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The relationship between smartphone use, symptoms of depression, symptoms of anxiety, and academic performance in college students

by

Elizabeth Mae Longnecker

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE

Major: Human-Computer Interaction

Program of Study Committee:
Reynol Junco, Major Professor
Jonathan Kelly
Robert Reason

The student author and the program of study committee are solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University

Ames, Iowa

2017

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DEDICATION

I would like to dedicate this thesis to my mom for her loving guidance and support throughout my life, especially during the completion of this thesis.

I would also like to specially thank my friends: Alex, Mozhan, Greg, James, Meg, Mohsen, and so many more. You've all helped me more than you can imagine.

Love,

Elizabeth

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ABSTRACT

The current study aims to research the relationship between smartphone use, symptoms of anxiety, symptoms of depression, and academic performance. Previous literature suggests that smartphone usage is related to mental health (Ha, Chin, Park, Ryu, and Yu, 2008; Rosen, Whaling, Rab, Carrier, and Cheever, 2013; Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013; Van Ameringen, Mancini, & Farvolden, 2003). Studies have also linked mental health to academic performance in college students (Eisenberg, Golberstein, & Hunt, 2009; Hysenbegasi, Hass, & Rowland, 2005). Young adults ages 18-29 years old are most likely to own and use a smartphone compared to any other age group (Anderson, 2015; Smith, 2015); additionally, 75% of mental health disorders have their first onset before the age of 24. Therefore, the subject sample for this study focuses on college students. It is necessary to examine this relationship to understand possible predictors and provide recommendations on how academic institutions can improve students' well-being and lower risk of academic failure.

Students (N = 216) attending a public university in the western U.S. were surveyed in a general education course on the global impact of technology and asked to download the Instant Quantified Self application to record their smartphone usage. Regression analyses determined that smartphone use significantly predicted academic performance, $t(147) = -2.732$, $\beta = -.254$, $p < .01$. Additionally, smartphone usage was negatively predictive of anxiety symptoms, $t(147) = -2.306$, $\beta = -.216$, $p < .05$, contradictory to previous research findings; therefore, smartphone usage may not be related to mental health as previously thought.

CHAPTER 1. INTRODUCTION

Background

The first smartphone was not the Apple iPhone as many would believe. In the beginning, smartphone developers were only aimed at selling to business professionals; business professionals had the need and the money to purchase this technology. Therefore, the first 'smartphone' (the term was not yet coined until 1997), the SIMON Personal Communicator, was produced in 1992 and patented in 1999 by International Business Machines Corporation (IBM; Budd, Karidis, & McVicker, 1999). SIMON was described as an all-in-one wireless handset phone with virtual image display, monochrome touchscreen, pager, fax machine, and limited-function computer (Budd, Karidis, & McVicker, 1999; Sager, 2012). The phone retailed for $899 (about $1500 in 2016 after adjustment for inflation), and IBM only sold around 50,000 units. Unfortunately, SIMON was before its time; it was produced, sold, and off the market before the web browser gained popularity soon after. In 2002, RIM released the Blackberry 5810, a phone with capabilities to check email and browse the web, yet the Blackberry's biggest problem was the required use of headphones during phone calls (Reed, 2010). This phone was still only aimed at selling to business professionals; although, a major turning point for the smartphone would soon be reached (Reed, 2010).

In January 2007, on the stage of the Moscone Convention Center in San Francisco, Steve Jobs presented the revolutionary 1st generation Apple iPhone. The first attempt at infiltrating the general market with the smartphone included a touchscreen,

sharp color display, ability to connect to Wi-Fi, ground-breaking integration of the mobile web browser, and access to a software development kit for third-party companies which later evolved into the App Store (Apple's iPhone, 2016; Reed, 2010). Selling one hundred times more devices than the SIMON, the Apple iPhone was and still is the device to which all smartphones are compared (Reed, 2010). Since 2007, Apple has released 14 additional models of the iPhone. Even with the unfortunate passing of Steve Jobs, the company has had no indication of slowing down its innovation or production of new technology.

The smartphone's multi-functionality has contributed to its integration into everyday life. With the onset of the Internet's popularity, developers have created social media platforms, mobile applications, and intelligent personal assistants (e.g. Siri), in addition to traditional text messaging and calling. Mobile phone users are now connected instantly to anyone almost anywhere at any time giving them access to information at their fingertips.

Smartphone Users

According to Pew research by Anderson (2015) and Smith (2015), 68% of adult Americans own a smartphone; specifically, young adults ages 18-29 years old are most likely to own a smartphone compared to any other age group. In a particular study by Smith on smartphone usage (2015), 100% of young adult participants that own a smartphone used their phone for text messaging at least once over the course of a week, 97% used the Internet, 93% placed phone/video calls, 91% sent emails, and 91%

used their phone for social networking. The popularity of smartphones among college-age adults is likely due to their openness to new technology. College students are generally early adopters, the first to try new technology, and innovators, pioneers creating new ways to use existing technology (Nelson, 2006; Rogers, 1995). Indeed, over 85% of college students own a smartphone, and the number of smartphone owners will continue to grow (Anderson, 2015; Emanuel, 2013).

By 2020, projections indicate that smartphone owners will more than double to 6.1 billion, 70% of the world's population. Many of these new users will emerge from developing countries through greater device affordability, growing economies, and young, growing populations (Cerwall, 2016). With this increase, smartphones will ultimately surpass the number of fixed phone lines worldwide (Cerwall, 2016) and quickly approach the ownership of personal computers (Anderson, 2015).

Smartphones have also allowed an affordable way for individuals from lower social economic statuses and from minoritized backgrounds to access the Internet. In 2015, Anderson reported only 50% of adults with household income under $30,000 owned a personal desktop or laptop computer. In comparison, at least 80% of adults with household incomes over $30,000 owned at least one personal computer (Anderson, 2015). Comparisons between white, Hispanic, and black households showed 79%, 63%, and 45% computer ownership, respectively (Anderson, 2015). However, when analyzing smartphone ownership, the differences of ownership between SES and ethnic backgrounds are reduced. The variation among adults with household income under $30,000 compared with household income over $30,000 is spread more evenly

(see Figure 1.1) in contrast to the sharp divided differences in computer ownership among separate incomes (Anderson, 2015). Additionally, ethnic/racial differences in smartphone ownership are almost non-existent (see Figure 1.2) with Black ownership at 68%, White at 66%, and Hispanic at 64% (Anderson, 2015). The availability and affordability of smartphones has shrunk the inequalities in Internet access that these populations face compared to their higher-income and White peers; ultimately, Internet access provides more equal opportunities and resources for all people.

Associated Outcomes of Smartphone Use

New innovations in technology come with new sets of consequences. We hope modernization enriches the human race, and in some ways, it does. Smartphones, for example, allow for the distribution of valuable tools in the form of applications. A study by Smith (2015) found that in 2015, over half of smartphone owners used their phone to research health information, do online banking, follow breaking new events, learn about community activities, and use GPS navigation. Additionally, 53% of smartphone owners have used their phone in an emergency (Smith, 2015). Smartphones have also provided an opportunity to distribute applications to help with behavioral problems. Cognitive behavioral practitioners find that incorporating technology into their therapies can help with interventions for people with fewer resources by extending the scope of therapy outside the office (Lane et al., 2011).

Developers have created apps to help correct behavioral problems such as medication nonadherence (Dayer et al., 2013), alcohol abuse (Dulin, Gonzalez, &

Campbell, 2014), and unhealthy habits affecting well-being (Lane et al., 2011). Specifically, medication nonadherence apps help with patients requiring daily treatment. Nonadherence is a costly and common problem, but new smartphone adherence apps offer inexpensive and easy solutions (Dayer et al., 2013). The highest rated adherence apps provide basic reminder features and advance functionality to correct this behavioral issue (Dayer et al., 2013). However, researchers stress the importance of using these self-help applications in conjunction with professional involvement; individuals may eventually lose motivation to use these cognitive behavioral therapy (CBT) tools (Dayer et al., 2013). Generally, only about 38% of all downloaded apps are opened more than once after a month, and this figure sharply decreases to 4% after a year (Farago, 2011).

While certain smartphone apps may help correct behavioral problems, smartphone use can become a behavioral issue in itself. In a 2015 study conducted by Smith (2015), 46% of smartphone users reported that they felt they could not live without their phone, 30% reported they felt their smartphone was a “leash”, restricting their freedom, and 19% felt their phone was a financial burden. Additionally, Rosen and his colleagues (2013) created an instrument measuring media and technology usage and attitudes (MTUAS) in which they surveyed college students over 18 on their technology habits and beliefs. They found that the time spent using a smartphone was positively related to anxiety about not checking in often enough with technology (Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013). In a second study by Rosen, Whaling, Rab, Carrier, and Cheever (2013), results from the MTUAS showed that having negative attitudes

about technology (e.g., technology makes life more complicated, technology makes people waste too much time, technology makes people more isolated) predicted more clinical symptoms of depression. This may indicate that quantitative use of smartphones may not always be problematic for users; however, smartphone use paired with negative attitudes and feelings of dependence and anxiety about technology may increase negative outcomes associated with smartphone use, specifically, smartphone users' risk for anxiety and depression (Rosen, Whaling, Rab, Carrier, & Cheever, 2013; Thomée, Härenstam, & Hagberg, 2011).

Anxiety and depression can have negative effects on mood (American Psychiatric Association, 2013), motivation/interest (American Psychiatric Association, 2013), sleep (Reynolds et al., 1983; Tsuno, Besset, & Ritchie, 2005), physical health (Kawachi, Sparrow, Vokonas, & Weiss, 1994; Keenan-Miller, Hammen, & Brennan, 2007), and self-esteem (Battle, 1978; Sowislo & Orth, 2013). Each of these symptoms can negatively impact life satisfaction and academic achievement (Andrews & Wilding, 2004; Koivumaa-Honkanen et al., 2004; Stein & Heimberg, 2004, Van Ameringen, Mancini, & Farvolden. 2003). In particular, college students with depression struggle more with academic performance than their healthier counterparts, having quantifiable negative effects on their GPA (Andrews & Wilding, 2004; Hysenbegasi, Hass, & Rowland, 2005). Hysenbegasi, Hass, and Rowland (2005) collected academic, health, and productivity data from university students and found that diagnosed depression was associated with half a letter grade deficit in overall GPA. Andrews and Wilding (2004) also conducted a study involving undergraduates and determined that depression predicted a decrease in

course exam performance between first and second years. In fact, 29% of college freshmen in Andrews and Wilding's (2004) study developed anxiety or depression before the end of their first year. However, 36% of students with prior diagnoses were recovered by the end of their initial year, indicating that while the transition from secondary to higher education can provide new stressors for students, opportunities for new, positive relationships and better understanding of mental health issues can also develop in this environment (Andrews & Wilding, 2004).

College Students and Mental Health

The years spent in college signify dramatic life changes. College students are pushed into independence while making some of their first career decisions such as declaring a major linked to a specific occupational area (Pascarella & Terenzini, 2005). Coincidentally, 75% of mental health disorders have their first onset before the age of 24, resulting in problematic outcomes within academic, social, and occupational aspects of life (Breslau, Lane, Sampson, & Kessler, 2008; Ettner, Frank, & Kessler, 1997; Kessler, Walters, & Forthofer, 1998; Kessler et al., 2005). In fact, 4.4% of high school graduates fail to even enter college because of mental health issues and approximately 2.6% of college dropouts attribute their departure to mental disorders (Breslau, Lane, Sampson, & Kessler, 2008). Traditional college-aged students are passing through a crucial stage in adult human development; therefore, effective treatment could promote long-term health benefits if implemented early.

Postsecondary institutions offer an ideal opportunity for students to identify and treat mental disorders. Campuses provide residences, social networks, and mental health services to students in a concurrent, convenient location; this is ideal for mental health treatment since support networks improve physical and psychological well-being through stress buffers and other direct means (Thoits, 2011). For example, social connections may provide a sense of belonging and acceptance (Thoits, 2011). With this acceptance, a student may feel connected to a network of communication as well as a sense of security that his/her needs will be met by their support system (Thoits, 2011).

Unfortunately, many adults with mental disorders do not receive appropriate treatment because of public stigma, unavailability of health care services, and financial barriers (Wang et al., 2005). However, most college campuses provide free or highly subsidized health care services, but college students still often do not seek treatment because of stigmatization, lack of perceived need for help, or unawareness of available services (Eisenberg, Golberstein, & Gollust, 2007).

Consequently, understanding the stressors in college students' lives is critical for providing successful treatment and support. If campus health providers can uncover additional factors attributed to mental disorders in college students, they will be able to increase self-awareness of possible mental health issues and give more comprehensive solutions for alleviating stress. Meanwhile, college institutions need to improve the marketing strategies for their mental health services because seeking help should not be perceived as weak or meaningless.

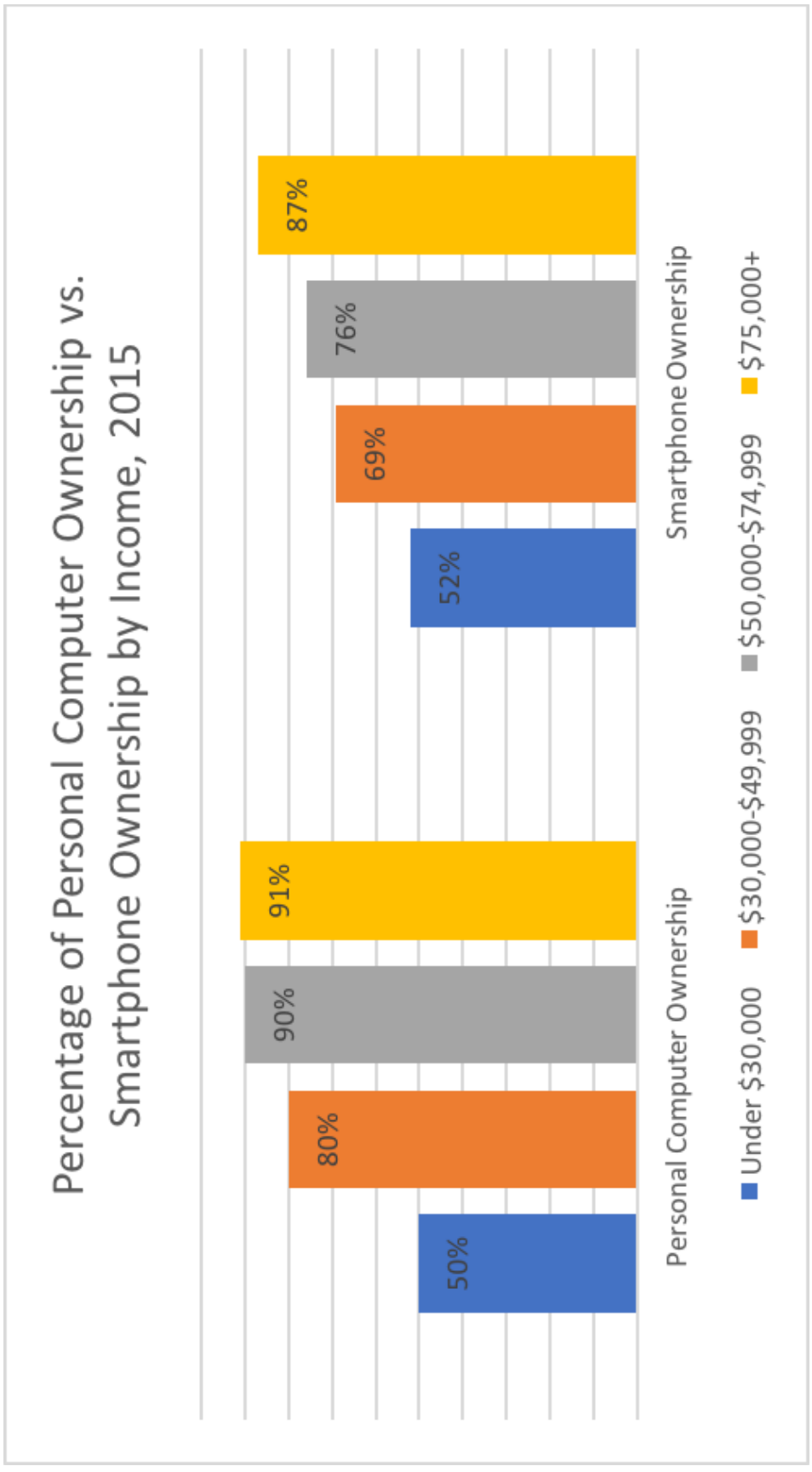

Figure 1.1: Computer vs. smartphone ownership by annual income (Smith, 2015)

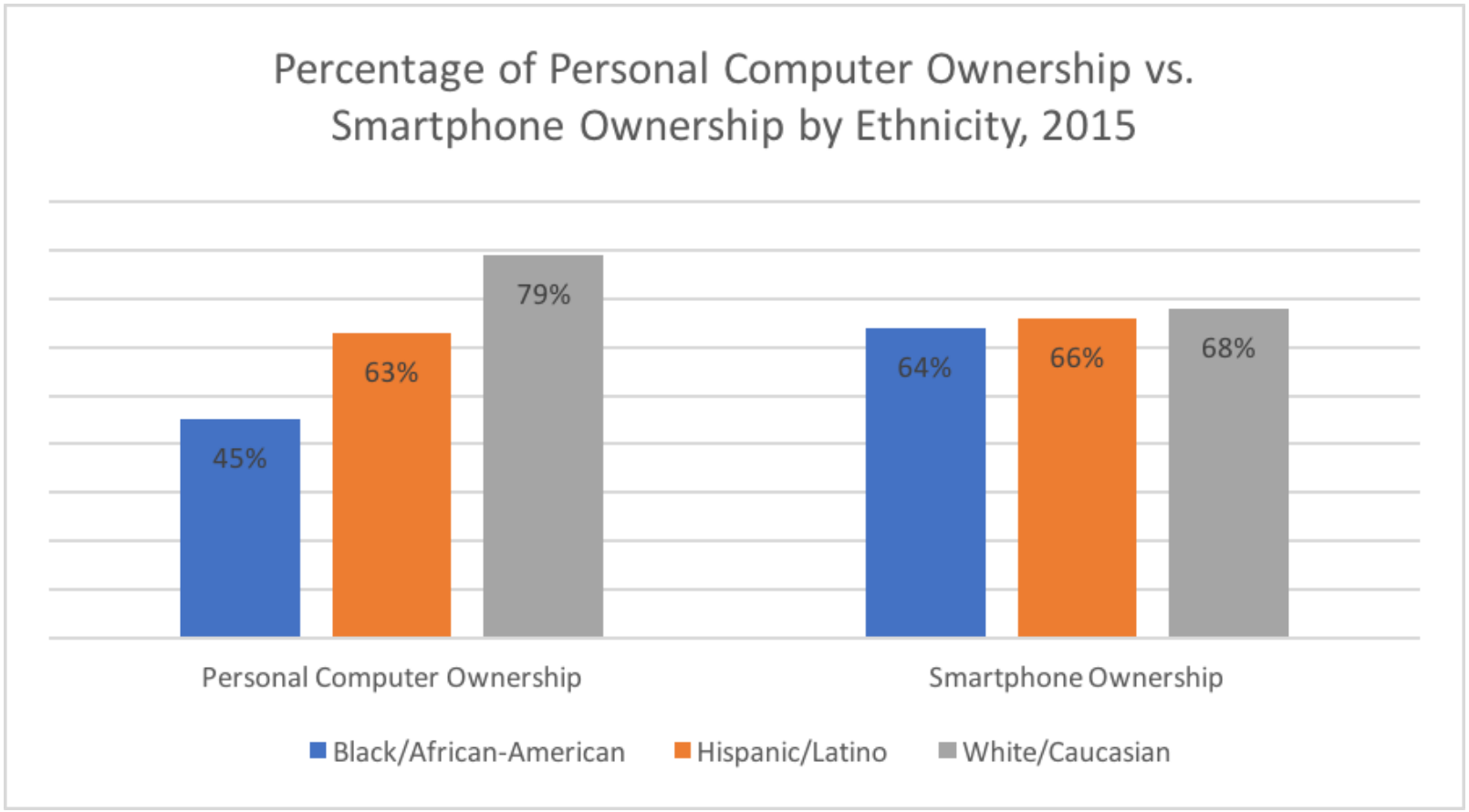

Figure 1.2: Computer vs. smartphone ownership by ethnicity (Smith, 2015)

CHAPTER 2. LITERATURE REVIEW

Hypothesis 1: Smartphone Use and Academic Performance

Research exploring the relationship between smartphone use and academic performance is still evolving from the early stages. However, in the studies that have been published, the relationship between these variables have been negative. Lepp, Barkley, and Karpinski (2015) determined, after controlling for known predictors of GPA (demographic variables, self-efficacy for self-regulated learning, self-efficacy for academic achievement, and actual high school GPA), that cell phone use was negatively and significantly related to college GPA in a sample of 536 undergraduates.

Additionally, Junco and Cotten (2012) revealed that browsing Facebook and texting while doing schoolwork were negatively associated with overall college GPA. College students were asked to complete a survey on their information and communication technology (ICT) usage, multitasking habits, and tech skills (Junco & Cotten, 2012). The researchers also received each subject's college and high school grade point averages (Junco & Cotten, 2012). From these data, they found that their hierarchical linear regression model predicting college GPA from demographics, high school GPA, Internet skill, and ICT multitasking was significant ($F_{(18,1623)} = 28.274$, $p < 0.001$, Adjusted $R^2 = 0.232$; Junco & Cotten, 2012). Therefore, they concluded that Facebook use or texting while completing schoolwork may overload students' capacity for cognitive processing and impede academic performance.

Furthermore, Rosen, Carrier, and Cheever (2013) determined from a sample of 263 US students (11-25 years old), those who used Facebook while working or studying

had lower overall GPAs than students who avoided multitasking with ICTs. In general, these studies focus on the use of technology while studying and its relationship with academic performance, attributing this connection to the impairment multitasking may cause on students' cognitive load. The division of attention between studying and other irrelevant tasks such as checking or using a smartphone may be the underlying mechanism for the relationship between these two variables. Therefore, the first hypothesis for the current study is:

Hypothesis 1: Smartphone use relates to academic performance.

Hypothesis 2: Smartphone use and anxiety

The second hypothesis of this study connects the independent variable in Hypothesis 1 (smartphone use) to symptoms of anxiety. Previous research on the relationship between phone use and anxiety is limited but those that exist show some significant results. For example, in the study by Ha, et al. (2008), students from a technical high school were asked to participate in a survey on excessive cell phone use; the survey included questions about "control difficulty, a persistent need for connection with others, and specific communication patterns via cellular phone" (Ha, Chin, Park, Ryu, & Yu, 2008, p. 783). The researchers used the upper and lower 30% of scores from the survey to classify users into excessive and low-user categories. The researchers found that excessive mobile phone users reported lower self-esteem, higher interpersonal anxiety, and difficulty in expression of emotion than low-usage comparison group (Ha, Chin, Park, Ryu, & Yu, 2008). However, these results were

correlational rather than predictive; therefore, the researchers were only able to determine that a trend exists between the variables but were unable to show a predictive model of their relationship.

An additional study by Jenaro et al. (2007) found that after comparing means (chi-squared) between cell phone heavy-users and light-users, cell phone heavy-users were more likely to suffer from somatic complaints, insomnia, social dysfunction, anxiety, and depression than light-users. The researchers also performed a logistic regression analysis on the variables as well. They found that their model predicting the likelihood of being a heavy or light cell phone user was significant (chi-square = 39.854, df = 6, $p < .001$) and anxiety subscore (Beck Anxiety Inventory) was significantly predictive of this likelihood (standardized beta = .291, $p < .05$; Jenaro et al., 2007). However, they did not test the linear relationship between continuous measures of cell phone usage and measures of anxiety symptoms. The current study intends to analyze linear regressions to show a similar relationship as previous studies. Consequently, the second hypothesis of this study states:

Hypothesis 2: Smartphone use relates to symptoms of anxiety in students.

Hypothesis 3: Anxiety and academic performance

Research shows that anxiety influences test performance, academic performance, and dropout rates in young adults. Regarding test performance and academic performance in students with anxiety, Desiderato and Koskinen (1969) determined that in a sample of 94 college freshmen women, those with debilitative

anxiety (anxiety that interferes with performance) earned lower grade point averages than those with facilitative anxiety (anxiety that may increase or improve performance).

Kessler et al. (1995) reported significant effects of anxiety disorders on failure to complete high school (odds ratio = 1.4, $p < .05$), failure to enter college (odds ratio = 1.4, $p < .05$), and failure to complete college (odds ratio = 1.4, $p < .05$) in a sample of over 5,000 participants ages 15 to 54. In a retrospective study by Van Ameringen et al. (2003), about 24% of psychological patients who dropped out of school reported leaving school prematurely because of their anxiety disorder. In particular, students with anxiety disorders avoid post-secondary education to prevent facing social and communication demands (Van Ameringen, Mancini, & Farvolden, 2003). Social anxiety typically involves the fear that an individual will be humiliated or embarrassed in social or performance situations; this fear can inspire avoidance in the individuals suffering from such anxiety (Van Ameringen, Mancini, & Farvolden, 2003).

Therefore, it is important for college students to build healthy social relationships at their institution; research shows that when students build social capital (benefits derived from social relationships i.e. emotional support, diverse ideas; Ellison et al., 2011), this promotes a sense of connection to their institution leading to greater academic commitment and academic performance (Pascarella & Terenzini, 2005; Tinto, 1993). Consequently, in a study by Brook and Willoughby (2015), researchers found that in a path analysis of 942 Canadian university students, social anxiety had a significant and negative relationship with academic achievement. Their findings emphasize the

importance of social capital in relation to academic outcomes. Therefore, the third hypothesis states:

Hypothesis 3: Symptoms of anxiety in students relate to academic performance.

Hypothesis 4: Smartphone use and depression

Factors contributing to smartphone use are now the pressures of daily obligations from work, school, and personal life. Smartphone use and demands for achievement were also identified as direct sources of stress and mental health symptoms (Thomée, Härenstam, & Hagberg, 2001). Thomée, Härenstam, and Hagberg (2001) investigated the relationship between cell phone usage, social support, and symptoms of depression in a sample of over 4,000 young adults. Social support could, in fact, buffer the effects of stress on individuals (Cohen, 1998). However, the researchers found that frequency of phone use had no association with perceived access to social support (Thomée, Härenstam, & Hagberg, 2001). They also concluded that high quantitative mobile phone use (11+ phone calls and texts a day) was related to symptoms of depression (Thomée, Härenstam, & Hagberg, 2001).

In addition, studies by Rosen et al. (2013) showed that anxiety about not checking text messages and social networking were significant predictors of depression (Rosen, Whaling, Rab, Carrier, & Cheever, 2013; Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013). Accordingly, the fourth hypothesis is:

Hypothesis 4: Smartphone use relates to symptoms of depression in students.

Hypothesis 5: Depression and academic performance

Academic engagement, first defined by Astin (1984) which includes aspects of "physical and psychological energy that the student devotes to the academic experience" (pg. 297). More recently, research suggests quantifying engagement as the time and effort students spend on educational activities that are linked to positive academic outcomes such as grades and retention (Kuh, 2009). Such activities involve interactions with faculty, interactions with peers, involvement in co-curricular activities, and investment in the college academic experience (Kuh, 2009; Pascarella & Terenzini, 2005). Kuh, Crouce, Shoup, Kinzie, & Gonyea (2008) found that in a group of over 6,000 college students from 18 different baccalaureate institutions, student engagement measures including time spent participating in co-curricular and educationally purposeful activities accounted for 13% of the variance in first-year student GPA.

Lack of student engagement could be quantified as a diminished involvement and investment in the academic experience. Creating engaged students requires the support of the campus community, instructors, and the students themselves. However, it can be difficult to engage or support a student experiencing symptoms of depression such as irritability, overwhelming fear, loss of energy, difficulty concentrating, and loss of interest in things they otherwise find pleasurable (Eisenberg, Golberstein, & Hunt, 2009).

Eisenberg, Golberstein, and Hunt (2009) concluded that anhedonia (losing pleasure in previously rewarding activities) significantly and negatively predicted college GPA even after controlling for other depressive symptoms including feeling tired,

undergoing sleep problems, and poor appetite. Additionally, Hysenbegasi, Hass, and Rowland (2005) found that diagnosed depression in college students relates to a half grade point deficit in overall GPA.

Those with depression are also likely to experience feelings of loneliness (Wei, Russell, & Zakalik, 2005). Loneliness has also been shown to indicate a lack of social skills, specifically relationship formation and maintenance skills, required to develop important interpersonal relationships necessary for social and academic engagement (Jones, Hobbs, & Hockenbury, 1982; Wittenberg & Reis, 1986). If students living with depression and anhedonia lose motivation to participate in extra- or co-curricular activities, their social and academic engagement will suffer, likely resulting in academic performance deficits. Consequently, the final hypothesis of this study is:

Hypothesis 5: Symptoms of depression in students relate to academic performance.

Summary

Considering the current research connecting smartphone usage to mental health as well as mental health to academic performance, this study aims to evaluate the link between all three variables. Therefore, the main research question is: *what is the relationship between college students' smartphone usage, mental health symptoms, and academic performance?*

The first study to research the connection between all three variables previously developed a structural equation model depicting the relationship between texting, anxiety, satisfaction with life, and college GPA (Lepp, Barkley, & Karpinski, 2013).

However, Lepp, Barkley, and Karpinski's (2013) model showed anxiety and GPA as mediating factors between texting and satisfaction with life. The current hypothesized model (Figure 2.1) for this study places depression and anxiety as mediating factors between smartphone use and academic performance. The current study also intends to include depression as a factor since previous literature demonstrates significant relationships between symptoms of depression and academic performance (Andrews & Wilding, 2004).

In addition, Lepp, Barkley, and Karpinski (2013) used measures of self-reported smartphone usage in their study. However, Junco (2013) found that when students report the amount of time they spend on Facebook, most significantly overestimate the actual time they spend on the social media site. Smartphone usage typically includes time spent on Facebook, other mobile applications, texting, and/or calling. Combining the amount of time spent using multiple smartphone features leaves greater room for error in self-reporting. Therefore, this study will be the first to use actual smartphone data to research the relationship between actual smartphone use, mental health symptoms, and academic performance.

Previous literature suggests that smartphone usage is related to symptoms of anxiety and depression (Ha, Chin, Park, Ryu, and Yu, 2008; Rosen, Whaling, Rab, Carrier, and Cheever, 2013; Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013; Van Ameringen, Mancini, & Farvolden, 2003). Studies have also linked mental health symptoms with poor academic performance in college students (Eisenberg, Golberstein, & Hunt, 2009; Hysenbegasi, Hass, & Rowland, 2005). It is possible that mental disorders are the link

between smartphone use and academic performance, so it is necessary to examine this relationship to understand possible predictors and provide recommendations on how academic institutions can improve students' well-being and lower risk of academic failure. Therefore, this study aims to link previous findings on the relationship between smartphone use, anxiety, depression, and GPA in order to obtain data to ultimately: (1) modernize students' approach towards technology by teaching them better ways to use smartphones and (2) create awareness about the relationship between smartphone use, mental health, and academic performance to influence policy changes at academic institutions regarding mental disorders and their treatment.

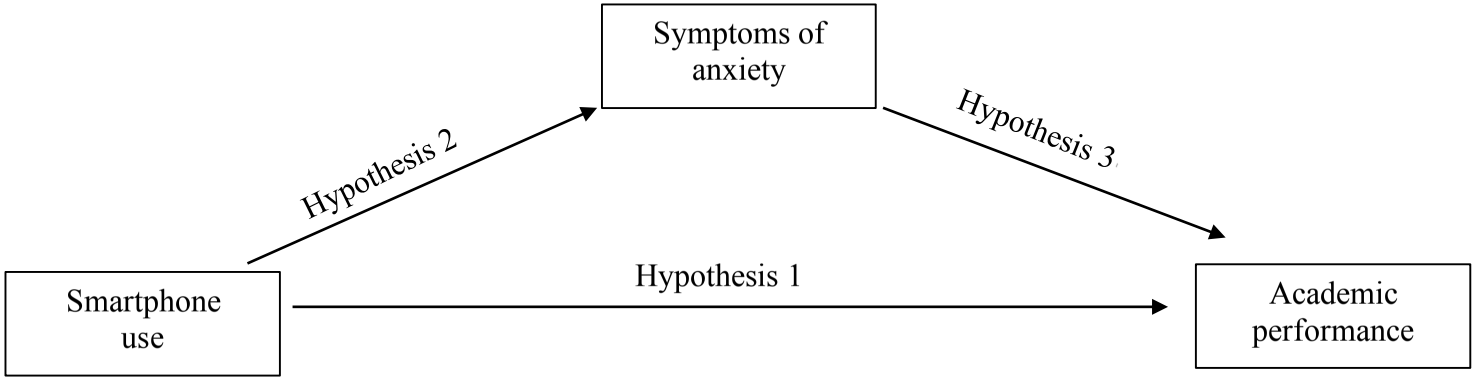

Figure 2.1: Hypothesized path model including smartphone usage, symptoms of anxiety, and academic performance.

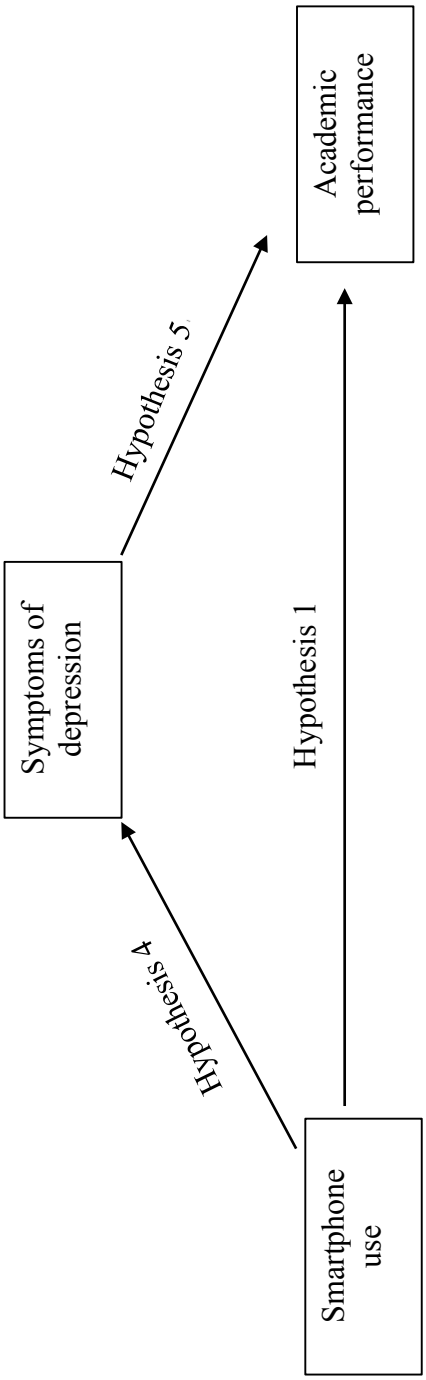

Figure 2.2: Hypothesized path model including smartphone usage, symptoms of depression, and academic performance.

CHAPTER 3. METHODOLOGY

Participants

During the spring 2016 semester, students (N = 216) attending a public university in the western U.S. were surveyed in a general education course on the global impact of technology. Participants were offered extra credit towards their course grade as an incentive. In addition to the survey, students were asked to download the Instant Quantified Self application (Emberify.com). The mobile application recorded the number of times a participant unlocked their phone as well as the amount of time their phone was in use (unlocked). A total of 179 surveys along with usage data were completed and collected for an overall response rate of 82.9%.

After removal of incomplete responses, special cases (see Data Cleaning and Analyses), and outliers, 158 participants remained. Among this sample, 60 (38.0%) were male and 98 (62.0%) were female. The subjects were composed of 85 (53.8%) Hispanic/Latino/Spanish students, 27 (17.1%) Asian students, 22 (13.9%) White/Caucasian students, 19 (12.0%) Black/African-American students, and 5 (3.2%) students whom identified as Other. Their ages ranged from 21 to 67 years old (M = 26.28, SD = 6.11). Participants supplied their home ZIP code (postal code) that was transformed into estimated median income based on the U.S. census figures (U.S. Census Bureau, 2010) and ranged from $25,028 to $153,621 ($M$ = $54,913.15, SD = $20,797.33). All participants were required to be 18 years or older and own a smartphone.

Instruments and Measures

Students were asked to answer questions from the Generalized Anxiety Disorder 7-item scale (GAD-7; Löwe et al., 2008), Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001), and asked to approximate their overall GPA at the university.

The Generalized Anxiety Disorder scale provides a brief 7-item questionnaire for finding potential cases of GAD. In a sample study involving the general public, the GAD-7 demonstrated acceptable internal consistency with a Cronbach's alpha of .89 (Löwe et al., 2008, pg. 268). In another study including adult mental health patients, data from the scale had acceptable internal consistency with Cronbach's alpha of .92 as well as acceptable one week test-retest reliability (intraclass correlation = .83; Spitzer, Kroenke, Williams, & Lo, 2006, pg. 1094). The mental health patient sample study also displayed evidence of convergent construct validity when compared with the Beck Anxiety Inventory (r = .72) and the anxiety subscale of the Symptom Checklist-90 (r = .74; Spitzer, Kroenke, Williams, & Lo, 2006, pg. 1094).

The 9-item Patient Health Questionnaire is a shortened version of the full Patient Health Questionnaire aimed at detecting DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, 4th edition) depressive disorders. Data from the administration of this survey instrument demonstrates reliability through internal consistency among primary care patients and obstetrics and gynecology (OBGYN) patients (Cronbach's alpha = .86-.89; Kroenke, Spitzer, & Williams, 2001, pg. 608). The PHQ-9 was also found to have convergent construct validity with the 12-item General Health Questionnaire (GHQ-12) and Brief Beck Depression Inventory (Brief-BDI); PHQ-9 scores were significantly and

positively correlated with GHQ-12 ($r = .59$; $p < .0001$) and BDI ($r = .73$; $p < .0001$; Martin, Rief, Klaiberg, & Braehler, 2006, pg. 75).

The PHQ-9 and GAD-7 scales were administered as part of a larger survey that also included estimated GPA, course grade, demographic items, Media and Technology Usage and Attitudes Scale (MTUAS; Rosen et al., 2013), Barratt Impulsivity Scale (BIS-11; Patton, Stanford, & Barratt, 1995), and other questions that were included for future analyses. Students were also required to download an app, Instant Quantified Self (Emberify.com), which was used to measure the minutes that the smartphone stayed unlocked each day. Participants reported their application data by exporting the data file from their phone or typing the results from their phone and sending the file to the primary investigator. Overall, at least 21 days of smartphone usage information was collected for each participant. In addition, the application had to be kept open in the background to provide accurate, complete daily data; however, some users mistakenly closed it. Therefore, any unlocks 2.5 standard deviations below each subject's mean unlocks were removed.

CHAPTER 4. RESULTS

Data Cleaning and Analysis

The survey data were downloaded and saved as an SPSS (IBM) file, and the Instant monitoring data were downloaded as well from student smartphones. Subjects were each assigned a randomized ID number and their survey and Instant data were manually matched by their ID numbers in order to maintain anonymity of the participants.

To test the hypothesized model, a path analysis was conducted through multiple regressions in SPSS. First, the data were tested for multivariate normality, collinearity, and outliers through diagnostics in SPSS. The sample started with 179 subjects who both responded to the survey questions and completed the Instant data collection requirements. Sixteen participants were removed from the sample because of missing responses and duplication. One was removed because of missing income data. An additional five subjects were identified as outliers with GAD-7 scores above the 95% confidence interval and were removed. The final sample contained 158 subjects.

Reliability analyses for the GAD-7 and PHQ-9 showed acceptable internal consistency for the current study's sample. The GAD-7 showed a Cronbach's alpha of .865 and the PHQ-9 showed .858. Concluding that the questions for each scale appropriately measured the same item.

After analyzing a post-survey about each participant's experience with the Instant app, many of the subjects reported that they changed their smartphone usage behaviors because of the application. The Instant app allows for the user to set a

notification to indicate when a certain level of usage was reached. Therefore, some participants engaged this feature and may have used their smartphone differently than normal. Other participants also felt that they were being "watched" by the application and therefore indicated that they changed their behavior to lessen or even increase their smartphone usage. Consequently, this behavioral change was included as a control variable.

Mobile operating system was also included as a control variable after it was discovered that Android users had significantly more unlocks per day than iOS users, $t(156) = 6.814$, $p < .001$, significantly fewer minutes per unlock, $t(156) = -4.822$, $p < .001$, but similar number of minutes, $t(156) = -.490$, $p > .05$. While Android users unlock their phone more, they likely use it fewer minutes per unlock because of widget prompts. For example, Android users may have access to more information on their lock screen via application widgets (a component of an interface that enables a user to perform a function or access a service), inviting them to check their phone more often, but they use their phone less per unlock because they don't need as much additional information as iOS users because of the preceding information provided by the Android widgets on the lock screen.

Demographic variables were also checked for important effects in relation to smartphone use, mental disorders, and academic performance. For example, previous research has noted an effect of gender on smartphone use; females generally use smartphones more than males (Jenaro et al., 2007; Tan, Pamuk, & Dönder, 2013). These demographic variables were used as control variables to show that any relationship

between the primary variables (smartphone use, depression/anxiety, and GPA) were independent from any confounding factors.

Blocked multiple regressions were performed to examine the path model and hypotheses. Using the Statistical Package for the Social Sciences (SPSS), hierarchical multiple regressions were performed among those 158 participants to test all hypotheses. The first block for all the models included control variables such as smartphone usage behavioral changes, mobile operating system, and demographic variables: gender, ethnicity, median income, and age. The second block for all the hypothesized models included smartphone use as an independent variable. The first, third, and fifth hypothesized regression models used academic performance as the dependent variable. The second used anxiety as the dependent variable, and the fourth model used depression as its dependent variable. The third hypothesized regression model also included anxiety as an independent variable in an additional third block, and the fifth model included depression in its third block.

Hypothesis 1: Smartphone use and academic performance

To test the first hypothesis, several demographic variables were controlled to examine variance explained by smartphone use on academic performance. The demographic variables controlled in the first hypothesis and all subsequent hypotheses were gender, participants under or over age 30 years, ethnicity, indication of smartphone use behavioral changes, mobile operating system, and median income.

After controlling for these variables, hypothesis 1 was tested with a series of hierarchical multiple regressions in which estimated GPA was the dependent variable and mean daily minutes spent on smartphone was the independent variable. This initial model and its predictors were shown to not be significant. Total course points is also an indicator of academic performance, which proved to be a more accurate representation since total GPA for each student was estimated by the participants themselves; total course points were reported by the instructor of the course. After changing the dependent variable, the second series of regression analyses also proved to not be significant. Daily smartphone unlocks is also a measure of smartphone use, so the model was tested with unlocks as the independent variable.

The regression model for step 1 (the control variables) was not statistically significant, $F(9, 148) = 1.672$, $R^2 = .092$, $p > .05$. However, the overall model including the control variables and mean unlocks was statistically significant, $F(10, 147) = 2.317$, $R^2 = .136$, $p < .01$. The standardized beta weight for mean unlock also proved significant in the final version of the model, $t(147) = -2.732$, $\beta = -.254$, $p < .01$. Hypothesis 1 was supported in that mean daily unlocks were predictive of course performance.

Hypothesis 2: Smartphone use and anxiety

The second hypothesis stated that smartphone usage is related to symptoms of anxiety. Using the same control variables as the model in hypothesis 1, the first step of the regression model was not statistically significant, $F(9, 148) = 1.610$, $R^2 = .089$, $p > .05$.

After including step 2, the overall model was significant, F(10, 147) = 2.023, R^2 = .121 p < .05, and mean unlocks was predictive of anxiety symptoms, t(147) = -2.306, β = -.216, p < .05. However, the direction of the coefficient was not as previously reported in prior studies. Hypothesis 2 was partially supported.

Hypothesis 3: Anxiety and academic performance

Hypothesis 3 stated that symptoms of anxiety are related to academic performance. Step 1 of the regression model was not statistically significant, F(9, 148) = 1.672, R^2 = .092, p > .05. After including step 2, mean unlocks, the model was statistically significant, F(10, 147) = 2.317, R^2 = .136, p < .05. After step 3, symptoms of anxiety, the overall model was still significant, F(11, 146) = 2.161, R^2 = .140, p < .05. Although, GAD-7 score was not predictive of total course points, t(146) = -.806, β = -.066, p > .05. Therefore, hypothesis 3 was not supported.

Hypothesis 4: Smartphone use and depression

Hypothesis 4 stated that smartphone use is related to symptoms of depression. Step 1 of the regression model was statistically significant, F(9, 148) = 2.025, R^2 = .110, p < .05. The overall model was also statistically significant, F(10, 147) = 2.035, R^2 = .122, p < .05. However, mean unlocks were not predictive of depression, t(147) = -1.414, β = -.132, p > .05. Hypothesis 4 was not supported.

Hypothesis 5: Depression and academic performance

The final hypothesis predicted that symptoms of depression are related to academic performance. Step 1 of the regression model was not statistically significant, $F(9, 148) = 1.672$, $R^2 = .092$, $p > .05$. After including step 2, mean unlocks, the model was statistically significant, $F(10, 147) = 2.317$, $R^2 = .136$, $p < .01$. After step 3, symptoms of depression, the overall model was still statistically significant, $F(11, 146) = 2.499$, $R^2 = .158$, $p < .01$. However, PHQ-9 score was not predictive of total course points, $t(146) = -1.966$, $\beta = -.159$, $p = .05$. Hypothesis 5 was not supported.

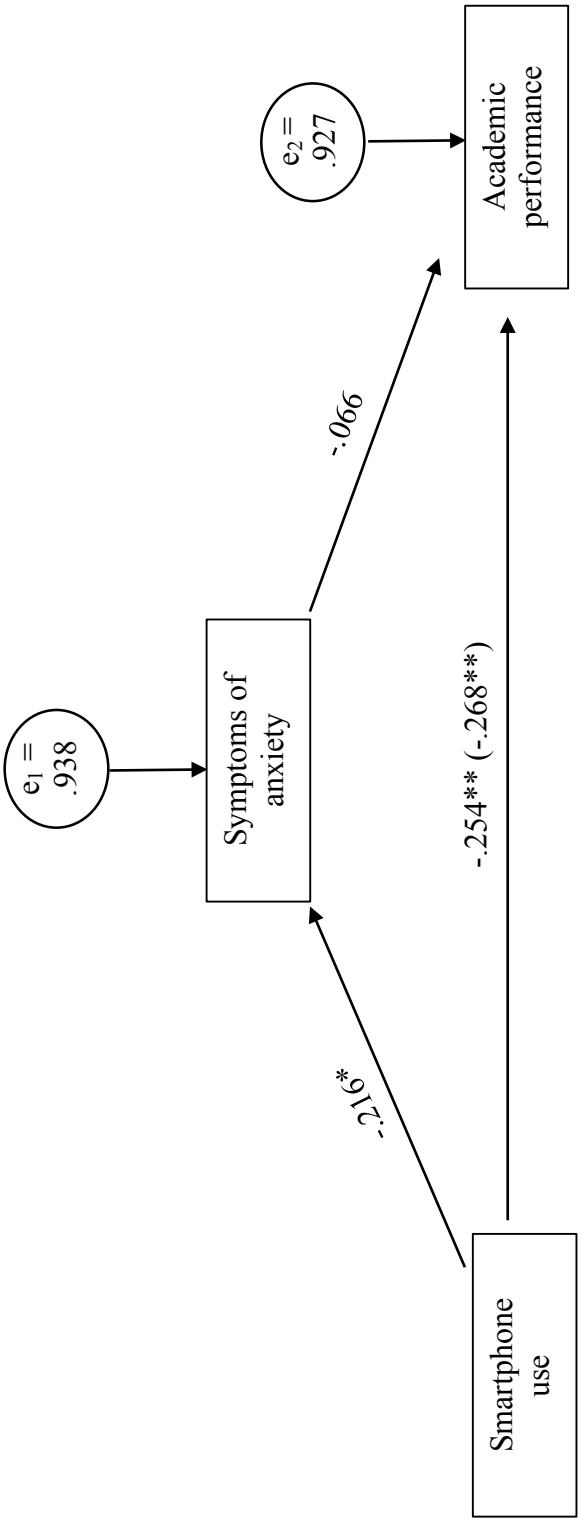

Figure 4.1: Path model including smartphone usage, symptoms of anxiety, and academic performance, N = 159.

Variables e_1 and e_2 represent the error variance or the portion of the variance of the model that is due to extraneous variables and measurement error.

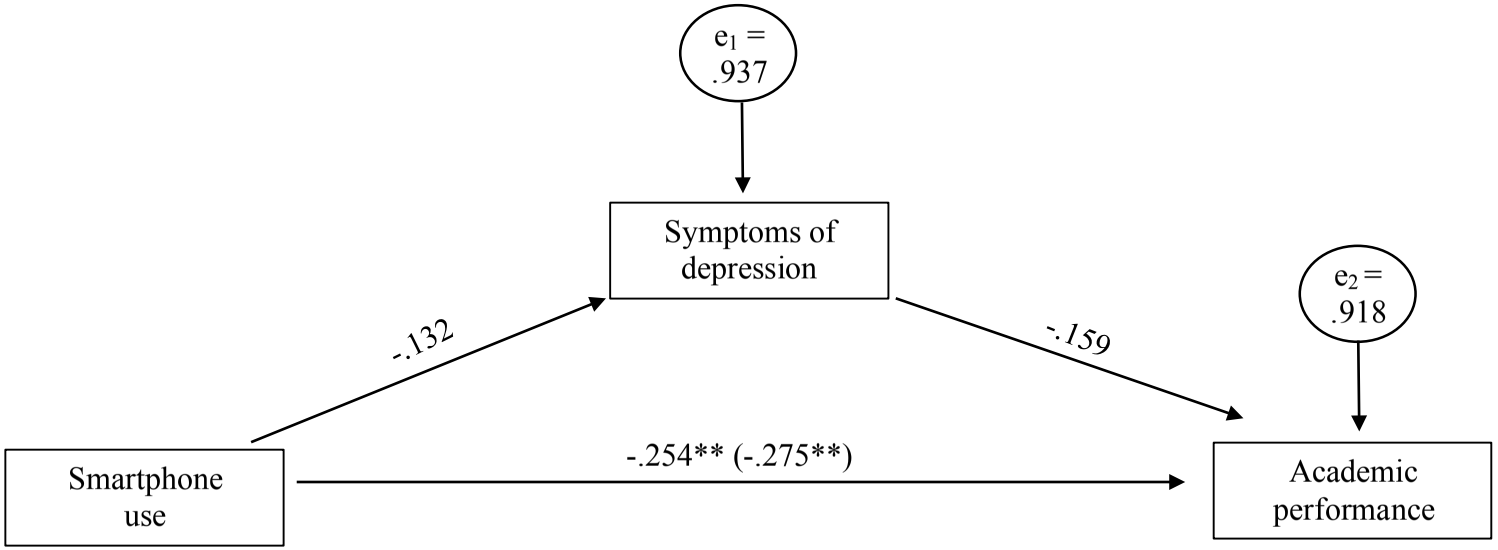

Figure 4.2: Path model including smartphone usage, symptoms of depression, and academic performance, N = 158, Variables e_1 and e_2 represent the error variance or the portion of the variance of the model that is due to extraneous variables and measurement error.

Table 4.1: Hierarchical regression model exploring how demographics, behavioral change, smartphone use, and symptoms of anxiety predict course total points (N = 158).

	Block 1 Demographics/Behavior	Block 2 Smartphone Use	Block 3 Anxiety
Independent variables			
Male	.050	.066	.057
Asian American	.384*	.353	.358
African American	.273	.268	.276
Hispanic/Latino	.297	.252	.256
White	.413*	.373*	.376*
Median Income	.020	.031	.038
Age over 30	.080	.010	-.002
iOS	-.009	-.134	-.139
Behavioral Change	.113	.109	.117
Mean Unlocks		-.254**	-.268**
GAD-7 Score			-.066
Adjusted R^2	.037	.077	.075
R^2 Change	.092	.044**	.004

*p < .05. **p < 0.01

Table 4.2: Hierarchical regression model exploring how demographics, behavioral change, and smartphone use predict symptoms of anxiety (N = 158).

	Block 1 Demographics/Behavior	Block 2 Smartphone Use
Independent variables		
Male	-.155	-.141
Asian American	.099	.072
African American	.132	.128
Hispanic/Latino	.103	.064
White	.087	.053
Median Income	.082	.092
Age over 30	-.128	-.187*
iOS	.033	-.074
Behavioral Change	.139	.135
Mean Unlocks		-.216*
Adjusted R^2	.034	.061
R^2 Change	.089	.032*

*p < .05. **p < 0.01

Table 4.3: Hierarchical regression model exploring how demographics, behavioral change, smartphone use, and symptoms of depression predict course total points (N = 158).

	Block 1 Demographics/Behavior	Block 2 Smartphone Use	Block 3 Depression
Independent variables			
Male	.050	.066	.045
Asian American	.384*	.353	.356
African American	.273	.268	.295
Hispanic/Latino	.297	.252	.245
White	.413*	.373*	.372*
Median Income	.020	.031	.055
Age over 30	.080	.010	-.022
iOS	-.009	-.134	-.139
Behavioral Change	.113	.109	.130
Mean Unlocks		-.254**	-.268**
PHQ-9 Score			-.158
Adjusted R^2	.037	.077	.095
R^2 Change	.092	.044**	.022

*p < .05. **p < 0.01

Table 4.4: Hierarchical regression model exploring how demographics, behavioral change, and smartphone use predict symptoms of depression (N = 158).

	Block 1 Demographics/Behavior	Block 2 Smartphone Use
Independent variables		
Male	-.135	-.126
Asian American	.036	.020
African American	.169	.167
Hispanic/Latino	-.019	-.043
White	.005	-.017
Median Income	.155	.161
Age over 30	-.164	-.201*
iOS	-.009	-.075
Behavioral Change	.077	.075
Mean Unlocks		-.132
Adjusted R^2	.055	.062
R^2 Change	.110*	.012

*p < .05. **p < 0.01

CHAPTER 5. DISCUSSION

Summary

The purpose of this study was to investigate the relationship between smartphone use, symptoms of anxiety, symptoms of depression, and academic performance after controlling for demographic variables, behavioral changes, and mobile operating system. With the growing popularity of smartphone technology among young adults, it is important to understand predictive factors of poor academic performance, depression, and anxiety to prevent negative outcomes.

The first hypothesis was supported in that mean number of daily smartphone unlocks was negatively predictive of course total points. It could be possible that those who use their phone more may have a more difficult time regulating their usage. Poor self-regulation could also affect academic performance negatively. Self-regulation is needed to organize and control one's own learning in and outside of the classroom (Zimmerman, 1990). After additional analyses, the current study found that smartphone minutes were positively related ($r = .182$, $p < .05$) and course total points were negatively related ($r = -270$, $p < .01$) to the non-planning portion of the Barratt Impulsiveness Scale which includes questions on self-control and cognitive complexity; higher score on the BIS non-planning subscale means less self-control and cognitive complexity. Self-regulation is an important skill for young adults to learn because it could have a negative effect on academic outcomes. It would be important for further

analyses to investigate the relationship between all three variables: self-regulation, academic achievement, and smartphone use.

It is also possible that those with poor self-regulation often multitask. Checking a smartphone while completing other tasks especially those related to academics could be detrimental to students' cognitive activity. Previous research by Junco and Cotten (2012) found that Facebook use or texting while completing schoolwork may overload students' capacity for cognitive processing and impede academic performance. Additionally, Rosen, Carrier, and Cheever (2013) attribute this relationship to the impairment multitasking may cause on students' cognitive load. However, the current study has no way of knowing exactly when the participants used their phone and if they were multitasking. So, further analyses would need to include more questions about multitasking and technology to test this theory.

The second hypothesis of the current study was partially supported. Smartphone unlocks were related to GAD-7 score. However, this relationship was shown to be negative, contrary to previous research (Jenaro et al., 2007; Ha, Chin, Park, Ryu, & Yu, 2008). One possible explanation is that unlocking or checking a smartphone can reduce symptoms of anxiety. Perhaps the social connections provided by a smartphone help create a support system for each user. Users have access to self-help applications, social networks, and other sources of social buffering. Social relationships have shown to be negatively related to stress via social buffering (effective social support networks lessen the adverse psychological consequences of stress; Aneshensel & Stone, 1982). It would be important to determine in future studies whether smartphone usage provides

effective social buffering, thus possibly explaining the negative relationship between smartphone use and anxiety symptoms.

Another possibility for the relationship between phone use and anxiety is that reducing smartphone usage could increase anxiety. For example, students who made behavioral changes to their phone use often stated that they knew they used their phone "too much" but were more aware of it by using the app (i.e., "I was so worried that I used my phone way too much", "I was surprised how much I spent time on my phone and what apps I used the most. Although, I did know but it was a wake-up call."). This awareness could have affected their usage so that the relationship between smartphone unlocks and GAD-7 scores was negative. It is feasible that those who changed their behaviors were more aware or perhaps sensitive to the fact that they use their phone more often; additional analyses showed that participants who made behavioral changes actually had higher anxiety scores than those who did not change their behavior, $t(156) = -2.216$, $p < .05$. Perhaps participants who accessed their phone less, inherently did so to avoid stressful or anxious feelings. But by avoiding their anxious feelings and using their phone less than they wanted or needed, they ultimately increased their anxiety symptoms. For example, Cheever, Rosen, Carrier, & Chavez (2014) found that moderate to high mobile phone users had increased anxiety when their device was absent. Future research would need to investigate this relationship further.

The third hypothesis was not confirmed. Anxiety did not predict academic performance. Although previous research concluded that anxiety relates to academic

outcomes (Desiderato & Koskinen, 1969; Van Ameringen, Mancini, & Farvolden, 2003), it could be that the students in the current study had a similar amount of debilitative as they did facilitative anxiety thus having a cumulative effect of no relationship to academic performance. Facilitative anxiety acts as a motivator to perform better while debilitative anxiety interferes with performance (Desiderato & Koskinen, 1969). Essentially, anxiety can have positive and negative effects on academic performance. Additional studies would need to separate these two types of anxiety using a scale such as the Achievement Anxiety Test (Alpert & Haber, 1960) which measures positive/negative (facilitative/debilitative) feelings, attitudes, and experiences about taking course examinations to determine if either has a mediating relationship between smartphone use and academic performance.

Hypothesis 4 was also not confirmed; smartphone use was not related to depression symptoms even though past research showed a positive relationship between these variables (Rosen, Whaling, Rab, Carrier, & Cheever, 2013; Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013; Thomée, Härenstam, & Hagberg, 2001). The study by Thomée, Härenstam, and Hagberg (2001) concluded that phone use had no association with perceived access to social support and that high quantitative mobile phone use (11+ phone calls and texts a day) was related to symptoms of depression (Thomée, Härenstam, & Hagberg, 2001). However, the researchers only accounted for texting and calling and how they relate to depression. It could be that since phones now access the internet and social networks, phone users now feel more social support through technology and consequently smartphone use no longer relates to symptoms of

depression (Shaw & Gant, 2002). Or, maybe actual mean unlocks is a better measure for mobile phone usage than only number of daily texts or and calls. Additional research should investigate the possible change in perceived social support and technology use to establish new ideas about attitudes towards smartphones and their relationship to mental health.

The final hypothesis was not confirmed; the current study showed that depression was not related to academic performance. Perhaps students are learning new ways to cope with depression, and stigmatization about mental health has decreased. Seven and a half percent (12) of students from the current study reported moderately severe to severe depression symptoms, 19.5% (31) reported moderate symptoms, and 27% (43) reported mild symptoms. The 95% confidence interval for the current study's sample is 5.73 – 7.29 meaning that in 95% of sample cases, our confidence interval would contain the population mean. This distribution of depression symptoms among college students was lower than previous findings; for instance, Garlow, et al. (2008) found a 95% confidence interval of 10.03 – 10.85 for PHQ-9 scores in their sample of 729 college students, suggesting no overlap between the original populations in each study. However, it is also possible that the current study's sample was an abnormal or inaccurate representation of depression prevalence in college students. Further analyses would need to investigate the number of students diagnosed with depression or receiving therapy for depression to help distinguish if students are finding help for their symptoms.

The study by Thomée, Härenstam, and Hagberg (2001) found that smartphone dependency and demands for achievement were identified as direct sources of stress and mental health symptoms. However, "smartphone dependency" may be a relative term to each person and cannot be accurately quantified; therefore, perhaps it is the perception of one's smartphone usage that determines the predictive quality of mental health symptoms. A more negative perception of smartphone usage paired with high smartphone use would be related to higher anxiety or depression. These negative thoughts could probably create more anxiety or stress for the user especially if they actually used their phone "too much". For example, the study by Rosen, Whaling, Rab, Carrier, and Cheever (2013), concluded that having negative attitudes about technology (e.g., technology makes life more complicated, technology makes people waste too much time, technology makes people more isolated) predicted clinical symptoms of depression. This may indicate that excessive quantitative use of smartphones may not always be problematic for users; however, excessive use paired with negative attitudes and feelings of dependence and anxiety about technology may increase negative outcomes associated with smartphone use, specifically, smartphone users' risk for anxiety and depression (Rosen, Whaling, Rab, Carrier, & Cheever, 2013; Thomée, Härenstam, & Hagberg, 2011). Future research should analyze the relationship between attitudes and perceptions of smartphone use, mental health symptoms, and actual smartphone usage by hypothesizing another path model to determine the significance of this link.

While the previous literature does support each hypothesis, the conclusion of this study states that since the last three hypotheses were not supported, symptoms of depression and symptoms of anxiety do not mediate the relationship between smartphone use and academic performance. However, it would be important to develop further research into these relationships and include additional factors such as attitudes about technology, help-seeking behaviors in students with mental health disorders, and perceived social support to conclude if they play a significant part in the path model proposed by the current study.

Limitations

This study contains a number of limitations. While previous literature has shown that college-age adults are at greater risk of mental health disorders and have higher smartphone usage, this sample population may not be representative of the general population of young adults. For example, the current study included an age range of participants that is not within the typical range of traditional-aged college students and was predominately female and Hispanic/Latino/Spanish descent.

Third, users reported possible skewed or inaccurate app data because of multiple reasons. For example, some participants reported multiple users on their phone (i.e. a child or friend). Some users set usage limits for themselves which notified them when they reached a certain number of minutes. Other users unknowingly closed the application, but for it to collect usage data, it needed to be constantly open in the background. However, the novelty of this data collection method could shed light on the

accuracy with which we estimate the amount of time spent on our phones. Perhaps some users overestimate their usage, thus inflating the effects of certain factors in previous research such as mental health symptoms.

Fourth, the study also included some self-reported survey data. While the GAD-7 and PHQ-9 have shown evidence of construct validity and reliability, they may not have been truly symbolic of each subject's experience. Participants were reassured of their anonymity throughout the study. However, these individuals received course extra credit for completing the survey, it is possible that this method of compensation could have influenced the integrity of their responses.

Lastly, this study included non-directional hypotheses even though most of the previous literature showed strong directional relationships between the variables used in this study. However, since the actual measurement of smartphone usage was novel in comparison to previous research, it was appropriate to assume non-directional hypotheses to prevent any biases. Additionally, this study is correlational and therefore not causal.

Implications

After creating and analyzing a path model, we can begin to understand the relationship between smartphone use, mental health, and academic performance. If, in fact, the everyday pressures of being a student in the age of digital technology are

enough to cause psychological symptoms leading to poorer academic performance, instructors, parents, and students must consider new approaches to smartphone use and institutions need to promote help-seeking behavior in their students.

However, results showed that the only statistically significant predictor of academic performance was smartphone use. Smartphone use also negatively predicted symptoms of anxiety. So, smartphone usage may not be related to mental health as previously thought. Therefore, we cannot definitively conclude that smartphone usage is directly indicative of poor mental health, but perhaps negative attitudes about smartphone usage could be attributed to mental health symptoms; possibly, a change of perception about technology could alleviate these symptoms.

Additionally, since smartphone use still shows to be negatively related to academic performance, researchers should continue to investigate possible mediating factors such as self-regulation and multitasking. Academic institutions, parents, and individuals still need to encourage better smartphone usage habits until additional research can add to these findings. However, to change this behavior, we must not encourage negative thoughts about technology for that may only increase anxiety and stress. As previously stated, excessive use paired with negative attitudes and feelings of dependence and anxiety about technology may increase negative outcomes such as risk for anxiety and depression (Rosen, Whaling, Rab, Carrier, & Cheever, 2013; Thomée, Härenstam, & Hagberg, 2011). Therefore, academic institutions and parents could teach students helpful, positive ways to use their smartphones for school, work, or home. Academic institutions could create initiatives for instructors to incorporate smartphone

technology as another teaching strategy in their classrooms to show students ways to use this technology to help their learning. Parents can set an example for their children by showing them that putting their phone away during important events can be helpful rather than stressful. Additionally, this is an opportunity to explain the consequences of multitasking on cognitive processes and to inspire those with mental health issues to use their smartphone as another tool to cope with stress.

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APPENDIX A: INFORMED CONSENT/IRB APPROVAL

* 1. As a student in my SBS318 course on "The Global Impact of Technology" we are inviting you to participate in this scientific survey for extra credit in the course. We appreciate your time. You will be getting extra credit if you complete this entire survey carefully and conclude by putting your LAST NAME and FIRST NAME in the appropriate boxes at the end of the survey. I thank you for your time and if you have any questions feel free to contact me at LROSEN@CSUDH.EDU.

YOU MUST BE 18 YEARS OLD OR OLDER TO PARTICIPATE IN THIS SURVEY.

Investigators:
The research project is being conducted by Dr. Larry Rosen and Dr. Mark Carrier, Professors of Psychology, California State University, Dominguez Hills.

Purpose of the Study:
The purpose of this study is to examine potential impacts of media use by college students.

Description of the Study:
The study contains a series of questions, most of which can be answered by simply checking a box. All answers are confidential, and although you will be asked to provide a name or other identifying information your extra credit that information will be stored separately from your answers. The entire survey should take you about 20 minutes if you are careful in answering the questions. You must complete the entire survey in one sitting so set aside time to do it when you feel you can do a good job and answer each question completely and honestly.

Risks or Discomforts:
There are no health risks or discomforts associated with participating in this project. However, if you should feel uncomfortable, you may discontinue participation at any time, either temporarily or permanently, and it will not affect your relationship with the researcher or the school.

If you do feel uncomfortable after answering these questions you may want to speak to someone at the crisis line. The national number to call is 1800273TALK. They will be able to direct you to local resources in your area.

Benefits of the Study:
This study will help us learn more about how different college students are impacted by their use of technology in their lives.

Confidentiality:
All answers are confidential, and you will be asked to provide your name at the very end of the survey to get your extra credit points but that information will be removed when the data have been collected.

Please take the time to think through your answers and share your feelings. Please answer each question and make sure that you put your name (last name, first name) at the end so that you will get credit.

Voluntary Nature of Participation:
Participation in this study is voluntary. Your choice of whether or not to participate will not influence your future relations with California State University, Dominguez Hills. If you decide to participate, you are free to withdraw your consent and to stop your participation at any time without penalty or loss of benefits to which you are entitled.

Questions about this Study:
If you have any questions about this study or your rights as a participant, you may contact Dr. Larry Rosen at lrosen@csudh.edu, Dr. Mark Carrier at lcarrier@csudh.edu, or the Institutional Research Board at 310-243-3756.

By checking the box below you are indicating that you have read the information in this document and agree to participate in the study.

You can change your mind and withdraw your consent at any time. By signing this consent form you are not giving up any of your legal rights.

Please check one of the following choices concerning your participation in this study.

- ◯ I am 18 or older and I wish to participate in this survey.
- ◯ I am sorry but I am not willing to participate in this survey.

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 3/1/2016

To: Dr. Reynol Junco
2628 Lagomarcino

From: Office for Responsible Research

Project Title: Personality Traits and Smartphone Use

The Co-Chair of the ISU Institutional Review Board (IRB) has reviewed the project noted above and determined that the project:

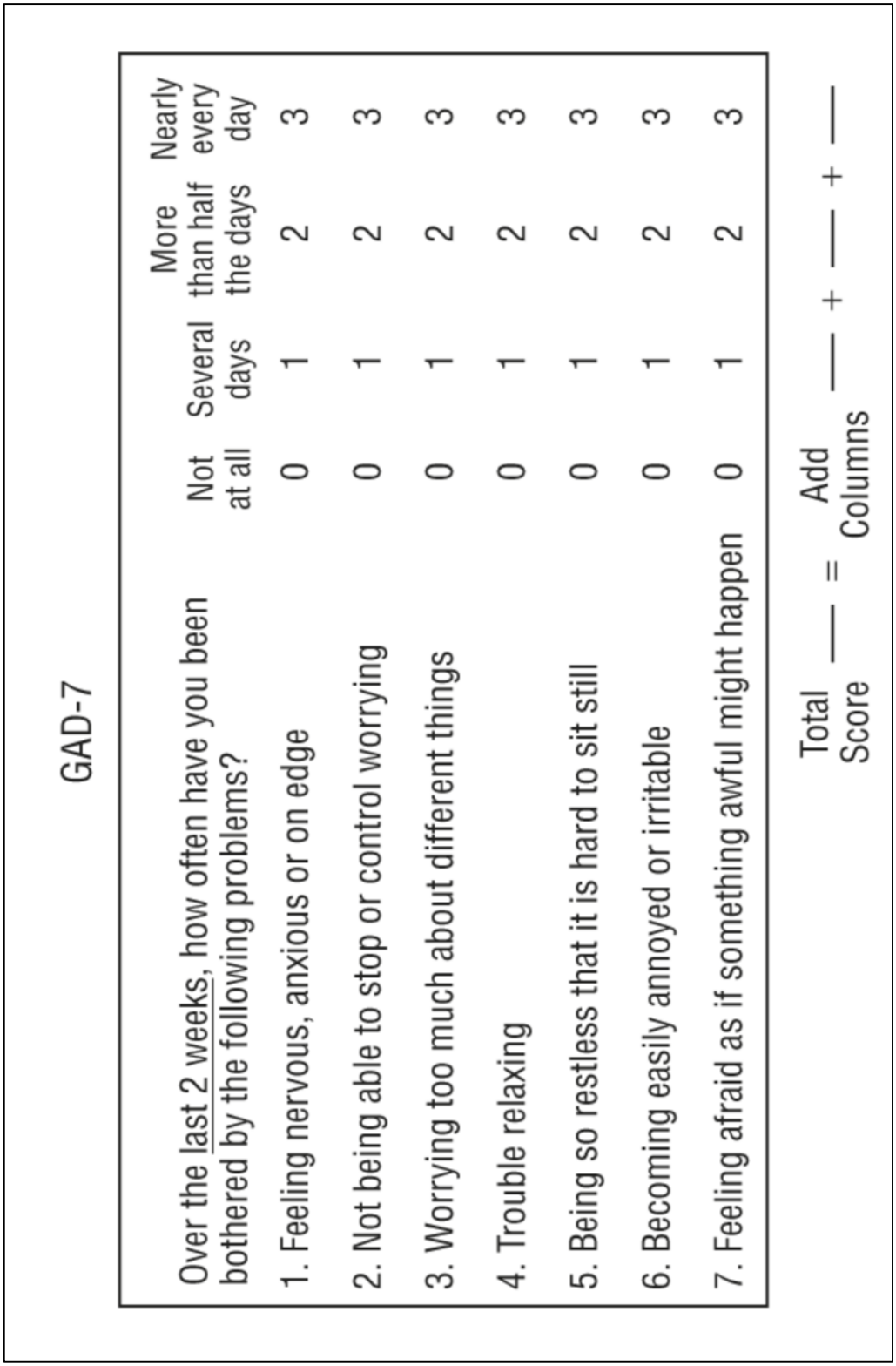
☐ Does not meet the definition of research according to federal regulations.

☒ Is research that does not involve human subjects according to federal regulations.

Accordingly, this project does not need IRB approval and you may proceed at any time. We do, however, urge you to protect the rights of your participants in the same ways you would if IRB approval were required. For example, best practices include informing participants that involvement in the project is voluntary and maintaining confidentiality as appropriate.

If you modify the project, we recommend communicating with the IRB staff to ensure that the modifications do not change this determination such that IRB approval is required.

APPENDIX B: SURVEY INSTRUMENTS



GAD-7

Over the last 2 weeks, how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3

Total Score ____ = Add Columns ____ + ____ + ____

(Spitzer, Kroenke, Williams, & Lo, 2006)

Nine-symptom Checklist

Name _____ Date _____

Over the *last 2 weeks*, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite —being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

(For office coding: Total Score ____ = ____ + ____ + ____)

(Kroenke, Spitzer, & Williams, 2001)