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SLEEP QUALITY, TECHNOSTRESS, AND MALADAPTIVE USE OF
TECHNOLOGY: PREDICTORS OF DEPRESSION AMONG COLLEGE STUDENTS

by

Michelle S. Goddard, M.S

A Dissertation

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Acknowledgements

I share this accomplishment with my sweet husband who supported me when I doubted myself, encouraged me to keep going when I was exhausted, and always had faith that we could dance our way through it. It was a long road, and I am so grateful to my mother for reminding me to enjoy the journey. I am also thankful to my many supporters. Thank you to Sara for dragging me across the finish line, to Sandra (“Gigi”) for her many, many hours of tireless help, to my brother who never doubted, to my original “cohort,” and to my friends Andrea, Harmony, and Brandy who always make me laugh. There were many other supporters, and I will always be grateful for every smile, every minute of assistance, and every word of encouragement.

I dedicate this to my children who motivate me each day. I hope I can encourage them to reach all of their goals and dreams in the same way my mother encouraged me.

Abstract

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Depression among college students is a substantial concern due to the risk of suicide, academic failure, and other psychosocial problems. Current literature suggests that the prevalence of depression among populations of college students has risen in the past two decades whereas sleep quality has decreased and technology use has increased. The purpose of this study was to investigate the ways that sleep quality, technostress, and misuse of technology might be associated with depression among college students. A total of 236 college undergraduates from a large, urban university were surveyed.

Independent samples *t* tests revealed no mean group differences between men and women for depression, sleep quality, technostress, or misuse of technology. A multiple hierarchical regression indicated that younger age and poor sleep quality were linked to higher amounts of depression among college students. Additional regression analyses revealed that technostress predicted an additional 1.1% of the variance in depression after controlling for sleep quality, and misuse of technology predicted an additional 4.9% of the variance in depression after controlling for sleep quality. A series of regression analyses to test for mediation were conducted to determine if technostress or technology misuse mediated the relationship between sleep quality and depression. Results did not support the hypotheses that partial mediation would occur. Implications regarding treatment and prevention of depression among college students were discussed.

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Chapter 1

Introduction

Over the past several decades, prevalence rates for depression have increased across populations and cultural groups (Cross-National Collaborative Group, 1992; Goldney, Eckert, Hawthorne, & Taylor, 2010), and epidemiologic evidence indicates that individuals born during the latter half of the 20th century are at increased risk for developing symptoms of major depression compared to previous generations (American Psychiatric Association, 2000; Ingram & Trenary, 2005). Further, the onset of depression is occurring earlier in the lifespan among modern generations compared to the age of onset in previous generations (American Psychiatric Association, 2000; Reinhartz, Giaconia, Carmola Hauf, Wasserman, & Silverman, 1999), with younger adults and adolescents being at particular risk to develop depression (Blazer, Kessler, MGonagle, & Swartz, 1994; Burke, Burke, Reiger, & Rae, 1990).

With the increase in depression well documented, it is not surprising that counseling centers have also reported an increase in the rates of depression among students on campuses in the United States since the early 1990s (Gallagher, Zhang, & Taylor, 2003). In particular, Sagan (2007) found that rates of depressive symptomology have increased significantly over time, and similarly, Benton, Robertson, Tseng, Newton, and Benton (2003) found that depression rates significantly increased during the 1990's among college students seeking counseling. Prevalence rates for depression are estimated to be as high as 15.6% among college undergraduates (Eisenberg, Gollust, Golberstein, & Hefner, 2007). Because multiple risks (e.g., suicide, lower academic and social

functioning, and decreased retention) are associated with depressive symptoms (Kisch, Leino, & Silverman, 2005), Kitzrow (2003) suggested that the increase in depression symptoms among current college students has become a challenge for college counseling centers to manage in recent years.

Because the incidence of students presenting with depressive symptoms is a growing problem for college campuses, contemporary understanding of the correlates and predictors of depression among college students is needed. Although a large body of literature exists regarding the correlates, risk factors, and causes of depression, there is a paucity of information regarding risk factors that may account for the increased rates of depression among modern cohorts of students born in the late 20th century (Cross-National Collaborative Group, 1992).

Depression

For the purpose of this study, depression will be defined using criteria for major depression in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000). Major depression is characterized by symptoms including depressed mood on most days for a minimum of two weeks, anhedonia, changes in appetite and weight, hypersomnia or insomnia, psychomotor agitation or retardation, loss of energy, feelings of worthlessness or guilt, decreased concentration, and thoughts of death or suicide (American Psychiatric Association, 2000). Major depressive episodes tend to be recurrent (Ingram & Trenary, 2005), and psychosocial stress is widely recognized as a predisposing factor in the development of depression (Monroe & Hadjiyannakis, 2002). Biological, cognitive, psychosocial and

interpersonal theories exist to explain the etiology of depression, and the diathesis-stress model is an overarching framework accepted by most theorists to explain the correlates and possible causes of depression (Ingram & Trenary, 2005; Metalsky, Halberstadt, & Abramson, 1987). Diathesis refers to a genetic or biological predisposition to develop depression, whereas stress refers to environmental or life stressors that might precipitate depressive episodes. Environmental stressors may include social, cultural, or life events that are perceived as stressful. Therefore, in the diathesis-stress model, genetically or biologically vulnerable individuals may develop depression after encountering stress.

Modern Stressors

Using the diathesis-stress framework to understand depression among college students, multiple researchers have suggested that modern lifestyles might create environmental stressors that may account for the increased prevalence of depression among college students (Moo-Estrella, Perez-Benitez, Solis-Rodriguez, & Arankowsky-Sandoval, 2005; Murphy & Archer, 1996). Thus, students living in the 1990's and the early part of the new century are exposed to cultural and social factors and stressors that may have differed from previous generations of students (e.g., rapid increase in use and access to technology, increased access to information via online resources, and increased deficits in sleep). Although multiple researchers have theorized and suggested that cultural and social variables may be contributing to depression among cohorts of students attending college since 1985 and beyond (Emmons, 2007; Murphy & Archer, 1996; Oliver & Novak, 1993; Sagun, 2007), few studies have actually investigated specific

variables associated with modern lifestyles that may be associated with depression among current college students.

Emmons (2007) theorized that the manifestation of increased depression among college students may be associated with lifestyle changes and “modern stressors” such as reduced sleep. Murphy and Archer (1996) also suggested that an increased prevalence of sleep problems may be associated with depression among modern cohorts of students. Additionally, recent studies provide evidence that stress associated with the use of technology may be linked to depression (Arnetz & Wikholm, 1997), and that the maladaptive use of technology among modern college students is also related with depressive symptoms (Morahan-Martin & Schumacher, 2000). Although use of technology and sleep problems have been acknowledged as possible risk factors for depression among college students, there is currently a paucity of research in the extant literature regarding the relationship between use of technology, sleep problems, and depression among college students. Therefore, the purpose of this study is to explore modern lifestyle stressors that may be associated with depression among currently enrolled college students. Specifically, technostress (i.e., stress associated with the use of technology), maladaptive use of technology, and sleep quality will be explored in association to the incidence of depressive symptoms among current college students.

Technostress

The positive relationship between perceived stress and depression among college students is well established (Mikolajczyk, Maxwell, Naydenova, Meier, & El Ansari, 2008), and Hamilton (2006) found that college students report stress as a significant

barrier to academic achievement. Previous researchers have focused on common college stressors including academic challenges, social adjustment, financial stressors, and developmental changes in the transition to adulthood (Ross, Niebling, & Heckert, 1999; Wright, 1967).

Although Murphy and Archer (1996) found that a similar pattern of academic and social stressors exists between college students enrolled in the 1960s and college students enrolled in the 1990s, they suggested that emerging stressors may account for increased rates of depression among current cohorts of college students. Potentially, contemporary college students may be exposed to a new type of stress associated with the use of technology. Arnetz and Wikholm (1997) initially described “technostress” to explain a myriad of physical and mental symptoms experienced by workers in office environments where technology is routinely used. Specifically, technostress refers to the manifestation of symptoms including physiological arousal, headaches, irritability, and depressed mood associated with the use of technology. The use of information and communication technologies includes the use of computers, the internet, social networking sites, email, mobile phones, and texting services, and it may create stress for a myriad of reasons. Bradley (2000) suggested that technostress may occur due to multiple reasons such as the need to constantly update technological skill, the need to handle overwhelming amounts of information, the requirement to be available to work regardless of time or place, and the social pressure to be accessible to colleagues, friends, and family via texting and email at all times.

Although the majority of the extant literature regarding technostress occurs in vocational psychology research, there are a few studies that have explored technostress among college students. For example, college students have identified the use of information and communication technology as a source of stress (Gustafsson, Dellve, Edlund, & Hagberg, 2003; Hamilton, 2006), and Ross et al. (1999) found that computer problems were cited as a common source of daily stress among college students.

Additionally, there are emerging sources of stress associated with the use of social networking sites. Boyd and Ellison (2009) defined social network sites as a web based system that allows individuals to create a profile, create a list of contacts (i.e., profiles of other individuals) within the system, and to “view and traverse” the list of contacts. The primary purpose of social network sites is to create and maintain social connections. Examples of current online social networks sites include Facebook, MySpace, and Twitter. In a review of the history of social network sites, Boyd and Ellison (2009) suggested that widespread use of these web-based systems is a relatively recent phenomenon. Social network sites emerged in 1997, and widespread use of Facebook and Twitter did not occur until 2006.

Although social networking via the internet may be beneficial due to the creation of social connections (Ellison, Steinfeld, & Lampe, 2007), emerging trends in the extant literature suggest that there are some potential disadvantages associated with online social network sites (Silverman, 2008). For example, one study found that Facebook use may be uniquely related to jealousy in romantic relationships even after controlling for individual, relationship, and personality factors (Muisse, Christofides, & Desmarais,

2009). Other stressors may also include concerns about privacy (Fogel & Nehmad, 2009; Lewis, Kaufman, & Christakis, 2008), worries about online victimization (Higgins, Ricketts, & Vegh, 2008), and concerns about gossip or impression management that emerge from online social connections (Tufekci, 2008).

Currently, no studies exist examining online social networking as a source of technology related stress (i.e., technostress) among college students. However, anecdotal evidence indicates that some stress may be associated with use of online social networks for college students. For example, Lewis et al. (2008) discussed reports in the popular media that indicate that information on social network profiles may keep some individuals from obtaining jobs. Additionally, a recent study revealed that college students report that use of Facebook interferes with their academic performance (Pempek, Yermolayeva, & Calvert, 2008). Because online social networks may be emerging as a source of technostress for college students, further research is needed to investigate technostress among college students using an expanded definition that encompasses stressors that may be associated with use of online social networks.

Arnetz and Wikholm (1997) did find a relationship between technostress and depressed mood among office workers, yet no other studies exist exploring the links between depression and stress associated with the use of technology. Additionally, only a few studies have examined technostress as a source of stress among college students. For example, Lin and Peper (2009) recently found that use of text messaging is associated with increased physiologic arousal. Additionally, some research indicates that negative feedback to social network profiles from online “friends” is associated with poor self-

esteem and decreased well-being among adolescents (Valkenburg, Peter, & Schouten, 2006). Because stress is widely acknowledged as a risk factor for depression (Ingram & Trenary, 2005), further research is needed to explore the relationship between technostress and depression among college students.

Maladaptive Use of Technology

Another modern risk factor for depression among college students may include maladaptive use of technology. For the purpose of this study, maladaptive use of technology will be defined as use of information and communication technology that interferes with social or occupational functioning. Therefore, the term ‘maladaptive use’ refers to misuse of technology related to activities that are common or typical among college students. Although there is much debate in the extant literature about the differences between maladaptive internet use versus internet addiction (Yellowlees & Marks, 2007), many researchers make the distinction that pathological or addicted users often use the internet for the purposes of gambling, gaming (massively multi-player online role playing games; MMORGs), or pornography (Davis, 2001; Young, 2009; Young & Case, 2004). Therefore, for the purpose of the current study, the definition of maladaptive use of technology among college students will be confined to use of technology for typical or common uses such as gathering information and social communication.

Maladaptive use of technology has been linked to depression among college students (Morahan-Martin & Schumacher, 2000). For example, Morgan and Cotton (2003) found that high rates of internet use for the purpose of shopping or research

predicted increased symptoms of depression among college freshmen, and other researchers have found that high rates of use of mobile phones, texting, and internet are associated with increased risk of depression among college students over time (Thomee, Eklof, Gustafsson, Nilsson, & Hagberg, 2007). Although multiple studies exist about maladaptive use of technology among college students, Morahan-Martin and Schumacher (2000) emphasized that a majority of studies used total amount of time spent using technology as an operational definition for maladaptive use. They suggested that maladaptive use should not be entirely defined as excessive use. Rather, they proposed that maladaptive use should also include impairment in functioning as an aspect of the operational definition. Using impaired functioning to define maladaptive use, Morahan-Martin and Schumacher (2000) did find that a majority of college undergraduates reported some symptoms of maladaptive use of the internet.

Currently, little research has been conducted examining the relationship between depression and maladaptive use of technology using impairment in functioning to operationally define maladaptive use. Young and Rogers (1999) did find a relationship between depression and misuse of the internet using the criterion of psychosocial impairment to operationally define maladaptive use among a sample of adult internet users. However, further research is needed to investigate depression and maladaptive use of technology among populations of college students using psychosocial impairment as a criterion to define maladaptive use. Furthermore, few studies have investigated maladaptive use of mobile phones and texting. Some evidence indicates that maladaptive use of texting and mobile phones is associated with distress among college students

(Beranuy, Oberst, Carbonell, & Chamarro, 2009); however, no studies to date have examined the relationship between maladaptive use of texting/mobile phone or social networking sites and depression among college students. Therefore, further research is needed to investigate maladaptive use of information and communication technology and depression among college students.

Sleep Quality

Sleep quality refers to an ability to obtain uninterrupted sleep, and quality can be defined by number of night awakenings, sleep latency (the length of time it takes to fall asleep), and the subjective feeling of being restored or refreshed upon awakening (Pilcher, Ginter, & Sadowsky, 1997). Typically, poor sleepers tend to report higher numbers of night awakenings, longer amounts of time to fall asleep, and feeling tired and unrefreshed upon awakening in the morning. Recently, researchers have found that sleep quality may have a stronger relationship to health and psychological complaints than sleep quantity (Krenek, 2006; Pilcher et al., 1997), and they suggested that future research include both sleep quality and sleep quantity to investigate the psychological sequelae of problematic sleep.

Young adults and college students report high prevalence rates of disturbed or poor quality sleep (Brown, Buboltz, & Soper, 2006; Coren, 1994). For example, Coren (1994) found that approximately 64% of young adults reported some symptoms of poor sleep, and other researchers have found that a large majority of college students report that their sleep is not restorative (Brown et al., 2006; Moo-Estrella et al., 2005).

Because college students are likely to experience high rates of sleep disturbance or poor sleep quality, they may be at increased risk for depression (Pilcher, et al., 1997). Krennek (2006) found that poor sleep quality was related to increased depression and poor adjustment among college students, and Moo-Estrella and colleagues (2005) found that depressed students were more likely to report poor sleep quality. In fact, in a longitudinal study of young adults, Breslau, Roth, Rosenthal, and Andreski (1996) found that even after controlling for previous symptoms of depression, poor sleep quality was a significant predictor of future episodes of depression. Although the extant literature provides evidence that college students are likely to experience poor sleep quality, relatively few studies exist investigating the relationship between poor sleep quality and depression among populations of college students (Krennek, 2006).

Gender Differences

Possible differences between men and women will also be explored in the current study. Because it is well established that women are diagnosed with and experience higher rates of major depressive disorder (American Psychiatric Association, 2000), the differences among men and women may be an important factor to consider. Additionally, men and women may differ in the experience of technostress. Potentially women may experience higher rates of technostress. Hargittai and Shafer (2006) found that women are more likely than men to assess their technological skills as low, and Hudiburg (1994) found that perceptions of low technology skills are associated with higher rates of technostress. Therefore, it is feasible that women may endorse more symptoms of technostress than men, but the differences between men and women's experiences of

technostress needs further exploration. Furthermore, men are more likely to report problematic or maladaptive use of the internet (Ceyhan, 2008; Morahan-Martin & Schumacher, 2000), and varying types of technology use differentially predict depression among men and women (Thomee et al., 2007). Therefore, the current study will explore gender differences associated with maladaptive use of technology. Finally, women are more likely to report lower sleep quality than men (Ling-Ling & Sheng-Ping, 2004). Therefore, it may be necessary to consider the experiences of men and women separately, and one goal of the current study is to investigate the differences between men and women in relation to technostress, maladaptive use of technology, sleep quality, and depression.

Sleep and Technology

Previous researchers have suggested that the manifestation of depression among adolescents and college students may be related to poor sleep quality (Dahl & Lewin, 2002; Moo-Estrella et al., 2005; Wolfson & Carskadon, 1998). Because trends indicate that populations born more recently are experiencing higher rates of insufficient and poor (National Sleep Foundation, 2006; Office of Communications and Public Liaison, 2003), researchers have theorized that technology use may be influencing the sleep of modern generations (Dahl, 2002). In particular, researchers have theorized that the increased use of information and communication technology may shorten and disrupt normal sleep cycles (Wolfson & Carskadon, 1998). In fact, a recent study found that internet surfing, mobile phone calls, and texting predicted poor sleep quality among college students (Thomee et al., 2007). However, few studies have examined the influence of technology

(i.e., technostress and maladaptive use of technology) on sleep quality as related to depression among college students. Therefore, a primary goal of this study is to determine if technostress and/or maladaptive use of technology mediates the relationship between sleep quality and depression.

Statement of Problem and Hypotheses

Since the early 1990s, college counseling centers began reporting increased rates of depression among students (Gallagher et al., 2003). Given the risks associated with depressive symptoms among college students, it is thus becoming increasingly important to better understand contemporary variables that may be risk factors for symptoms of depression among college students. Because environmental stressors are often precipitating events for major depression (Mazure, 1998; Monroe & Hadjiyannakis, 2002), several researchers have theorized that modern lifestyle stressors may play a role in the manifestation of depression among generations of college students enrolled in the late 20th century and early 21st century (Emmons, 2007; Murphy & Archer, 1996). Modern college students may experience stressors including sleep problems (Moo-Estrella et al., 2005), technostress (Gustafsson et al., 2003), and maladaptive use of technology (Morahan-Martin & Schumacher, 2000) that previous generations of students did not experience. Furthermore, technostress, maladaptive use of technology, and poor sleep quality may place college students at risk for depression. Given the relative dearth of research related to each of these variables and their relationship to depression among college students, this study has three primary objectives including the following: a) to examine the possible differences between college men and women in relation to

technostress, maladaptive use of technology, and sleep quality b) to investigate the amount of variance in depression that can be predicted by each of the following variables: technostress, maladaptive use of technology, and sleep quality and c) to investigate the ways that technostress and maladaptive use of technology might interact with sleep quality to predict depression among college students.

Therefore, the overarching goal of this study is to investigate contemporary variables that may be associated with depression among college students. Specifically, the influence of technostress, maladaptive use of technology, and sleep quality will be examined in relationship to depression. Given the rationale discussed, specific research questions and hypotheses will include the following:

Question 1: Are there significant group differences between men and women college students in depression, technostress, maladaptive use of technology, and sleep quality?

Hypothesis 1: Men and women college students will differ in technostress, maladaptive use of technology, and sleep quality.

Question 2: How much variance in depression is explained by sleep quality among college students?

Hypothesis 2: Poor sleep quality will account for a significant amount of variance in depression among college students.

Question 3: How much variance in depression is explained by technostress among college students?

Hypothesis 3: Higher amounts of technostress will account for a significant amount of variance in depression among college students.

Question 4a: How much variance in depression is explained by technostress after controlling for sleep quality?

Hypothesis 4a: High amounts of technostress will account for a significant amount of variance in depression among college students after controlling for sleep quality.

Question 4b: Will technostress mediate the relationship between sleep quality and depression among college students?

Hypothesis 4b: Technostress will mediate the relationship between sleep quality and depression among college students.

Question 5: How much variance in depression is explained by maladaptive use of technology among college students?

Hypothesis 5: Higher amounts of technology misuse will account for a significant amount of variance in depression among college students.

Hypothesis 6a: How much variance in depression is explained by maladaptive use of technology after controlling for sleep quality?

Hypothesis 6a: High amounts of technology misuse will account for a significant amount of variance in depression among college students after controlling for sleep quality.

Question 6b: Will maladaptive use of technology mediate the relationship between sleep quality and depression among college students?

Hypothesis 6b: Maladaptive use of technology will mediate the relationship between sleep quality and depression among college students.

Chapter 2

Literature Review

In the late 1980s, college counseling centers reported the emergence of increased distress among students (Johnson, Ellison, & Heikkinen, 1989; Robbins, May, & Corazzini, 1985). In particular, the incidence of depression has increased among college students during the past 20 years (Sagun, 2007). Depression among college students is associated with multiple deleterious effects including suicidal ideation (Kisch et al., 2005), decreased academic performance (Karabenick, 1995), poor retention rates (Gerdes & Mallinckrodt, 1994), and poor health outcomes (Rawson, Bloomer, & Kendall, 1994). Additionally, Kitzrow (2003) suggested that depressed students may negatively impact other students, staff, and faculty on college campuses.

Because depression is a growing problem for university counseling centers (Gallagher, Gill, & Sysko, 2000), it is important to understand factors that are associated with depression among college students. Specifically, environmental stressors associated with modern lifestyles may be related to depression among college students in the new millennium (Lewinsohn, Rohde, Seeley, & Fischer, 1993; Moo-Estrella et al., 2005). Environmental stressors include social and cultural variables specific to the time and place in which students live. Technological advances in modern society may pose unique stressors for cohorts of students enrolled in college in the last two or three decades. Even 10 years ago, Ross et al. (1999) suggested that environmental stressors may include daily hassles related to technology such as computer problems or being “put on hold” during telephone interactions. Because modern cohorts of students are much more likely to use

computers, the internet, and mobile phones compared to previous generations of students, modern cohorts of students are increasingly exposed to environmental stressors associated with the use of technology. In particular, millennial college students may experience technostress (Hudiburg, 1996) and maladaptive use of technology (Morahan-Martin & Schumacher, 2000) that previous generations of students did not experience.

Additionally, Murphy and Archer (1996) suggested that sleep disturbance may be an emerging stressor among college students, and they proposed that poor sleep may be related to the incidence of depression among modern students. Similarly, other researchers suggested that poor sleep quality are increasingly associated with modern lifestyles (Moo-Estrella et al., 2005).

Given concerns about the increased prevalence of depression among current cohorts of college students, the purpose of the following chapter will be to review the extant literature related to modern environmental variables that are associated with depression among college students. In particular, literature related to technostress, maladaptive use of technology, and sleep quality will be reviewed in relationship to depression among college students.

Technostress

The link between stress and depression among college students is well established (Rawson et al., 1994; Wright, 1967). However, previous research primarily focused on links between academic, social and financial stressors and depression among college students (Archer & Lamni, 1985; Misra & McKean, 2000; Roberts & White, 1989). Recently, however, stress related to use of information and communication technology

(ICT) has also been identified as a potential source of stress among college students (Gustafsson et al., 2003; Thomee et al., 2007). Information and communication technology includes activities such as the use of computers, internet surfing, use of online social networks, texting, and use of mobile phones (Thomee et al., 2007). Originally, Arnetz and Wikholm (1997) coined the term technostress to describe the physiological and mental arousal associated with high rates of technology use in modern office environments. Arnetz and Wikholm (1997) found that symptoms of depressed mood, irritability, headaches, fatigue, and decreased concentration were associated with high rates of technology use among office workers, and they described the pattern of mental and physical symptoms as technostress. Thus, for the purpose of this study technostress refers to psychological or somatic symptoms of stress associated with use of technology.

Bradley (2000) discussed the concept of technostress in work environments. Although advances in technology were designed to enhance efficiency and foster global communication, Bradley, suggested that rapid developments in technology have created new types of stress related to an accelerated pace of work created by a technological environment. In particular, she proposed that technology creates stress related to being inundated with information, requirements or social pressure to be constantly accessible to others, requirements or pressure to be available to work regardless of physical location, and increased dependency on well-functioning technology.

Other researchers have investigated technostress among working adults. Ayyagari (2008) investigated technostress among 692 working adults, and found indications that technostress did significantly predict job strain. In particular, he found that the intrusive

aspects of technology that create infringement upon personal time were a main predictor of technostress. Additionally, a recent study of 77 teachers found that computers may be a source of technostress among educators. In particular, teachers with low self-efficacy for computer knowledge were more likely to report computer related anxiety and symptoms of stress (La Paglia, Caci, & La Barbera, 2008).

Although there is a paucity of information related to technostress among college students, the high rate of technology use among college students may place them at risk to experience technostress. Biocca (2000) estimated that students in the “internet generation” may spend a cumulative total of “20 years of their lives” using information and communication technology (p. 22), and use of internet, social networking sites, mobile phones, texting, and email continues to increase exponentially among youth and college students in the United States (Lenhart, Madden, & Hitlin, 2005; Perry, Perry, & Hosack-Curlin, 1998). The recent emergence of online social network sites is another noteworthy advancement in technology that may impact college students. In 2007, Lenhart and Madden found that approximately 91% of college students use Facebook, and more recently, Pempek et al. (2008) found that over 90% of college students report using Facebook an average of 30 minutes daily regardless of how busy they reported they were with other academic and social obligations.

Due to the increasingly reliance on Information and Communication Technology (ICT) by college students, researchers are beginning to investigate the potential sequelae that may be associated with high use of technology among this population. For example, a recent qualitative study examined attitudes of 25 college students toward ICT to

investigate the potential influence of the use of technology on health (Gustafsson et al., 2003). After completing interviews with the students, the authors analyzed themes in the participants' responses. Although students reported positive associations with use of ICT including freedom and efficiency, the students also acknowledged stressors associated with high rates of ICT use. In particular, students identified feelings of restriction and anxiety about the constant accessibility associated with ICT use. Additionally, students indicated fears of dependence on technology, pressure to update skills to use technology, and they reported that ICT use could be disruptive and distracting.

Interestingly, Lin and Peper (2009) recently found that college students experience physiologic arousal associated with use of text messages on cell phones. They measured various physiological indicators including muscle tension, pulse, temperature, skin conductance, and respiration on a group of 12 college students. They found significant increases in respiration, heart rate, skin conductance, and muscular tension among all students when they were texting or receiving text messages. Additionally, 83% of the students reported hand and neck pain during texting, and students were also likely to hold their breath when receiving text messages. However, Lin and Peper (2009) reported that students did not detect any subjective changes in their levels of physiological arousal.

Other research also linked technostress and anxiety among college students. For example, Hudiburg (1991) conducted a study of 103 college students, and he found that computer stress was significantly related to somatic symptoms and global stress scores. Later, Hudiburg (1994, 1996) investigated the association between psychological distress

and technostress in samples of college students. He found that computer related stress was significantly associated with somatization and anxiety, and symptoms decreased as computer knowledge increased.

Additionally, use of social networking sites may create sources of stress for college students. In a descriptive study investigating use of Facebook among 92 undergraduate students, researchers recently found that the majority of students reported that use of Facebook interfered with their academic functioning (Pempek et al., 2009). Approximately 76% reported a somewhat negative effect on academic work whereas approximately 3% reported a very negative effect on academic work. In addition to interfering with academic work, use of online social networks also creates privacy concerns among college students. Lewis et al. (2008) investigated the use of privacy features on online social networking sites among college students. They found that approximately 33.2% of a sample of 1,710 undergraduates had private profiles during their investigation. The authors found that users whose roommates or friends had private profiles, women, and individuals with stronger cultural preferences for privacy were more likely to maintain private profiles among the Facebook users. The researchers commented that issues of privacy can create stressors due to worries about possible social consequences, the potential to lose or not be hired for jobs, and safety or identity theft concerns among users of online social networks.

Online social networks may also create a unique form of technology related stress among college students due its potential impact on romantic relationships. Recently, researchers investigated the ways that Facebook jealousy may influence romantic

relationships (Muisse et al., 2009). They investigated the use of Facebook among 308 college students between the ages of 17 to 24 years of age. They found that use of Facebook uniquely predicted jealousy in romantic relationships even after controlling for gender, trait jealousy, personality traits, and relationship factors. In a qualitative portion of the study, researchers found that participants reported that Facebook creates accessibility to information about romantic partners that is otherwise not available. Respondents reported that this may be problematic because the increased amount of information is often ambiguous and occurs on Facebook without a context for interpretation. The authors concluded that use of Facebook creates unique stressors in the romantic relationships of college students.

Although several studies have investigated technostress among various populations (La Paglia et al., 2008), there is a paucity of research investigating technostress among college students. Also, there are no current studies that can be found in the extant literature investigating use of online social networks as a source of technology related stress among college students. Therefore, one purpose of this study is to include use of online social networks as an aspect of technostress.

Additionally, the relationship between technostress and depression among college students needs further investigation. As discussed previously, Arnetz and Wiholm (1997) did find that technostress was significantly related to depressed mood among working adults, however, no studies to date have investigated the relationship between technostress and depression among college students. Therefore, one purpose of this study

is to explore the prevalence of technostress and the relationship between technostress and depression among college students.

Maladaptive Use of Technology

Although technostress may be related to maladaptive use of technology, misuse or maladaptive ICT use is a distinct construct that refers to use of technology that interferes with social or occupational functioning (Morahan-Martin & Schumacher, 2000). In the past 15 years, research has increasingly focused on maladaptive use of technology among college students. However, definitions of maladaptive use have varied across studies (Yellowlees & Marks, 2007), and a large majority of studies have used a measure of the total hours spent using technology as a way to differentiate between use and maladaptive use of information and communication technology (Morahan-Martin & Schumacher, 2000). For example, there is some evidence that increased rates of Internet use predicts depression among adults and adolescents (Kraut, et al., 1998). In a study of 169 individuals in 73 households, Kraut and colleagues (1998) conducted a longitudinal study to investigate the effects of internet use among family members. They found that an increase in depressive symptoms occurred in family members whose rates of internet used increased over time. Although the results were subsequently debated because further studies found that the depressive symptoms dissipated over time in spite of ongoing internet use (Kraut, Kiesler, Boenva, Cummings, Helgeson, & Crawford, 2002), later studies found that differences in type of internet use and amount of social support may be linked to depressive outcomes among internet users (Bessiere, Kiesler, Kraut, & Boneva, 2008).

Similarly, Morgan and Cotton (2003) investigated the risks associated with high rates of internet use among college students. In particular, they conducted a study to examine the relationship between hours spent using the internet and symptoms of depression among a sample of 287 college freshmen. They found that internet usage did account for approximately 7.2% of the variance of depression symptoms among college students. Interestingly, findings indicated that depressive symptoms increased among students who spent more hours using the internet for non-communication purposes including playing games, shopping, and surfing the internet for information. However, a negative relationship existed between use of the internet to communicate via email and chat rooms and depression among college students. The authors concluded that further research is needed to understand the associations between internet use and depression among the college population.

In a similar study, researchers conducted longitudinal research to investigate the relationship between the amount of information and technology use and psychosocial symptoms including stress, depression, and sleep disturbance among a sample of 1,127 college students in Sweden (Thomee et al., 2007). In particular, they examined rates of use of mobile phone calls, texting, and internet activities including surfing, emailing, and online chatting. In contrast to Morgan and Cotton (2003), they did find that use of technology for communication purposes predicted increased rates of depression. In particular, they found that use of emailing and online chatting were associated with increased risk to develop depression symptoms among women, and higher rates of texting were associated with increased risk of symptoms of depression among men.

Morahan-Martin and Schumacher (2000) also investigated “pathological” internet use. However, they commented that pathological or maladaptive use is ill defined in the existing literature, and they suggested that definitions of misuse of technology are not entirely a function of the amount of time spent using the technology. Rather, they proposed that maladaptive use of technology is also defined by impairment in functioning and “failure to fulfill major role obligations” (p. 14). Additionally, the researchers commented that “pathological” use is typically investigated using samples of online participants instead of a normative sample from the general population. Using a definition of “pathological” use based upon psychosocial impairment, Morahan-Martin and Schumacher (2000) conducted a study to investigate misuse of the internet among 277 undergraduate students. They found that a majority of the students (64.7%) reported some symptoms of maladaptive use. Additionally, they found that problematic users were more likely to report higher rates of loneliness than non-pathological internet users.

In an online study of adults, Young and Rogers (1999) found a comparable pattern of results. They posted surveys online to investigate the relationship between depression and problematic internet use. Young and Rogers also defined problematic internet use with a focus on impairment in psychosocial functioning. They used criteria for addiction found in the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV; American Psychiatric Association, 1994) to develop a questionnaire designed to measure internet addiction. Among 259 adult internet users, they found that depression was significantly related to maladaptive internet use. Thus, maladaptive use of the internet may be a function of both time and impairment in social and psychological

functioning, but the majority of studies include only a measure of the amount of time spent using the internet to measure maladaptive use. Therefore, further research is needed to investigate maladaptive use of ICT among college students that operationally defines maladaptive use including both amount of time and impairment in functioning as criterion.

Additionally, few studies have investigated the relationship between maladaptive use of mobile phones/texting and depression among college students. In one study, Beranuy et al. (2009) did include problematic mobile phone use in an investigation of maladaptive use of technology among 365 college students in Spain. They used questionnaires based on DSM-IV criteria to investigate the relationship between pathological use of the internet and mobile phones and global symptoms of psychological distress among college students. They found that mobile phone and internet use were both significantly related to distress among college students. In particular, mobile phone use accounted for 8.7% of the variance in distress among the participants, and internet use accounted for 11.7% of the variance in distress among the sample of students. They suggested that further research is needed to understand the relationship between specific mental disorders and use of all types of technology among the college student population.

Finally, few studies have investigated maladaptive use of social networking sites among college students. As previously mentioned, a recent descriptive study investigating students' use of Facebook, found that a majority of students do report that use of Facebook interferes with their academic functioning (Pempek et al., 2008). Additionally, a study including 103 undergraduate students recently investigated the

relationship between shyness and use of Facebook. The researchers found that shy individuals were more likely to spend more time on Facebook than non-shy counterparts. Additionally, shy students were more likely to perceive Facebook positively and they were more likely to have fewer online “friends” than non-shy students. Therefore, although Facebook may be favored as a social tool among shy individuals, the authors suggested that there is a potential for shy individuals to misuse or develop an overreliance on social networking sites. Additionally, qualitative data suggest that college students recognize that the voyeuristic nature of social networking sites may be “addictive” (Muisse et al., 2009; Pempek et al., 2008), and therefore, there is a potential for maladaptive use that interferes with relationships and other areas of functioning among college students. Thus, one purpose of the current study is to operationally define maladaptive use of technology to include questions specific to use of social networking sites.

Quality of Sleep

Pilcher et al. (1997) defined sleep quality using multiple components including the number of night awakenings, the length of time it takes to fall asleep, the subjective experience of the satisfaction and depth of sleep, and feeling restored or rested after sleep. The authors found that poor sleep quality was related to health complaints and increased feelings of tension, depression, anger, fatigue, and confusion. Other researchers have also investigated the relationship between sleep quality and mental health among college students. For example, Moo-Estrella and colleagues (2005) investigated links between sleep alterations and depression among 638 college students in Mexico. They

defined sleep alterations using a questionnaire to assess sleep quality. Sleep quality was defined as the perception of feeling rested after sleep. Additionally, the authors included questions about amount of sleep, the length of time it takes to fall asleep at night, the number of nighttime awakenings, and daytime sleepiness. Findings indicated that only 15.6% of the participants reported that their sleep was restorative. Additionally, students identified as depressed were more likely to report poor quality of sleep, difficulties falling asleep, and a larger number of nighttime awakenings.

Krenek (2006) also examined the relationship between sleep quality, adjustment to college, and physical and mental health among college students. Krenek found that male and female students with poor sleep quality were more likely to experience depression, anxiety, interpersonal problems, academic problems, and poor physical health.

Krenek (2006) commented that there are relatively few studies investigating mental health and sleep quality among college students. However, links between depression and poor quality sleep have been found in other populations. For example, one study found that symptoms of insomnia predict onset of depression among young adults between the ages of 21 to 30 (Breslau et al., 1996). Breslau and colleagues (1996) conducted a longitudinal epidemiologic study of 979 young adults to investigate the links between psychiatric disorders and sleep disturbance. In particular, they found that insomnia symptoms predicted subsequent episodes of depression. Insomnia included intermittent wakefulness, difficulty falling asleep, and early morning awakenings that impact sleep quality. The researchers found that young adults with insomnia symptoms

were more likely to develop depression even after controlling for previous symptoms of depression (Breslau et al., 1996).

Another study investigated the relationship between poor sleep quality and depression among high school students (Kirmil-Gray, Eagleston, Gibson, & Thoresen, 1984). In an investigation of 277 students, they found that students identified as chronic or occasional poor sleepers were more likely to report symptoms including depressed mood, irritability, and low energy than good sleepers. Similar patterns have been found in studies investigating sleep quality and depression among pregnant women (Skouteris, Germano, Wertheim, Paxton, & Milgrom, 2008), older adults (Motivala, Levin, Oxman, & Irwin, 2006), cancer patients (Hann, Winter, & Jacobsen, 1999), and psychiatric populations (Agarun, Kara, & Somaz, 1997).

Although few studies exist investigating links between sleep quality and depression among college students, evidence does indicate that sleep quality is particularly problematic for college students and young adults. For example, Coren (1994) conducted an epidemiologic study to investigate the prevalence of sleep disturbance among college students. He defined sleep disturbance using components similar to the definition of sleep quality proposed earlier. In particular, he investigated the rates of delayed sleep onset, frequent awakenings, early awakenings, waking tired, disrupted sleep, day napping, and nightmares among 2,782 young adults between the ages of 17 to 30 years of age. Surprisingly, he found that the majority of the participants reported some level of sleep disturbance. Approximately 64% of the participants endorsed symptoms of sleep disturbance, and almost half (46.5%) reported that they

frequently or almost always awaken in the morning feeling tired. Coren also found that women were more likely to experience nightmares, frequent night awakenings, and delayed sleep onset than men, and men were more likely to take daytime naps than women. Coren (1994) suggested that the epidemiologic data could be used as a control or reference group of sleep disturbance among non-clinical populations.

Buboltz, et al. (2001) found a similar pattern of results among a sample of 191 undergraduate students. They investigated the prevalence of sleep difficulties among college students in the United States, and they found that the majority of the participants, approximately 73%, reported occasional sleep problems. Common sleep difficulties included difficulties falling asleep more than three times per week, morning tiredness, and waking too early. Approximately 15% of the participants reported poor sleep quality, and more than half of men and women reported feeling tired upon awakening in the morning. Women were more likely to report nighttime wakefulness, higher rates of morning tiredness, and higher rates of daytime napping than men. Buboltz and colleagues (2001) concluded that the college population is particularly prone to disturbances in the quality of sleep, and they suggested that further research is needed to understand the relationship between sleep quality and depression among college students.

Gender

A final purpose of this study will be to examine differences among men and women. Gender is an important consideration because it is well established that women are more likely to report symptoms of depression and to be diagnosed with major depressive disorder than men (American Psychiatric Association, 2000; Ingram &

Trenary, 2005). Gender may also be an important to consider regarding technostress and maladaptive use of technology. Since the emergence of personal computers and widespread access to the internet, researchers have found that men are more likely to use technology and the internet than women (Morahan-Martin, 1998), and further research found that women may be more likely to use the internet and computer technology for the purpose of communication and the development and maintenance of relationships (Boneva, Kraut, & Frohlich, 2001; Tracking Life Online, 2000). Although multiple stereotypes exist to suggest that women may not be as technologically savvy as men, Hargittai and Shafer (2006) found that men and women do not actually significantly differ in their ability to use the internet. However, they did find that women were more likely than men to assess their web-based abilities as low. Because Hudiburg (1994) found that technostress decreased as self-assessed computer skills increased, it is feasible that women may be more likely to experience stress related to the use of technology than men due to perceived differences in skill level.

Gender may also be important to consider regarding maladaptive use of technology. Morahan-Martin and Schumacher (2000) found that male college students were more likely to endorse symptoms of maladaptive use of the internet, whereas other researchers have found that women are more likely to report maladaptive use of cell phones (Beranuy et al., 2009). Finally, gender may significantly interact with sleep quality. In particular, college women are more likely to report poor quality sleep than college men (Ling-Ling & Sheng-Ping, 2004). Therefore, gender differences will be explored in the current study.

Chapter 3

Methods

The methods section is divided into four subsections. The first section includes a description of participants, the next section includes identification and description of instruments used in the study. The description of instruments includes information regarding psychometric properties including reliability and validity data, and finally, the third section describes procedures that were used to collect the data for the study.

Participants

Participants in this study were drawn from a large public university in the Mid-Southern United States. Volunteers were recruited from undergraduate classrooms and campus sanctioned groups of undergraduate students. An online link was also sent to list serves, email, and social network sites to recruit participants throughout the United States. For the college students recruited, 278 began the survey. Out of the 278 participants that started the survey, 5 completed the survey online and 231 completed a paper and pencil copy. Thus a total of 236 college undergraduate students were analyzed for this study.

The sample of 236 college students included 116 (48.9%) men and 120 (51%) women. Participants ranged in age from 18 to 57 years old ($M = 25.28$, $SD = 8.6$). Participants identified as Caucasian (48.9%), African American (43.5%), Multi-racial (6%), Latino/Latina (6%), Asian American (4%), and other (.8%). For year in college, 14% identified as freshman/first year ($n = 33$), 28.4% identified as sophomore/second year ($n = 67$), 30.1% identified as junior/third year ($n = 71$), 14.8% identified as

senior/fourth year ($n = 35$), 9.7% identified as fifth year ($n = 23$), 1.3% identified as non-degree seeking ($n = 3$), and 1.7% identified as other ($n = 4$).

Instruments

The *Center for Epidemiologic Studies Scale* (CES-D; Radloff, 1977) is a widely used self-report instrument designed to measure depressive symptomatology in the general population. The scale was designed to yield one total score to estimate the severity of depression (Radloff, 1977). However, individual items do represent symptoms of depression. Items include questions designed to measure symptoms including depressed mood, feelings of guilt or worthlessness, loss of appetite, and psychomotor retardation, and feelings of hopelessness. Respondents are asked about symptoms during the past week, and responses to items can range from “*rarely or none of the time*” (0) to “*most or all of the time*” (3). The scoring of positive items is reversed. The possible range of scores is from 0 to 60 with higher scores indicating a higher degree of depressive symptomatology, and a score of 16 or higher indicates a high level of depression (Keyser & Sweetland, 1985).

The normative samples for the CES-D included non-clinical and psychiatric populations. Radloff (1977) established high internal consistency reporting coefficient alphas of .85 and .90 (Spearman-Brown, split-halves method) for the general population sample and the psychiatric sample respectively. Test-retest coefficients were adequate and ranged from .45 to .70 over time intervals ranging from 2 weeks to 12 months with a tendency for higher reliabilities to be found across smaller time intervals. Radloff found that individuals who reported negative life events between test and retest administrations

were more likely to have lower test-retest correlations. Radloff reported that the CES-D was designed to measure current levels of depression, and depressive symptomology is expected to vary across time. Therefore, low to moderate test-retest correlations can be expected. Since the CES-D was developed, other researchers have also found similar internal consistency and test-retest reliability (Hann et al., 1999; Morgan & Cotton, 2003).

To establish validity, Radloff (1977) compared the CES-D scores of patient versus well samples, and she found that CES-D scores discriminated between psychiatric patients and the general population with a majority (71%) of the patient sample scoring higher than 16 on the CES-D, whereas only 21% of the general population scored in the high range of the CES-D. Radloff (1977) also found convergent and discriminant validity by comparing the CES-D with other measures. The CES-D demonstrated adequate convergence with related measures including interviewer ratings of depression, and other self-report measures, and the CES-D was negatively correlated with instruments designed to measure positive affect. Additionally, CES-D scores decreased post-treatment for patient samples.

Other researchers have also established convergence between the CES-D and the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) with correlations ranging from .82 to .86 in studies of college students (Joseph, Lewis, & Olsen, 1996; Santor, Zuroff, Cervantes, Palacios, & Ramsey, 1995). Although the BDI is widely used, after comparing the CES-D and BDI in a study of college students, Skorivkov and VanderVoort (2003) concluded that the CES-D was more appropriate for

use with non-clinical populations than the BDI. Currently, the CES-D is widely used to measure depressive symptomology among college students.

Radloff (1991) also evaluated the CES-D for use with college students and young adults. The normative samples for young adults included college students and young adults in the general population between the ages of 18 to 25. Internal consistency coefficients for college students and young adults were .87 and .84 respectively, and Radloff concluded that the CES-D can be used reliably for college students and young adults. Estimates of internal consistency in the current study were similar and revealed a coefficient alpha of .869 for the CES-D for this study's sample of college students.

The *Computer Hassles Scale-Revised* (CHS-R; Hudiburg, 1997) is a 71-item scale designed to measure technostress or "stress resulting from human-computer interactions" (p. 42). Items are designed to measure stressors resulting from daily interaction with computers and the internet. Examples of items related to computer use include "computer system is down," "slow computer speed," "lost data," "crashed system," or "forgot to save work." Examples of items related to stressors associated with internet use include "too many email messages," "unsolicited or spam email," "too much internet information," or "internet connection errors". Hudiburg (1997) defined computer and internet hassles as stimuli that may evoke stress or be perceived as stressors. Respondents can rate the severity of the hassles using a scale of 0 (*not at all severe*) to 3 (*extremely severe*) to rate how severe the hassle has been perceived during the past two months. Severity hassles scores can be determined by summing the scores with higher scores indicating higher levels of computer and internet stress. Hudiburg (1995) suggested that

scores of 38 or higher indicate high levels of technostress and scores of 10 or lower indicate low levels of technostress.

Normative data were collected using a sample of 1,199 college students who use computers (Hudiburg, 1995). Test-retest reliability was moderate ($r = .60$) after a 5-week interval (Hudiburg, 1997). Although the Computer Hassles Scale-Revised is relatively new, some evidence for construct validity exists. Hudiburg (1994) found that severity hassles scores were moderately correlated with the somatization-anxiety items on Symptom Checklist-90 with a correlation coefficient of .57, and technostress scores were lower among college students with higher amounts of computer knowledge. Hudiburg (1989) also found significant convergence between technostress scores and scores on the Perceived Stress Scale and somatic complaints on the Hopkins Symptom Checklist, and Hudiburg, Rashaj, and Wolfe (1999) found that scores on the Computer Hassle Scale were correlated to somatic complaints and anxiety reactions measured by the NEO-Five Factor Inventory.

Hudiburg (1997) suggested that one limitation of the Computer Hassles Scale is that new technology related hassles are not included in the scale, and in particular, stressors related to the use of texting and mobile phones are not included in the CHS-R. Biocca (2000) suggested that texting and mobile phone use is prevalent among college students, and Gustafsson and colleagues (2003) found that college students reported stress related to cell phone use and texting. To date, no other scales or self-report instruments can be found that measure technostress associated with mobile phone use and texting in the extant literature. Therefore, for the purpose of this study, items were added

to the Computer Hassles Scale-Revised to include stressors associated with mobile phone use, texting, and social networking sites, and a brief pilot study ($n = 27$) was conducted to test internal consistency of the additional items. The coefficient alpha for the pilot study was .93, and the coefficient alpha for the current study with the entire sample of participants was .97. Both estimates were similar to previous research findings in the normative sample (Hudiburg, 1995).

The *Technology Misuse Use* scale is an adapted version of the *Pathological Internet Use* (PIU; Morahan-Martin & Schumacher, 2000) scale, developed for use in a study to investigate pathological internet use among college students. Morahan-Martin and Schumacher (2000) created a 13-item scale designed to measure distress and impairment associated with maladaptive internet use. They created the self-report scale to assess for academic, occupational, and interpersonal impairment. Additionally, items were created to assess for distress and withdrawal symptoms. Examples of some of the items include “I have missed classes or work because of online activities,” “I have never gotten into arguments with a significant other over being online,” and “I feel guilty about the amount of time I spend online”. Respondents can circle either yes or no in response to each item. The number of positive responses is summed to obtain a score, and negative items are reverse scored. Morahan-Martin and Schumacher (2000) suggested that a score of 4 or higher indicates pathological internet use, and higher scores indicate higher levels of pathological use. Morahan-Martin and Schumacher (2000) found that high scores on the scale were convergent with scores on the UCLA Loneliness Scale. Niemz, Griffiths, and Banyard (2005) also used the PIU to investigate pathological internet use among

British college students, and they found that high scores on the PIU were significantly correlated to low self-esteem.

Although the PIU measures impairment associated with pathological use of the internet, items are not included to measure impairment associated with pathological use of cell phones and texting. Because college students are likely to use cell phones and text messages frequently (Biocca, 2000) and because problematic cell phone use does occur among the college population (Jenaro, Flores, Gomez-vela, Gonzalez-Gil, & Caballo, 2007), the PIU was adapted to include 13 additional items related to pathological texting and cell phone use for the purpose of the current study. Examples of additional items include “I have missed classes or work because of texting or use of my cell phone,” “I have never gotten into arguments with a significant other over texting or cell phone use,” and “I feel guilty about the amount of time I spend texting or using my cell phone.”

In regard to internal consistency, Morahan-Martin and Schumacher (2000) reported a coefficient alpha of .87 for a sample of college students in a previous study. Estimates of internal consistency for the current study also examined. The alpha coefficient was .803 and suggested that the measure has acceptable levels of internal consistency in the current sample of undergraduate college students.

The *Pittsburgh Sleep Quality Index* (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) is a self-report questionnaire that was designed to measure subjective estimates of sleep quality. It includes 19 items to yield a Global Sleep Quality score, and scores can range from 0 to 21. Higher scores indicate worse sleep quality, and scores greater than 5 are an indication of poor sleep quality. The global score is a sum of 7

component scores including duration of sleep, sleep disturbance, sleep latency, daytime dysfunction, sleep efficiency, use of medications, and overall sleep quality. Normative data for the PSQI was gathered using healthy individuals, patients diagnosed with sleep disorders, and individuals self-identified as poor sleepers. Discriminant validity was established by comparing scores between healthy sleepers and patient groups, and Buysse and colleagues (1989) found that the PSQI was able to successfully discriminate between patients and normal controls. Test-retest reliability was also high as indicated by a coefficient of .85, and internal consistency was high as indicated by a Cronbach's alpha of .83, and across two administrations at different times. Since the development of the PSQI, other researchers have found similar estimates of internal consistency (Grandner, Kripke, Yoon, & Youngstedt, 2006; Lund, Reider, Whiting, & Prichard, 2009). Internal consistency in the current study was comparable with a coefficient alpha of .721 indicating acceptable levels of reliability for this study. The PSQI has been widely used to assess sleep quality in various populations including clinical populations (Carpenter & Andrykowski, 1998) and college students (Lund et al., 2009).

Procedures

IRB (Internal Review Board) approval was obtained prior to the onset of the study. Participants for this study were solicited via electronic mail (e-mail), listservs, and undergraduate classes on the campus of a large urban university in the mid-south. The emails described the study as an investigation of the ways that sleep and technology influence students' moods. Individuals interested in participation were directed to a

website on the World Wide Web (WWW) where they were able to access the survey, or alternatively, participants were given access to a paper and pencil version of the survey.

If individuals were interested in completing the survey online, participants agreed to the informed consent by checking the box next to the statement “I have read this page and would like to complete the survey.” By checking the box and agreeing to the informed consent, participants were directed to the demographic data and online survey. The paper and pencil version also included informed consent information. Participants were given the option to provide their email address if they wished to receive a summary of the research findings. If participants did not wish to provide an email address, a website was provided to post the findings of the study.

In order to recruit study participants, a raffle for three \$25 gift certificates to amazon.com was used as an inducement. As students completed the survey, they were asked to provide their names and contact information for the raffle. The names and contact information were separated from the survey in order to maintain the confidentiality of participants. Completion of the surveys took approximately 20 to 25 minutes. Participants were provided with information including resources available to students including counseling services, and contact information for the principal investigator.

Chapter 4

Results

The following chapter presents the statistical analyses used to evaluate the study's research questions and hypotheses described in previous chapters. All variables of interest were examined through SPSS 14.0 for accuracy in data entry, missing values, appropriate ranges and frequencies, and the normality of distributions. Data entry errors were corrected, and participants with missing data were omitted from the analysis. Ranges and frequencies were within normal limits, and the sample did meet underlying assumptions of normality.

Preliminary Analyses

Because data collection methods included use of electronic access via a World Wide Web (WWW) site ($n = 5$), and traditional use of paper and pencil collection ($n = 231$), a t-test was conducted to examine mean differences in depression, sleep quality, technostress, and technology misuse between the two groups. For, the dependent variable depression, results indicated that the group that completed the survey electronically ($M = 14.20$, $SD = 9.63$) was not significantly different than the group that completed the paper version of the survey ($M = 14.03$, $SD = 8.95$), $t(234) = -.042$, $p = .967$. Additionally, no significant mean group differences were found for sleep quality, technostress, or misuse of technology. Because no significant difference existed between the two data collection methods, the groups were combined for further analyses.

To determine if outliers were influencing the data, a multiple regression was run with depression as the dependent variable. The results were examined to determine if any

data points had a Mahalanobis distance greater than 14.28 (Stevens, 2002), a Cook D value greater than 1, and a leverage (LEVER) value ($n = 236, k = 3$) greater than .061. No multivariate outliers were found on the dependent variable depression. Additionally, no univariate outliers were found for the variables technostress, misuse of technology, or sleep quality. Thus, a total of 236 undergraduate college students were analyzed for this study.

The underlying assumptions of curvilinearity and homoscedasticity were assessed. A review of the scatterplots suggested that there was no curvilinearity in the data and there was not a pattern in the plot suggesting a violation of the assumption of homoscedasticity. Review of the normal P-P plot of regression standardized residual suggested the normality assumption was met. Based on the review of the histogram for depression, there does not appear to be a violation of normality due to the normal distribution in the sample of college students.

One-way analysis of variance (ANOVA) procedures were run on the key demographic variables of race/ethnicity and income level to determine if group differences existed within the current sample for the dependent variable, depression, and for each of the predictor variables. First, to determine if mean differences in depression existed across racial/ethnic groups, a one way ANOVA was conducted. Results indicated that there was not a significant effect of ethnicity on depression, $F(5, 230) = .327, p = .897$. A one way ANOVA was conducted to examine mean differences across income levels. There was no significant difference in depression across income levels, $F(8, 225) = 1.587, p = .130$. After mean group differences for the dependent variable were

examined, ANOVAs were also performed to determine if mean group differences existed across the predictor variables. Results indicated that there were no significant differences in sleep quality, technostress, or misuse of technology among racial groups or income levels.

Because age could influence depression (Mirowsky & Ross, 1992), sleep quality (Buysse et al., 1989), and technology use (Czaja et al., 2006), correlations between age and each variable were examined. Results indicated that age was significantly correlated to depression ($P = -.328, p < .05$) and technology misuse ($P = -.361, p < .05$), but age was not significantly correlated to sleep quality or technostress. Due to the significant correlations between age and depression and between age and technology misuse, age was considered a control variable for further regression analyses used to address the primary research questions.

Intercorrelations among variables was also explored, and as shown in Table 1, the correlations between the measure of depression, the CES-D (Center for Epidemiologic Studies Scale) and all the other indices were significant (all p 's $< .01$). Specifically, the CES-D was significantly correlated with the PSQI (Pittsburgh Sleep Quality Index), CHS-R (Computer Hassles Scale-Revised), and PIU (Pathological Internet Use).

Descriptive analyses were also conducted to explore typical patterns of technology use among college students. The means and standard deviations for minutes of technology use per day are summarized in Table 2.

Research Question 1

Research Question 1: Are there significant group differences between men and women college students in depression, technostress, maladaptive use of technology, and sleep quality?

Table 1

Correlations of Sleep Quality, Technostress, and Misuse of Technology with Depression

	PSQI	CHS-R	PIU	CES-D
PSQI	1.00			
CHS-R	.169**	1.00		
PIU	.218**	.237**	1.00	
CES-D	.426**	.215**	.412**	1.00

Note. **Correlation is significant at the 0.01 level (2-tailed); PSQI (Pittsburgh Sleep Quality Index), CHS-R (Computer Hassles Scale-Revised); PIU (Pathological Internet Use), and CES-D (Center for Epidemiologic Studies Scale)

Table 2

Means and Standard Deviations for Minutes of Technology Use per Day

Type of Technology	Males			Females		
	Mean	Range	Standard Deviation	Mean	Range	Standard Deviation
Email	52.48	0-1440	134.01	46.29	0-1440	142.91
Texting	151.48	0-1440	324.47	384.77	0-1440	527.81
Instant Message	9.44	0-120	19.05	29.80	0-1440	146.89
Surfing Internet	85.73	0-500	74.54	109.42	0-1440	180.00
Posting on SNS	71.57	0-1440	200.46	76.90	0-1440	202.74
Looking at SNS	59.13	0-1440	148.44	99.16	0-1440	227.03
Sex Sites	8.04	0-60	14.74	2.02	0-120	12.10
Gambling Sites	.52	0-60	5.57	1.00	0-120	10.91
Internet Games	42.20	0-360	59.33	14.68	0-360	47.74
Cell Phone Call	76.68	0-1440	142.83	218.90	0-1440	408.87
Other Tech Use	6.52	0-240	35.04	1.20	0-120	10.97

Note. SNS = Social Network Sites

Analyses of independent samples t tests with Bonferroni adjustment for protection of experiment-wise error rate were conducted to examine if there were differences between men and women on depression, sleep quality, technostress, and maladaptive use of technology. With $\alpha_E = .19$, an $\alpha = .013$ was used for the test (Kirk, 1982). As shown in Table 3, results revealed no statistically significant differences for depression, sleep quality, technostress, and misuse of technology between men and women.

Table 3

T Test Analysis Summary for Men and Women (N = 236)

	Men (N = 116)		Women (N = 120)		<i>T</i>	<i>df</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Depression	13.32	9.23	14.73	8.63	1.21	234
Sleep Quality	7.16	3.66	7.71	3.85	1.13	234
Technostress	68.09	48.39	66.02	52.27	-0.317	234
Technology Misuse	9.03	5.14	9.73	6.28	0.937	234

Note. ** $p < .013$.

Research Question 2

Research Question 2: How much variance in depression is explained by sleep quality among college students?

Hierarchical linear regression was used to examine the amount of variance in depression that is explained by sleep quality. Preliminary exploratory analyses indicated there were no multicollinearity problems in the data as evidenced by the variance inflation factors (VIF) being less than 10 (Stevens, 2002). The largest VIF was 1.000 for the hierarchical regression with depression as the dependent variable. Age was entered into the first block as a control variable. The second block entered into the equation was sleep quality. In the first step, the regression results indicated that age accounted for a significant amount of variance in depression among the sample of undergraduate college students ($R^2 = .107$, $F(1, 234) = 28.133$, $p = .000$). As age increased, rates of depression

decreased. In the second step, sleep quality accounted for a significant amount of additional variance in depression after controlling for the variance explained by age ($R^2 = .285$, R^2 change = .178, $F(1, 233) = 58.046$, $p = .000$). Poor sleep quality was predictive of higher rates of depression. The control variable of age accounted for 10.7% of the variance in depression while the combination of age, and sleep quality accounted for an additional 17.8% of the variance in depression. The combination of age and sleep quality accounted for 28.5% of the variance in depression among the sample of college students.

Research Question 3

Research Question 3: How much variance in depression is explained by technostress among college students?

Hierarchical linear regression was used to examine the amount of variance in depression that is explained by technostress. Preliminary exploratory analyses indicated there were no multicollinearity problems in the data as evidenced by the variance inflation factors (VIF) being less than 10 (Stevens, 2002). The largest VIF was 1.012 for the hierarchical regression with depression as the dependent variable. Age was entered into the first block as a control variable. The second block entered into the equation was technostress. As previously established, the regression results indicated that age accounted for a significant amount of variance in depression among the sample of undergraduate college students ($R^2 = .107$, $F(1, 234) = 28.133$, $p = .000$). In the second step, technostress accounted for a significant amount of additional variance in depression after controlling for the variance explained by age ($R^2 = .140$, R^2 change = .033, $F(1, 233) = 8.881$, $p = .003$). As technostress increased, rates of depression increased. The control

variable of age accounted for 10.7% of the variance in depression while technostress accounted for an additional 3.3% of the variance in depression. The combination of age and technostress accounted for 14.0% of the variance in depression among the sample of college students.

Research Question 4a and 4b

Research Question 4a: After controlling for sleep quality, how much variance in depression is explained by technostress?

Hierarchical linear regression was used to examine the amount of variance in depression that is explained by technostress after controlling for sleep quality. Preliminary exploratory analyses indicated there were no multicollinearity problems in the data as evidenced by the variance inflation factors (VIF) being less than 10 (Stevens, 2002). The largest VIF was 1.041 for the hierarchical regression with depression as the dependent variable. Age was entered into the first block as a control variable and significantly accounted for 10.7% of the variance in depression among the sample of college students as previously discussed. The second block entered into the equation was sleep quality, and sleep quality significantly accounted for an additional 17.8% of the variance in depression as previously discussed. In the final block, technostress was entered. Regression results indicated that technostress accounted for a significant amount of additional variance in depression after controlling for the variance explained by age and sleep quality ($R^2 = .298$, $R^2 \text{ change} = .012$, $F(3, 232) = 32.804$, $p < .05$). The technostress accounted for an additional 1.2% of the variance in depression after controlling for age and sleep quality. The combination of age, sleep quality, and

technostress accounted for 29.8% of the variance in depression among the sample of college students. Age ($B = -.310$), sleep quality ($B = .403$), and technostress ($B = .114$) significantly contributed to the full model (see Table 4).

Table 4

Summary of Hierarchical Regression Analysis for Depression among Undergraduate College Students, (Full model) (N = 236)

	<i>b</i>	<i>B</i>	<i>t</i>
Step 1			
Age	-.322	-.310	-5.600**
Step 2			
Sleep Quality	.958	.403	7.220**
Step 3			
Technostress	.020	.114	2.028*

Note. $R^2 = .107$ for Step 1 ($p = .000$); $\Delta R^2 = .178$ for Step 2 ($p = .000$); $\Delta R^2 = .012$ for Step 3 ($p = .044$); * $p < .05$. ** $p = .000$.

Research Question 4b: Will technostress mediate the relationship between sleep quality and depression among college students?

To determine if technostress mediates the relationship between sleep quality and depression after controlling for age, a series of regression analyses were used (Baron & Kenny, 1986) in a four step process as summarized in Table 4. In each step, age was entered as a control variable in the first block. In the first step, the relationship between sleep quality and depression was established. The effect of sleep quality on depression was equal to 1.004, with a 95% confidence interval of .744 to 1.263 and a medium effect

size ($r = .447$) See Research Question 2 for a summary. In the second step, the relationship between technostress and sleep quality was established by regressing sleep quality on technostress. The effect of sleep quality on technostress was equal to 2.240 with a 95% confidence interval of .548 to 3.933 and a small effect size ($r = .168$). In the third step, the effect of technostress on depression after controlling for sleep quality was investigated. The effect of technostress on depression after controlling for sleep quality was equal to .020, with a 95% confidence interval of .001 to .040, and a small effect size ($r = .132$). See research question 4a for a summary. In the fourth and final step, the effect of sleep quality on depression after controlling for technostress was investigated. Results indicated that the effect of sleep quality on depression after controlling for technostress was equal to .958, with a 95% confidence interval of .697 to 1.220 and a medium effect size ($r = .428$). Therefore, in testing the mediating effect of technostress on the relationship between sleep quality and depression, a reduction from $\beta = 1.004$ (path c) to $\beta = .958$, $p = .000$ (path c') was found (see Figure 1). This indicated possible partial mediation. However, the Sobel-Goodman test statistic was non-significant, $z = .004$, $p > .05$ indicating no indirect effect.

Research Question 5

Question 5: How much variance in depression is explained by maladaptive use of technology among college students?

Table 5

Summary of Regression Analyses for Research Question 4b

<i>z</i>	Path	Estimate	95% CI	Beta	<i>p</i>
1	c	1.004	[0.744, 1.263]	.422	.000
2	a	2.240	[0.548, 3.933]	.167	.000
3	b	0.020	[0.001, 0.040]	.114	.044
4	c'	0.958	[0.697, 1.220]	.403	.000

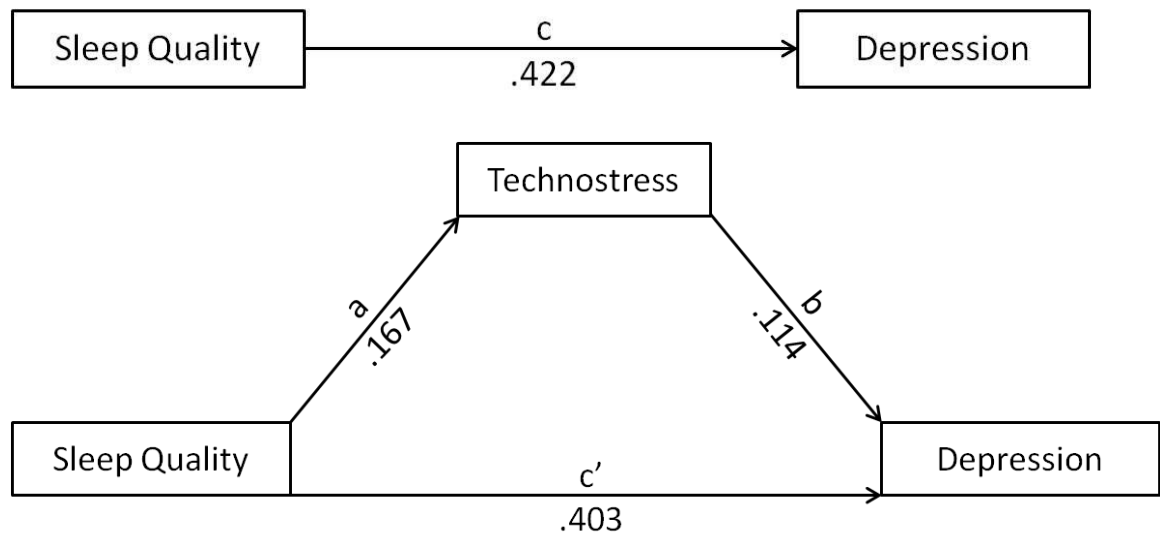


Figure 1. Unmediated and Mediated Model of the relationship of sleep quality and depression with technostress as mediator

Hierarchical linear regression was used to examine the amount of variance in depression that is explained by maladaptive use of technology. Preliminary exploratory analyses indicated there were no multicollinearity problems in the data as evidenced by the variance inflation factors (VIF) being less than 10 (Stevens, 2002). The largest VIF was 1.150 for the hierarchical regression with depression as the dependent variable. Age was entered into the first block as a control variable. The second block entered into the equation was maladaptive use of technology. As previously established, the regression results indicated that age accounted for a significant amount of variance in depression among the sample of undergraduate college students ($R^2 = .107$, $F(1, 234) = 28.133$, $p = .000$). In the second step, maladaptive use of technology accounted for a significant amount of additional variance in depression after controlling for the variance explained by age ($R^2 = .206$, $R^2 \text{ change} = .099$, $F(2, 233) = 30.316$, $p = .000$). The control variable of age accounted for 10.7% of the variance in depression while maladaptive use of technology accounted for an additional 9.9% of the variance in depression. The combination of age and maladaptive use of technology accounted for 20.6% of the variance in depression among the sample of college students.

Research Question 6a and 6b

Question 6a: After controlling for sleep quality, how much variance in depression is explained by maladaptive use of technology among college students?

Hierarchical linear regression was used to examine the amount of variance in depression that is explained by maladaptive use of technology after controlling for sleep

quality. Preliminary exploratory analyses indicated there were no multicollinearity problems in the data as evidenced by the variance inflation factors (VIF) being less than 10 (Stevens, 2002). The largest VIF was 1.150 for the hierarchical regression with depression as the dependent variable. Age was entered into the first block as a control variable and significantly accounted for 10.7% of the variance in depression among the sample of college students as previously discussed. The second block entered into the equation was sleep quality, and sleep quality significantly accounted for an additional 17.8% of the variance in depression as previously discussed. In the final block, maladaptive use of technology was entered. Regression results indicated that technology misuse accounted for a significant amount of additional variance in depression after controlling for the variance explained by age and sleep quality ($R^2 = .335$, $R^2 \text{ change} = .049$, $F(3, 232) = 38.928$, $p = .000$). Maladaptive use of technology accounted for an additional 4.9% of the variance in depression after controlling for age and sleep quality. The combination of age, sleep quality, and technostress accounted for 33.5% of the variance in depression among the sample of college students. When considering the full model age ($B = -.243$), sleep quality ($B = .369$), and technology misuse ($B = .245$) significantly contributed to the full model (See Table 6).

Question 6b: Will maladaptive use of technology mediate the relationship between sleep quality and depression among college students?

To determine if maladaptive use of technology mediates the relationship between sleep quality and depression after controlling for age, a series of regression analyses were used (Baron & Kenny, 1986) in a four step process as summarized in Table 7. In each step, age

was entered as a control variable in the first block. In the first step, the relationship between sleep quality and depression was established. The effect of sleep quality on depression was equal to 1.004, with a 95% confidence interval of .744 to 1.263 and a medium effect size ($r = .447$). See Research Question 2 for a summary. In the second step, the relationship between maladaptive use of technology and sleep quality was established by conducting a regression with sleep quality as the predictor variable and maladaptive use of technology as the dependent or criterion variable. The effect of sleep quality on technology misuse was equal to .334 with a 95% confidence interval of .155 to .513 and a small effect size ($r = .234$). In the third step, the effect of maladaptive use of technology on depression after controlling for sleep quality was investigated. The effect of maladaptive use of technology on depression after controlling for sleep quality was equal to .382 with a 95% confidence interval of .200 to .563, and a small effect size ($r = .263$). See research question 4a for a summary. In the fourth and final step, the effect of sleep quality on depression after controlling for maladaptive use of technology was investigated. Results indicated that the effect of sleep quality on depression after controlling for maladaptive use of technology was equal to .876, with a 95% confidence interval of .618 to 1.135 and a medium effect size ($r = .402$). Therefore, in testing the mediating effect of maladaptive use of technology on the relationship between sleep quality and depression, a reduction from $\beta = 1.004$ (path c) to $\beta = .876$, $p = .000$ (path c') was found (see Figure 2). This indicated possible partial mediation. However, the Sobel-Goodman test statistic was non-significant, $z = .06$, $p > .05$ indicating no indirect effect.

Table 6

Summary of Hierarchical Regression Analysis for Depression among Undergraduate College Students, (Full model) (N = 236)

	<i>b</i>	<i>B</i>	<i>t</i>
Step 1			
Age	-.243	-.234	-4.065**
Step 2			
Sleep Quality	.876	.369	6.691**
Step 3			
Technology Misuse	.382	.245	4.152**

Note. $R^2 = .107$ for Step 1 ($p = .000$); $\Delta R^2 = .178$ for Step 2 ($p = .000$); $\Delta R^2 = .049$ for Step 3 ($p = .000$). ** $p = .000$.

Table 7

Summary of Regression Analyses for Research Question 6b, Technology Misuse as Mediator

Step 1	Path	Estimate	95% CI	<i>Beta</i>	<i>p</i>
1	c	1.004	[0.744, 1.263]	.422	.000
2	a	.334	[0.155, 0.513]	.218	.000
3	b	.382	[0.200, 0.563]	.245	.000
4	c'	.876	[0.618, 1.135]	.369	.000

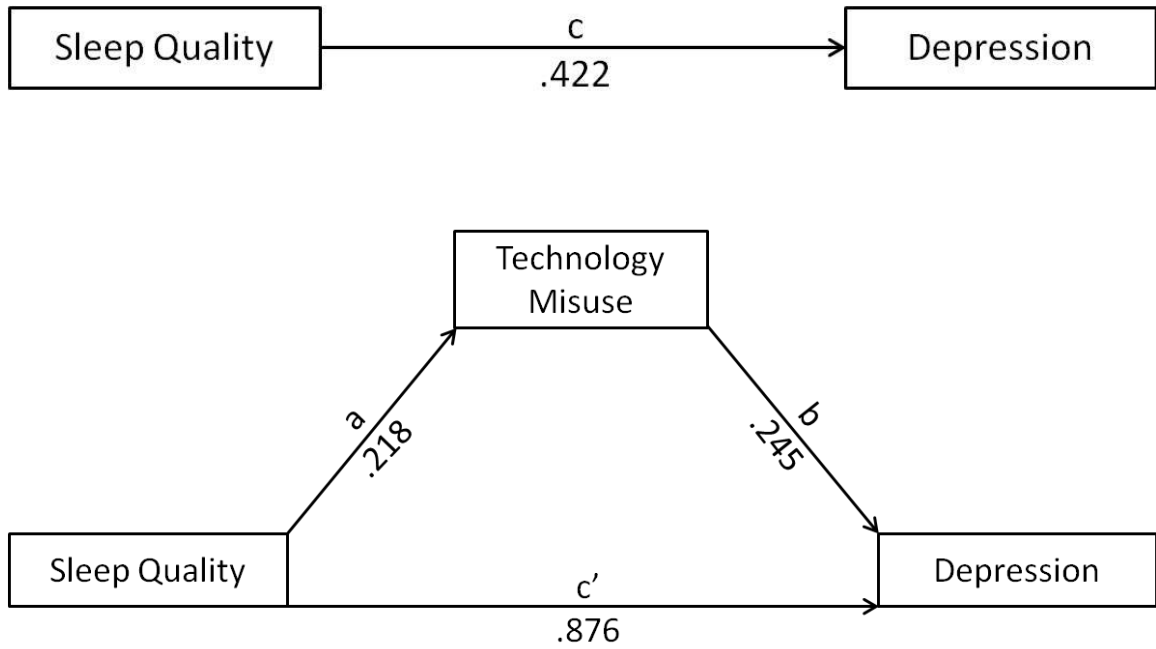


Figure 2. Unmediated and Mediated Model of the relationship of sleep quality and depression with technology misuse as mediator.

Chapter 5

Discussion

Introduction

The purpose of the current study was to investigate the ways in which sleep and technology might influence or predict depression among college undergraduate students. Specifically, the goal of this research was to investigate the ways in which sleep quality, technology misuse, and technostress (i.e., stress associated with the use of technology) might directly or indirectly predict depression. Additionally, gender differences were also explored because previous research indicated that women have higher rates of depression (American Psychiatric Association, 2000), lower rates of technology misuse (Morahan-Martin & Schumacher, 2000), and poorer sleep quality (Ling-Ling & Sheng-Ping, 2004) than men.

Gender Differences

Surprisingly, results of the current study indicated that no significant differences existed between men and women college students in depression, technostress, maladaptive use of technology, and sleep quality. Although there is substantial evidence that women historically experience and/or report depression more frequently than men (American Psychiatric Association, 2000; Ingram & Trenary, 2005), and this trend remains evident in large samples of the general population (Essau, Lewinsohn, Seeley, & Sasagawa, 2010), some recent research indicates that gender differences in depression among late adolescents and young adults may be decreasing (Bennett, Ambrosini, Kudes, & Metz, 2005; Bracken & Reintjes, 2010). Potentially, the results of this study offer

preliminary support to the possibility that gender differences in depression among college students also may be decreasing, which is not to say that depression is decreasing, rather that college men, unfortunately, are catching up with college women in the prevalence of depression.

The results of this study also indicated no differences among college men and women for the technology variables. In contrast to previous research (Ceyhan, 2007; Morahan-Martin & Schumacher, 2000), men and women did not differ in technology misuse in the current study. The hypothesis that women would experience more technostress was also not supported. Potentially, the results may indicate that gaps and differences among contemporary men and women college students are decreasing. Although previous research found that men are more likely to use technology and the internet than women (Morahan-Martin, 1998), recent research has suggested that the differences in the amount of technology use between men and women may be decreasing across time (Hargittai & Shafer, 2006). Yet, gender differences may still exist regarding men and women's reasons and purposes for using technology (Tracking Life Online, 2000). For example, Boneva et al. (2001) suggested that women might be more inclined to use technology to make social connections. However, access and rates of technology use may not be substantially different between groups of college men and women. Therefore, gender differences in technology misuse and technostress may not be as prevalent as expected among college students.

In addition to exploring gender differences in depression and technology, differences in sleep quality between men and women were also investigated. In contrast

to expectations, the hypothesis that women would experience poorer sleep quality was not supported. Further exploration of gender differences in sleep quality may need to be explored in future research.

Sleep Quality and Depression

As expected, sleep quality significantly predicted depression among college students. Poor sleep quality predicted higher levels of depression and accounted for a substantial amount of the variance (i.e., 17.8%) in depression after controlling for age. This finding was consistent with a body of previous research indicating that poor sleep quality predicts depression and depressive symptoms among various population groups (i.e., Agarun et al., 1997; Breslau et al., 1996; Hann et al., 1999; Kirmil-Gray et al., 1984; Motivala et al., 2006; Skouteris et al., 2008). Although some previous research has found that the link between sleep quality and depression also exists among college students (Moo-Estrella et al., 2005), additional research among this particular population was needed. The findings in this study provide evidence that the link between poor sleep quality and depression also exists among college students.

Technology and Depression

The hypothesis that technostress predicts depression among college students was supported. As expected, higher rates of technostress predicted depression among the sample of college students. After controlling for age, technostress did contribute a small but significant (i.e., 3.3%) amount of the variance to depression. Although technostress only accounted for a small amount of variance, this finding was noteworthy because the ways in which technostress might contribute to depression have yet to be documented.

Previous research findings have shown that stress in general does contribute to depression among college students (Mikolajczyk et al., 2008). For example, previous researchers have documented that academic and financial worries significantly predict depression among college students (Ross et al., 1999). However, contemporary stressors associated with the use of technology remain relatively unexplored. The use of technology has increased dramatically in the past two decades (Lenhart, Madden, & Hitlin, 2005), and contemporary college students use and are expected to use multiple types of information and communication technologies (Lenhart et al., 2005). Although the use of technology is associated with multiple benefits (Ellison et al., 2007), technology use also generates stress (Gustafsson et al., 2003; Hamilton, 2006). Stressors associated with technology use might include difficulties with skills and access to information and communication technologies, problems with outdated or failed technologies, and concerns about privacy and pressure to be accessible via online social networks and text messages (Bradley, 2000). Although some preliminary research found that technostress is linked to depression among office workers (Arnetz & Wikholm, 1997), the link between technostress and depression among college students is not well established. The current study is among the first to investigate the ways in which technostress might be linked to depression among college students, and results revealed that stress associated with the use of technology does predict depression among college students.

The hypothesis that misuse of technology would significantly predict depression was also supported. Misuse (or maladaptive use) of technology refers to use of technology that interferes with psychosocial functioning (Morahan-Martin &

Schumacher, 2000). After controlling for age, technology misuse contributed significantly (9.9%) to the variance in depression among college students. The results of this study were consistent with previous research; for example, Morgan and Cotton (2003) found that college students who use the internet excessively were more likely to be depressed. Similarly, other researchers found that excessive use of mobile phones, text messages, and online chatting was associated with higher rates of depression (Thomee et al., 2007). Although previous researchers have established that misuse of the internet and mobile phones is associated with higher rates of depression among college students, this study is among the first to include misuse of online social networks as an aspect of the operational definition of technology misuse.

Mediation Models

After establishing the links among sleep quality, each of the technology variables, and depression, a final purpose of this study was to explore the ways that technology variables might be influencing the relationship between sleep quality and depression. The hypothesis that technostress would predict depression among college students after controlling for sleep quality was supported. After controlling for age and sleep quality, technostress did significantly contribute approximately 1.1% of the variance in depression among college students. Similarly, after controlling for sleep quality (and age as a control variable), misuse of technology significantly contributed 4.9% of the variance in depression. Although the effect was relatively small for each of the technology variables, this did provide some preliminary evidence that stress associated with the use of technology may be an important aspect of a full understanding of the

ways by which sleep and technology both contribute to depression among college students.

As a follow-up, this study also sought to examine possible pathways to depression by examining technostress as a mediator between sleep quality and depression as well as by examining technology misuse as a mediator between sleep quality and depression. Although technostress, sleep quality and depression were linked to each other, results did not support the idea that technostress mediates the relationship between sleep quality and depression. In addition, findings indicated that misuse of technology, sleep quality, and depression were associated with each other, however, results did not support the hypothesis that misuse of technology mediates the relationship between sleep quality and depression. Although the results were not significant, further research may be warranted. Recent trends have suggested that quality of sleep has reduced across time (National Sleep Foundation, 2006; Office of Communications and Public Liaison, 2003), and some researchers have theorized that technology might be impacting the sleep quality of adolescents and young adults (Dahl & Lewin, 2002). In particular, Wolfson and Carskadon (1998) suggested that increased use of various types of technologies may shorten and disrupt normal sleep cycles. Use of televisions, computers, and cell phones create bright light that may disrupt circadian rhythms (Dahl & Lewin, 2002), and college students may shorten sleep time and sleep quality for the purpose of using information and communication technology (Thomee et al., 2007). Therefore, additional research may be needed to continue to explore the pathways among sleep quality, technology, and depression among college students.

Implications

Based upon the current study, neither technostress nor misuse of technology mediated the relationship between sleep quality and depression among college students. However, this study suggested that sleep quality, technology use and depression may be inter-related among college students. First, it was clearly established and consistent with prior research (Krenek, 2006) that sleep quality is a significant predictor of depression among college students. Because depression is a common and prevalent concern for college undergraduates (Sagun, 2007; Zucker, 2000) and because college students frequently experience disruptions in sleep (Moo-Estrella et al., 2005), the possibility that poor sleep quality may be a risk factor for depression is an important clinical consideration (Harvey, 2001). Potentially, treatment focus for college students with depression may need to include assessment and interventions designed to improve sleep quality.

This study also found that technology (i.e., technostress and technology misuse) contributes or predicts depression after controlling for sleep quality among the sample of college undergraduates. Although causal paths have not been established, this finding suggests that technology use may be another important implication in the treatment of depression among college students. Depressed students may be at higher risk for abusing technology or for experiencing stress associated with the use of technology. Therefore, patterns and experiences of technology use may need to be assessed among college students who are experiencing depression.

Limitations

The current study had several limitations that should be noted. In particular, the Sobel-Goodman test was used to test for indirect effects in the mediation models. Although results indicated non-significance, it might be possible that the test was too conservative to detect significance given the sample size. Potentially, future studies may include a larger sample to investigate possible pathways among the variables. Although results were non-significant, misuse of technology might actually mediate the relationship between sleep quality and depression if the sample size was larger.

Secondly, the instruments used to measure technostress (i.e., CHS-R) and technology misuse (i.e., PIU) need additional investigation for item analysis and reliability across samples. Because investigation of these constructs is relatively new, the instruments are not well established in the extant literature. In particular, some variability may have been introduced into this study because items may be redundant on the CHS-R, and future studies may focus on using factor analysis to explore better ways to measure the construct of technostress.

Finally, results may not be generalizable to typical or traditional college students. The sample of college students obtained for this particular study included non-traditional students from a large, urban university. Students varied in age and income level, and the sample may not reflect typical demographics that occur among traditional college students.

Future Research

Future research may be needed to continue to explore mediation models to further investigate the ways that sleep quality, technology use, and depression are related. Although previous researchers have postulated that causal paths exist among sleep quality, technology, and depression among young adults and college students (Dahl & Lewin, 2002), further investigation is needed to examine the ways that quality of sleep, technology, and depression may be causally linked. In particular, further investigation of the possibility that technology misuse mediates the relationship between sleep quality and depression may need to be examined to determine if significant effects might be found in a larger sample of students.

In addition, future research may be needed to determine the ways that particular types of technology use may interfere with sleep quality. Technology use includes surfing the internet, use of online social networks, use of mobile phones for calling and texting, and use of computers for various applications. Differences may exist in the ways that the type of technology use is related to sleep quality and/or depression among college students.

Conclusions

This study examined the ways that sleep quality, technology stress, misuse of technology are related to depression among college students. Although women typically report higher rates of depression than men (American Psychiatric Association, 2000), gender differences for depression were not found for this particular study. Gender differences were also not found for the technology variables or for sleep quality.

Potentially, this provides some preliminary evidence that gender differences among college students might be decreasing in regard to technology use, depression, and sleep quality.

In this study, poor sleep quality did contribute to higher amounts of depression among the participants. Therefore, low quality of sleep may be a risk factor for depression among populations of college students as established in previous research (Krenek, 2006). This study also found that stress associated with the use of technology and abuse of technology were significant predictors of depression among college students, and this suggested that technology may be an important factor to consider when understanding the ways that sleep quality influences depression. Although the hypotheses regarding the ways that technology variables may mediate the relationship between sleep quality and depression were not supported, further research is needed to elucidate the possible pathways among sleep, technology, and depression.

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Appendix A

Informed Consent

Dear Student:

Thank you for taking the time to read about our study. We are interested in investigating how sleep and technology are related to students' moods. We really appreciate your time to participate in this survey.

Completion of the survey will take approximately 20 minutes. We will make every effort to protect the confidentiality and anonymity of each participant. All analyses will be performed on group data and confidentiality of data will be maintained within the limits allowed by law. A raffle for three \$25 dollar gift certificates to a bookstore is being conducted for the participants in this study. After completing the survey, you can choose to link to a separate website where you can enter your e-mail address for the raffle.

The results of this research may be published. However, we will make every effort to ensure anonymity of each participant in any publication. Your participation in this research study is completely voluntary and you may withdraw from participation at any time without consequence. Finally, there are no known risks associated with participation in this study beyond those encountered in everyday life. There is no compensation for participating in this study. The University of Memphis does not have any funds budgeted for compensation for injury, damages, or other expenses.

If you have any questions about this study, please call/e-mail the investigators: Michelle Goddard, M.S. at (901) 603-3318, mstaley@memphis.edu or Dr. Sara Bridges at (901) 678-2081, sbridges@memphis.edu. If you have additional questions regarding research rights, the Chair of the University of Memphis Institutional Review Board for the Protection of Human Subjects may be contacted at (901) 678-2533.

Your agreement to participate in this study indicates that you have read the informed consent letter, you will allow the researchers to include your data in the aggregate data set, and you may withdraw from the study at any time without consequence.

You may indicate your consent to participate in this research study by checking the box below. Thank you very much for your time, consideration, and support.

Sincerely,

Michelle Goddard, M.S.
Doctoral Candidate
The University of Memphis
Department of Counseling, Educational Psychology and Research

Appendix B
Demographic Data

1. Your Age:

2. Gender
 - Female
 - Male
 - Intersexed
 - Transgendered

3. Country of origin:

3. In what U.S. state do you currently reside?

4. In what type of area do you currently live?
 - Large Metropolitan Area
 - Small Metropolitan Area
 - Non-Metropolitan Area

5. Which of the following best describes your ethnicity?
 - African American
 - Asian American
 - Caucasian
 - Latino/Latina
 - Native American
 - Multiracial:
 - Other:

6. Are you currently enrolled in college classes?
 - Yes
 - No

7. Which of the following best describes your current year in college?
 - Freshman/First Year
 - Sophomore/Second Year
 - Junior/Third Year
 - Senior/Fourth Year
 - Fifth Year
 - Graduate Student
 - Non-degree seeking/Non-traditional student
 - Other, please specify _____

7. What is your current income level in U.S. dollars?

- Under \$10,000
- \$10,000 - \$19,999
- \$20,000 - \$29,999
- \$30,000 - \$39,999
- \$40,000 - \$49,999
- \$50,000 - \$74,999
- \$75,000 - \$99,999
- \$100,000 - \$150,000
- Over \$150,000

8. What is your current relationship status?

- Divorced
- Living with another
- Married/Partnered
- Separated
- Single
- Widowed

9. What substances do you currently use?

- Alcohol Times per week _____
- Caffeine Times per week _____
- Marijuana Times per week _____
- Cocaine Times per week _____
- Heroin Times per week _____
- medication prescribed to you by your health care professional; please specify _____
- non-prescribed* prescription pills; please specify _____
- over the counter medication; please specify _____

10. Please estimate how many minutes per day you use the following types of technology:

- Email _____
- Texting _____
- Instant Messaging _____
- Surfing the internet for information _____
- Posting information on social networking sites (i.e. Facebook, MySpace, Twitter, etc) _____
- Looking at information posted on social networking sites (i.e. Facebook, MySpace, Twitter, etc) _____
- Looking at sexually related websites _____
- Gambling _____
- Playing Games on the internet or computer _____

- Making mobile phone calls _____
- Other:

Appendix C

Center for Epidemiologic Studies Depression Scale

Center for Epidemiologic Studies Depression Scale (CES-D), NIMH

Below is a list of the ways you might have felt or behaved. Please tell me how often you have felt this way during the past week.

Week	During the Past			
	Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
1. I was bothered by things that usually don't bother me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I did not feel like eating; my appetite was poor.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I felt that I could not shake off the blues even with help from my family or friends.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I felt I was just as good as other people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I had trouble keeping my mind on what I was doing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I felt depressed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I felt that everything I did was an effort.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I felt hopeful about the future.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I thought my life had been a failure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I felt fearful.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. My sleep was restless.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I was happy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I talked less than usual.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I felt lonely.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. People were unfriendly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. I enjoyed life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. I had crying spells.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. I felt sad.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. I felt that people dislike me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I could not get "going."	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SCORING: zero for answers in the first column, 1 for answers in the second column, 2 for answers in the third column, 3 for answers in the fourth column. The scoring of positive items is reversed. Possible range of scores is zero to 60, with the higher scores indicating the presence of more symptomatology.

Appendix D

Pittsburgh Sleep Quality Index

Subject's Initials _____ ID# _____ Date _____ Time _____ AM
PM

PITTSBURGH SLEEP QUALITY INDEX

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?
BED TIME _____
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?
NUMBER OF MINUTES _____
3. During the past month, what time have you usually gotten up in the morning?
GETTING UP TIME _____
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)
HOURS OF SLEEP PER NIGHT _____

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you . . .
 - a) Cannot get to sleep within 30 minutes

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------
 - b) Wake up in the middle of the night or early morning

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------
 - c) Have to get up to use the bathroom

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------

d) Cannot breathe comfortably

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------

e) Cough or snore loudly

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------

f) Feel too cold

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------

g) Feel too hot

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------

h) Had bad dreams

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------

i) Have pain

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------

j) Other reason(s), please describe _____

How often during the past month have you had trouble sleeping because of this?

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------

6. During the past month, how would you rate your sleep quality overall?

Very good _____

Fairly good _____

Fairly bad _____

Very bad _____

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all _____
 Only a very slight problem _____
 Somewhat of a problem _____
 A very big problem _____

10. Do you have a bed partner or room mate?

No bed partner or room mate _____
 Partner/room mate in other room _____
 Partner in same room, but not same bed _____
 Partner in same bed _____

If you have a room mate or bed partner, ask him/her how often in the past month you have had . . .

a) Loud snoring

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

b) Long pauses between breaths while asleep

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

c) Legs twitching or jerking while you sleep

Not during the past month _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

d) Episodes of disorientation or confusion during sleep

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------

e) Other restlessness while you sleep; please describe _____

Not during the past month _____	Less than once a week _____	Once or twice a week _____	Three or more times a week _____
------------------------------------	--------------------------------	-------------------------------	-------------------------------------

Appendix E

Technostress

COMPUTER HASSLES SCALE - revised

Directions: Computer technology hassles are irritants related to experiences with computers and computer technology. These irritants can range from minor annoyances to fairly major problems. They can occur infrequently or fairly often.

Listed below are a number of ways in which a person can feel hassled by computers and computer technology. Respond to each hassle by clicking a 0, 1, 2, or 3 to indicate how SEVERE the hassle has been for you during the past MONTH.

SEVERITY :

0 - not at all 1 - somewhat severe 2 - moderately severe 3 - extremely severe

HASSLES

	0 Not at all	1 Somewhat Severe	2 Moderately Severe	3 Extremely Severe
1. computer system is down	0	1	2	3
2. lost in the computer	0	1	2	3
3. poorly documented software	0	1	2	3
4. computer hardware failure	0	1	2	3
5. computer keyboard lockup	0	1	2	3
6. programming error	0	1	2	3
7. illegal input error	0	1	2	3
8. updated software requirements	0	1	2	3
9. poor user/computer interface	0	1	2	3
10. slow program speed	0	1	2	3
11. slow computer speed	0	1	2	3
12. poorly written computer documentation	0	1	2	3
13. incompatible software program	0	1	2	3
14. incomprehensible computer instructions	0	1	2	3
15. outdated computer skills	0	1	2	3
16. increased time demands	0	1	2	3
17. electrical surges - data are lost	0	1	2	3
18. lost data	0	1	2	3
19. lost program	0	1	2	3
20. crashed program	0	1	2	3

21. crashed system/ lockup	0	1	2	3
22. damaged storage media - disks, tapes, zip drives	0	1	2	3
23. need to update skills	0	1	2	3
24. keyboard typing errors	0	1	2	3
25. need to learn new software	0	1	2	3
26. forgot to save work	0	1	2	3
27. keyboard paralysis	0	1	2	3
28. uninformative computer conversations	0	1	2	3
29. violent language of computers	0	1	2	3
30. too much computer information	0	1	2	3
31. too little computer information	0	1	2	3
32. software confusion	0	1	2	3
33. lack of help with a computer problem	0	1	2	3
34. lack of computer expertise	0	1	2	3
35. increased computer use expectations	0	1	2	3
36. lack of computer application software	0	1	2	3
37. obsolete computers	0	1	2	3
38. viewing the monitor too long	0	1	2	3
39. gaining access to a computer when needed	0	1	2	3
40. other people not knowing how to use a computer	0	1	2	3
41. network/server is down	0	1	2	3
42. too small monitor viewing area	0	1	2	3
43. computer peripherals problem (e.g., printer, mouse)	0	1	2	3
44. inadequate disk space	0	1	2	3
45. unsolicited e-mail (spamming)	0	1	2	3
46. too many e-mail messages	0	1	2	3
47. slow download or web page loading time	0	1	2	3
48. dead web link (error 401 message)	0	1	2	3

49. www domain name not recognized	0	1	2	3
50. busy website	0	1	2	3
51. websites with frames	0	1	2	3
52. websites with java script	0	1	2	3
53. websites with too many graphics	0	1	2	3
54. websites with too many commercials	0	1	2	3
55. web search engines query language	0	1	2	3
56. too much internet information	0	1	2	3
57. security of personal information on the internet	0	1	2	3
58. slow web browser speed	0	1	2	3
	0	1	2	3
59. inadequate internet skills	0	1	2	3
60. busy Internet Service Provider connect number	0	1	2	3
61. problems with operating system (Windows, Mac OS)	0	1	2	3
62. inadequate application program help screens	0	1	2	3
63. library computerized databases	0	1	2	3
64. internet on-line forms	0	1	2	3
65. forbidden access (error 403 message)	0	1	2	3
66. page not found (error 404 message)	0	1	2	3
67. internet connection errors (i.e., Host Unavailable, Unable to Locate Host, server busy)	0	1	2	3
68. popup browser windows with advertisement	0	1	2	3
69. secure server certificate requirements	0	1	2	3
70. host is unreachable at this time	0	1	2	3
71. computer viruses	0	1	2	3
72. low or dead battery on cell phone	0	1	2	3

73. lost call on cell phone	0	1	2	3
74. poor or no cell phone coverage in area	0	1	2	3
75. text message undelivered	0	1	2	3
76. text message typing errors	0	1	2	3
77. too many text messages	0	1	2	3
78. unsolicited text messages	0	1	2	3
79. text messages disrupting ability to concentrate	0	1	2	3
80. feeling pressured to respond to text messages quickly	0	1	2	3
81. worried about privacy on Facebook, MySpace or other online social networks	0	1	2	3
82. postings on Facebook, MySpace, Twitter, or other online social networks disrupting ability to concentrate	0	1	2	3
83. too many postings to read when using online social networks (i.e. Facebook, MySpace, etc).	0	1	2	3
84. feeling pressured to respond quickly to messages or postings to your profile or profile of friends	0	1	2	3
85. worried or concerned about what to post on Facebook, MySpace, Twitter, or other online social networks	0	1	2	3
86. worried or concerned about what others have posted on Facebook, MySpace, Twitter, or other online social networks	0	1	2	3
87. unsolicited friend requests or unsolicited postings found when using online social networks	0	1	2	3

Appendix F

Maladaptive Technology Use

Maladaptive Technology Use Scale

**adapted from the Pathological Internet Use Scale (Morahan-Martin & Schumacher, 2000)*

Listed below are questions related to your current use of online social networks, texting, and the internet.

Please circle either yes or no in response to each question. For the following questions, “**Online social networks**” refer to sites such as **Facebook, MySpace, Twitter**, etc.

1. I have never gotten into arguments with a significant other over using online social networks.
Yes No
2. I have been told I spend too much time on online social networks.
Yes No
3. If it has been a while since I last logged on to an online social network, I find it hard to stop thinking about what will be waiting for me when I do
Yes No
4. My work and/or school performance has not deteriorated since I started using online social networks.
Yes No
5. I feel guilty about the amount of time I spend using online social networks.
Yes No
6. I have used online social networks to make myself feel better when I was down or anxious
Yes No
7. I have attempted to spend less time on online social networks but have not been able to
Yes No
8. I have routinely cut short on sleep to spend more time on online social networks.
Yes No

9. I have used online social networks to talk to others at times when I was feeling isolated
Yes No
10. I have missed classes or work because of online social network activities
Yes No
11. I have gotten into trouble with my employer or school because of being on online social networks
Yes No
12. I have missed social engagements because of online social network activities
Yes No
13. I have tried to hide from others how much time I am actually on online social networks
Yes No

For the next set of questions, “being online” refers to use of the world wide web such as surfing, emailing, shopping, online chatting, and gathering information for academic, personal or work purposes. However, it does NOT refer to use of online social networks, i.e. Facebook, Twitter, MySpace, etc.

Please circle either yes or no in response to each question.

14. I have never gotten into arguments with a significant other over being online.
Yes No
15. I have been told I spend too much time online.
Yes No
16. If it has been a while since I last logged on, I find it hard to stop thinking about what will be waiting for me when I do
Yes No
17. My work and/or school performance has not deteriorated since I started going online
Yes No
18. I feel guilty about the amount of time I spend online
Yes No
19. I have gone online to make myself feel better when I was down or anxious

Yes No

20. I have attempted to spend less time online but have not been able to

Yes No

21. I have routinely cut short on sleep to spend more time online

Yes No

22. I have used online to talk to others at times when I was feeling isolated

Yes No

23. I have missed classes or work because of online activities

Yes No

24. I have gotten into trouble with my employer or school because of being online

Yes No

25. I have missed social engagements because of online activities

Yes No

26. I have tried to hide from others how much time I am actually online

Yes No

*The next set of questions refer to your use of texting and making cell phone calls.
Please circle either yes or no in response to each question*

27. I have never gotten into arguments with a significant other over texting or cell phone use.

Yes No

28. I have been told I spend too much time texting or using my cell phone.

Yes No

29. If it has been a while since I last looked at my text messages, I find it hard to stop thinking about what will be waiting for me when I do

Yes No

30. My work and/or school performance has not deteriorated since I started texting or using my cell phone

Yes No

31. I feel guilty about the amount of time I spend texting or using my cell phone

Yes No

32. I have used text messages to make myself feel better when I was down or anxious

Yes No

33. I have attempted to spend less time texting or using my cell phone but have not been able to

Yes No

34. I have routinely cut short on sleep to spend more time texting or using my cell phone

Yes No

35. I have used text messages to talk to others at times when I was feeling isolated

Yes No

36. I have missed classes or work because of texting

Yes No

37. I have gotten into trouble with my employer or school because of texting

Yes No

38. I have missed social engagements because of texting or cell phone activities

Yes No

39. I have tried to hide from others how much time I am actually texting or using my cell phone

Yes No