multitasking behaviors and learning process. Our goal is to provide suggestions for improved learning methods to help learners achieve their best learning outcomes in a multi-media (reading, video, and internet) environment. Such information will enhance our understanding towards how 21st-Century media and technology may be influencing or changing our ways of learning.

Confidentiality
All data obtained from participants will be kept confidential and will only be reported in a conglomerate format (only reporting combined results and never reporting individual results). All questionnaires will be concealed, and no one other than then primary
investigator and assistant researchers listed below will have access to them. The data collected will be stored in the HIPPA-compliant, Qualtrics-secure database until it has been deleted by the primary investigator.

Compensation
There is no direct compensation.

Participation
Participation in this research study is completely voluntary. You have the right to withdraw at anytime or refuse to participate entirely without jeopardy to your academic status, GPA or standing with the university. If you desire to withdraw, please just close your internet browser and feel free to inform the principal investigator at this email (email) or tell them as you leave.

Questions about the Research
If you have questions regarding this study, you may contact Jennifer Lee, at 940-565-2729, jennifer.lee@unt.edu.

Questions about your Rights as Research Participants
If you have questions you do not feel comfortable asking the researcher, you may contact Dr. Lin Lin, at 940-369-7572, lin.lin@unt.edu or contact Boyd Herndon, Director of Research Compliance, at boyd.herndon@unt.edu or 940-369-7429.

I have read, understood, and printed a copy of, the above consent form and desire of my own free will to participate in this study.
APPENDIX D

INFORMED CONSENT FORM FOR INDIVIDUAL INTERVIEWS
Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose and benefits of the study and how it will be conducted.

Title of Study: An Examination Of The Relationship Between Multitasking Orientation And Grade Point Average

Principal Investigator: Lin Lin, Ed.D., UNT, Dept. of Learning Technologies
Student Investigator: Jennifer Lee, UNT, Dept. of Learning Technologies

Introduction
The goal of this study is to examine the relationship between multitasking orientations and Grade Point Average, an important indicator of academic performance among college students. Additionally, the study sought to identify which, if any, multitasking orientation group, perform better in their coursework.

Procedures
You have completed a survey about your multitasking habits and preferences.

As a follow-up to the survey, you have been asked if you are willing to participate in an interview to help us understand your multitasking habits in your daily life. The interview will take approximately 20-30 minutes.

Risks/Discomforts
There are no foreseeable risks associated with this study.

Benefits
We expect the project to benefit you by giving you a better understanding of your multitasking orientation and academic performance. This study is expected to provide baseline information on learners’ multitasking behaviors and learning process. Our goal is to provide suggestions for improved learning methods to help learners achieve their best learning outcomes in a multi-media (reading, video, and internet) environment. Such information may enhance our understanding towards how 21st-Century media and technology may be influencing or changing our ways of learning.

Confidentiality
All data obtained from participants will be kept confidential and will only be reported in a conglomerate format (only reporting combined results and never reporting individual results). All questionnaires and interviews will be concealed, and no one other than then primary investigator and assistant researches listed below will have access to them. The
survey data collected will be stored in the HIPPA-compliant, Qualtrics-secure database until it has been deleted by the supervising investigator.

**Compensation**
At the completion of the interview, you will be compensated $15.00 for your time.

**Participation**
Participation in this research study is completely voluntary. You have the right to withdraw at anytime or refuse to participate entirely without jeopardy to your academic status, GPA or standing with the university. If you desire to withdraw from the survey, please just close your internet browser and feel free to inform the principal investigator at this email (email) or tell them as you leave.

**Questions about the Research**
If you have questions regarding this study, you may contact Jennifer Lee, at 940-565-2729, jennifer.lee@unt.edu.

**Questions about your Rights as Research Participants**
This research project has been reviewed and approved by the University of North Texas Institutional Review Board (IRB). Contact the UNT IRB at 940-565-3940 with any questions regarding your rights as a research subject.

I have read and understood the above consent form and desire of my own free will to participate in this study.

Name: __________________________

Date: __________________________

Signature: _______________________
APPENDIX E

RECRUITMENT EMAIL TO STUDENTS
Dear student,

I am contacting you with a special request for your voluntary participation in an online survey research about your multitasking habits and preferences.

The questionnaire is made up of 58 questions and will take approximately 20 minutes or less. Questions are designed to determine your multitasking preferences. As a follow-up to the survey, you may be asked if you are willing to participate in an audio interview to help us understand your multitasking habits in your daily life. The interview will take approximately 20-30 minutes.

We expect the project to benefit you by giving you a better understanding of your multitasking preference and academic performance. This study is expected to provide baseline information on learners’ multitasking behaviors and learning process. Our goal is to provide suggestions for improved learning methods to help learners achieve their best learning outcomes in a multi-media (reading, video, and internet) environment. Such information may enhance our understanding towards how 21st-Century media and technology may be influencing or changing our ways of learning.

If you complete the survey, you'll be entered to win one of four $25 gift cards. Below is the link to the online survey. It will not ask for any information that identifies you. ALL RESPONSES ARE CONFIDENTIAL. Prior to consenting to participate in the current survey, it is important that you read and review the description of this study.

The survey is available until March 1, 2012. Winners will be contacted via email by MAY 30, 2012.

If you have any questions, please contact me by e-mail, research_name@unt.edu, or xxx-xxx-xxxx. Please TAKE ME TO THE SURVEY. You can also copy and paste the link on your browser, http://untedu.qualtrics.com/SE/?SID=SV_1RZjyoHcsMmN5wE

Sincerely,
Jennifer Lee
Ph.D candidate  Department of Learning Technology
APPENDIX F

EMAIL REMINDER 1
Dear student,

Hope your semester is going well. I want to thank you if you have participated in my survey.

If you have not, there is still time. I hope you will take a few minutes out of your busy schedule to make an important contribution to the study. Many students tell me that multitasking is a way of life. I would love to get your input on this :)

I am contacting you with a special request for your voluntary participation in an online survey research about your multitasking habits and preferences.

The questionnaire is made up of 58 questions and will take approximately 20 minutes or less. Questions are designed to determine your multitasking preferences. As a follow-up to the survey, you may be asked if you are willing to participate in an audio interview to help us understand your multitasking habits in your daily life. The interview will take approximately 20-30 minutes.

We expect the project to benefit you by giving you a better understanding of your multitasking preference and academic performance. This study is expected to provide baseline information on learners’ multitasking behaviors and learning process. Our goal is to provide suggestions for improved learning methods to help learners achieve their best learning outcomes in a multi-media (reading, video, and internet) environment. Such information may enhance our understanding towards how 21st-Century media and technology may be influencing or changing our ways of learning.

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The survey is available until March 1, 2012. Winners will be contacted via email by May 20, 2012.

If you have any questions, please contact me by e-mail, research_name@unt.edu, or xxx-xxx-xxxx.

Please TAKE ME TO THE SURVEY. You can also copy and paste the link on your browser, http://untedu.qualtrics.com/SE/?SID=SV_1RZjyoHcsMmN5wE

Sincerely,

Jennifer Lee
Ph.D candidate Department of Learning Technology
Dear student,

Do you identify with the one or more of the following statements?

"I love listening to music while I study."

"I often chat with my friends on Facebook while I work on my assignments or projects."

"I can focus on many things at the same time."

Or are you one of those students who can only study without any media interruptions?

This is the last round of reminder (I am sure you are happy to hear that lol) for those who would like to help me understand multitasking habits among college students (yeah, it's for a good cause).

I am contacting you with a special request for your voluntary participation in an online survey research about your multitasking habits and preferences. The questionnaire is made up of 58 questions and will take approximately 20 minutes or less. Questions are designed to determine your multitasking preferences. As a follow-up to the survey, you may be asked if you are willing to participate in an audio interview to help us understand your multitasking habits in your daily life. The interview will take approximately 20-30 minutes.

We expect the project to benefit you by giving you a better understanding of your multitasking preference and academic performance. This study is expected to provide baseline information on learners’ multitasking behaviors and learning process. Our goal is to provide suggestions for improved learning methods to help learners achieve their best learning outcomes in a multi-media (reading, video, and internet) environment. Such information may enhance our understanding towards how 21st-Century media and technology may be influencing or changing our ways of learning.

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If you have any questions, please contact me by e-mail, research_name@unt.edu, or xxx-xxx-xxxx.

Please TAKE ME TO THE SURVEY. You can also copy and paste the link on your browser, http://untedu.qualtrics.com/SE/?SID=SV_1RZjoHcsMmN5wE
Sincerely,
Jennifer Lee
Ph.D candidate
Department of Learning Technology
APPENDIX H

EMAIL INVITING PARTICIPANTS FOR A FOLLOW-UP INTERVIEW
Dear student,

I am contacting you because you participated in a survey on media multitasking recently. Thank you for your help :)

I have your results and I will be happy to share your multitasking score with you.

I am interested in interviewing you for my study. The interview will take 15-20 minutes. To compensate for your time, you will receive $15.00 at the completion of the interview. The questions are easy. I am interested in understanding how college students multitask. Your responses are confidential and no personal identifying information will be used.

If you are interested, please send me an email soon so that we can set up a time to meet. I am on the Denton campus, Monday-Friday from 8:00-5:00 pm. I am flexible and I can work around your class/work schedule. I prefer to conduct the interview no later than May 2.

If you do not wish to be interviewed, send me an email so that you will no longer receive any communication about the study.

Please contact me by e-mail, research_name@unt.edu, or xxx-xxx-xxxx (office).

You can text me at xxx-xxx-xxxx. Be sure to mention the study in your text message and include your first and last name.

Sincerely,

Jennifer Lee
Ask if participant agrees with the assessment of his or her MM orientation.

Do you find it easy to switch from one activity to another while studying? Why or why not?

Think of a time when you were studying or doing your homework, did you multitask (check email, read, text a friend, read, check email) or focus on one activity at a time? Describe your media use when you study, write a paper, or work on a school project.

Can you describe how long can you focus your attention on one thing before you switch to another activity? Why?

Do you think multitasking helps or interferes with learning?

What do you think are the benefits of multitasking?

What do you think are the drawbacks of multitasking?

Is there anything else about multitasking that you would like to share with me?
REFERENCES


