Marijuana Use Among Community College Students: A Study of Academic and Social Involvement

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Marijuana Use Among Community College Students:
A Study of Academic and Social Involvement

by
Matthew J. Borcherding

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Marijuana Use Among Community College Students:
A Study of Academic and Social Involvement
Matthew J. Borcherding

This quantitative study examined the effects of marijuana on academic and social involvement in undergraduates using a structural equation model. The study was conducted at a mid-sized comprehensive community college in the mid-West and was guided by Astin’s (1985) theory of student involvement and by Anderson’s (1998) cultural identity theory of drug abuse.

A survey link was e-mailed to all 4,527 eligible students at the college and 573 students participated in the study. Of the 573 students, 194 identified as users of marijuana and were used as the primary basis of the study. The data from the survey were used in a structural equation model to determine correlations between academic and social involvement and marijuana use. Independent samples t-tests were also used to compare users to non-users of marijuana.

The overall results of the study showed no significant correlation between marijuana use and academic and social involvement. Further, a positive, significant difference regarding academic involvement was revealed between infrequent users of marijuana compared to non-users. A negative, significant difference regarding social involvement was also found between more than once daily users of marijuana and non-users.

Keywords: Marijuana, academic involvement, social involvement
Acknowledgements

To my wife, Brittany, my daughters, Alexa and Aubrey, my advisor, Dr. Steven McCullar, my cohort comrades, my family, my friends, and my dissertation committee: The following song written by J.R.R. Tolkien summarizes my journey more eloquently than I could ever. Thank you all for your wisdom, guidance, and above all patience.

The Road goes ever on and on
Down from the door where it began.
Now far ahead the Road has gone,
And I must follow, if I can,
Pursuing it with eager feet,
Until it joins some larger way
Where many paths and errands meet.
And whither then? I cannot say.

The Fellowship of the Ring, Book 1, Chapter 1
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CHAPTER I – INTRODUCTION

Attending college has long been associated with finding oneself academically, socially, and spiritually. During those undergraduate years, young students are faced with new ideas that may challenge their perceived norms, may be introduced to an academic field that sparks a lifelong career, or may establish (or disengage) faith in a higher power. Students are exposed to a host of factors that impact their collegiate experience; some may yield a positive influence, whereas others may produce a more nefarious impact on lifelong learning. The old saying, “There is a time and place for everything, and it is called ‘college’” is often used by parents and former students to justify their non-academic collegiate experiences, also known as the “experimentation” stage of one’s life. This dissertation will explore the many facets of one particular experiment often tried by students in college – marijuana.

Marijuana has a long and tumultuous history in the United States. During the 19th century, marijuana was wildly accepted as a medicinal herb. Between 1840 and 1900 over 100 articles in American and European journals purported marijuana’s therapeutic values, ranging from the treatment of gout to uterine hemorrhaging (Thomas, 2010). It was not until 1937 that the use of marijuana was restricted (Marihuana Tax Act, 1937). Thirty-three years later, marijuana was classified as a Schedule I narcotic, which are drugs defined as having no currently accepted therapeutic use and a potential for high abuse (Comprehensive Drug Abuse Prevention and Control Act, 1970). In addition to marijuana, heroin, lysergic acid diethylamide (LSD), ecstasy, methaqualone, and peyote are also considered Schedule I narcotics. These chemicals are often considered to be the most dangerous drugs, due to the potential for psychological and physiological dependence. As drugs increase in schedule rating, the less dangerous they are
considered to be by the federal government. Cocaine, methamphetamine, methadone, oxycodone, and other commonly abused narcotics are classified as Schedule II drugs.

The illegality of marijuana and its Schedule I status has not stopped its use within the United States. According to the 2010 National Survey on Drug Use and Health (NSDUH), 17.4 million Americans claimed to have used the drug within the past month. Marijuana use among young people is still prevalent (Institute for Social Research, 2012). Even though annual marijuana use among 8th, 10th, and 12th graders has been declining since the mid-1990s, 22.6 percent of high school seniors are considered to be current users, with 17.6 percent and 7.2 percent of sophomores and eighth graders claiming current use, respectively. These numbers may correlate to those students who enter colleges and universities upon completion of their high school diploma. Further, there may be a correlation between the age of marijuana first use and the long-term implications in thereof.

Marijuana use has been associated with mental disease, murderous rage, lethargy, low cognitive ability, and a lack of overall motivation. Some of these claims are based in reality, while others may have stemmed from the 1930’s “War on Drugs” – at any rate, the effects of marijuana on the human body have been chronicled and explored since the 1960s and 1970s. The conclusions of these studies have been highly variable, but several studies have identified chronic marijuana users as lacking overall motivation, having impaired mathematical and complex problem solving skills, and overall relatively poor academic performance compared to their peers (Indlekofer, et al., 2008; Lysnkey & Hall, 2002; Wadsworth, Moss, Simpson, & Smith, 2006).

Those within the academy must be aware of the effects marijuana has on our students and how the drug impacts those students’ ability to be successful while enrolled in our colleges and
universities. The goal of this study is to illuminate the correlations between the impact of marijuana use and its effects on academic and social involvement.

**Purpose and Significance of the Study**

In 2006, nearly 33 percent of college students in the United States reported using marijuana within the past year (Johnston, O'Malley, Bachman, & Schulenberg, 2007). Daily consumption of marijuana is on the rise as well. In 2007, 3.5 percent of college students used marijuana daily and that number has increased to 5.1 percent in 2013 (The Brown University Child & Adolescent Update, 2014). Additionally, one must consider the other adverse behaviors associated with marijuana use as well, including binge drinking, tobacco use, and multiple sexual partners, among others (Wright & Palfai, 2012). These behaviors are typically discouraged by college and university campuses, but marijuana use and abuse is typically ignored. Because marijuana is one of the most widely used recreational drugs on college campuses, it is imperative that educators and administrators understand how marijuana affects college students, and how marijuana use and abuse directly impact the overall college experience including other adverse or risky behavior.

One example of the widespread use of marijuana and the policy ramifications would be the traditional “4/20 Smokeout” at the University of Colorado, Boulder. Historically, the long standing tradition of the smoke out, which began in 2011, “has brought 10,000 to 12,000 people to campus to light up and no doubt this year [2012] with recreational weed newly legalized, university leaders were very likely concerned with drawing record crowds (Ferner, 2013, March 11).” The university continued to keep the campus closed on April 20th until 2015, where it remained open, with few exceptions, to students, staff, faculty, and the public. Philip DiStefano, chancellor of the University, issued a memorandum in 2015 which discussed the rationale for
closure over the past several years and ended with rationale as to why the university was to remain open in 2015. He states:

Why is this year the right time to open the campus? After three years of closing the campus to non-affiliates, the public understands that we are serious about eliminating this gathering that disrupted the academic mission of the university. At the same time, there are now several sanctioned events occurring April 18-20 around the Denver metro region for people to attend. We have made great strides over the past three years, and I thank all of you for your patience and cooperation in helping us toward that goal (P. DiStefano, memorandum, April 3rd, 2015).

It took the university three years to re-open on April 20th, and in 2015 it roped off the famous Norlin Quad where the historical smokeouts have occurred since 2011. In 2015, about 300 students engaged in marijuana related behavior on another campus field and at nowhere near the level of magnitude from years past.

Colorado is not the only state that has perceived problems with marijuana consumption among college students. The state of Minnesota has developed a state-wide initiative utilizing a Substance Abuse and Mental Health Services Administration (SAMHSA) Strategic Prevention Framework in collaboration with Partnerships for Success (SPF PFS). This goal of the initiative is to assess and prevent underage alcohol use (under age 21) and young adult (age 18 – 25) marijuana use among college students. The first phase of this project was completed during the late summer of 2015 in two communities in Northwest Minnesota.

Fergus Falls, MN is a city of approximately 13,000 people and is home to a single college campus of Minnesota State Community and Technical College (MSCTC). In Fergus Falls, MN 20 local college faculty, staff, and administrators along with local community leaders, law
enforcement officials, and city council members were interviewed using snowball sampling techniques to ascertain their perceptions regarding the severity of underage alcohol and marijuana use among college students (Wilder Research, 2015). Regarding marijuana use, 53 percent ($N=20$) of those interviewed stated that marijuana use among the local college students was a “big problem” and 95 percent stated that its use was a “Moderate” problem. Further, those interviewed claimed that marijuana was easy to obtain (although it remains a mystery as to how people are obtaining it) and that the drug is becoming more socially acceptable to use. Additionally, interviewees also suggested that marijuana may be used as a coping mechanism, a rite of passage, or as self-medication (Wilder Research, 2015).

The same report prepared by Wilder Research (2015) focused on another local community of Moorhead, Minnesota. The Fargo-Moorhead metropolitan area houses several colleges in addition to MSCTC, including North Dakota State University, Concordia University, Minnesota State University, Moorhead, and several for-profit institutions including Globe University and Rasmussen College. As with Fergus Falls, MN, a total of 20 phone interviews were conducted to garner the perceptions of the prevalence of underage drinking and marijuana use by college students enrolled at MSCTC.

In Moorhead, 25 percent of those interviewed felt that marijuana was a “Big Problem” amongst the student population at MSCTC. Further, 90 percent of those interviewed thought that their student believe that marijuana use is a small problem. Similarly to Fergus Falls, those interviewed from Moorhead felt that marijuana was easily accessible, becoming more socially acceptable to use, and may be used as a coping mechanism to deal with stress (Wilder Research, 2015).
Despite the common and often publicly acknowledged use of marijuana, its use has demonstrated multiple adverse effects on the human body; ailments ranging from dramatic brain alterations, abnormal development, and even the acquisition of mental illness have been attributed to the drug’s use (Goodman & Gilman, 2006). On the other hand, the use of medicinal marijuana has been approved in the United States in 20 states, Washington DC, and in a limited number of European nations for some time. Paradoxically, marijuana is classified by the Food and Drug Administration (FDA) as a Schedule I narcotic – meaning that the substance possesses no medical benefits to humans. The paradoxical nature of the drug and its effects has wreaked havoc within the scientific community in terms of effectively researching the drugs purported positive and negative effects.

In 2014, the American Academy of Neurology (AAN) petitioned for the reclassification of marijuana from a schedule I narcotic to increases accessibility or the substance for research purposes (American Academy of Neurology, 2014). Stringent IRB protocols have limited researchers with regards to access of the drug for study. If the drug was reclassified as even a schedule II narcotic, researchers would have much greater success studied the effects of the drug for both medical and psychological purposes.

To address the academic and social impacts that marijuana use has on our college students, my study was guided by Astin’s (1985) theory of student involvement. The social aspect of involvement examines the affective and psychological domain of development, and the academic involvement piece focuses on the cognitive and behavioral domain. The literature demonstrates the impact of marijuana on intellectual development (Goode, 1971, Indlekofer, et al., 2008; Lysnskey & Hall, 2002; Wadsworth, Moss, Simpson, & Smith, 2006) and specifically on one’s ability to recall and retain information, as well as the conception that marijuana is
linked to amotivational syndrome – a pattern of behavior linked to apathy and an overall lack of motivation. These lifestyle choices regarding drug use pair with Anderson’s (1998) cultural identity theory of drug abuse, which was additionally used as a secondary lens to frame the research. Anderson (1998) posits that drug abuse is a product of several factors that lead to a drug-related identity change. These changes, in turn, lead an individual down a path of drug abuse that is positively enforced by societal and cultural norms.

Drawing on both theoretical frameworks provided the clarity necessary for this study to contribute to the established body of knowledge, and to fill the gaps in the current literature pertaining to the frequency of marijuana use and its relationship with academic and social involvement under the auspices of Astin’s (1985) theory of student involvement. Further, Anderson’s (1998) theory is applicable due to the nature of a drug related identity change.

Statement of the Problem

Despite years of research on marijuana and its effects on the human body, significant gaps in the literature exist. The gaps range from the true medicinal benefits of the drug (which vary widely from study to study) to the physical effects on learning, memory, and social integration. There are further gaps in the marijuana literature that effectively exclude those individuals who are enrolled in our colleges and universities. The present study will explore the correlation between marijuana use and its effects on academic and social involvement within a two-year comprehensive community college. Further, the study will address the difference in academic and social involvement between non-users of marijuana as compared to infrequent, weekly, daily, and more than once daily users.

According to a 2007 study, Hafeez and Mardell demonstrated that social involvement during undergraduate studies has yields a positive correlation with academic achievement.
Further, academic involvement within a course was also positively correlated to success. In a 2005 study, Handelsman, Briggs, Sullivan, and Towler provided evidence supporting Astin’s (1985) theory of student involvement, evidence suggesting that the more a student is involved in the classroom, the greater success he or she will reap.

Given the nature of involvement and success, one could argue that a student must be involved (academically, socially or both) in order to be successful during the collegiate experience. Coupling the purported effects of marijuana with regards to motivation, memory, and social deviance, logic would suggest an inverse relationship between marijuana use and academic and social involvement. The present study attempted to identify any such correlations and discuss the policy ramifications in thereof.

**Research Questions and Hypotheses**

The study will focus on answering the following research questions (RQ) and hypotheses:

RQ1: Is there a correlation between marijuana use and academic involvement in undergraduate students?

- **H\(_0\)\(_1\):** The use of marijuana will have no effect on academic involvement in undergraduate students.
- **H\(_a\)\(_1\):** The use of marijuana will decrease academic involvement in undergraduate students.

RQ2: Is there a correlation between marijuana use and social involvement in undergraduate students?

- **H\(_0\)\(_2\):** The use of marijuana will have no effect on social involvement in undergraduate students.
- **H\(_a\)\(_2\):** The use of marijuana will decrease social involvement in undergraduate students.
RQ3: Is there a difference in academic and social involvement between non-users as compared to infrequent users, weekly users, daily users, or more than once daily users of marijuana?

\( H_{03} \): Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana will not have different levels of academic and social involvement.

\( H_{a3} \): Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana will have different levels of academic and social involvement.

**Description and Scope of the Research**

The goal of this quantitative, structural equation model study is to examine the relationship between the impact of marijuana use and academic and social involvement. The relevancy of marijuana usage with respect to education is ever increasing as several states within the United States have begun to legalize marijuana for recreational use. Several studies have identified chronic marijuana users as lacking overall motivation, having impaired mathematical and complex problem solving skills, and overall relatively poor academic performance compared to their peers (Indlekofer, et al., 2008; Lynskey & Hall, 2002; Wadsworth, Moss, Simpson, & Smith, 2006). However, few studies have been conducted to delineate the differences in usage frequency regarding academic and social involvement. The focus of the present study was to examine potential correlations between the frequency of marijuana use and academic and social involvement.

The Marijuana Smoking History Questionnaire (MSHQ) developed by Bonn-Miller and Zvolensky (2009) was used and modified for the study. The MSHQ has been used successfully as a measure of marijuana use history and pattern. In addition to the MSHQ, an academic and social involvement scale developed by Sharkness and DeAngelo (2011) was also used and modified. The two involvement scales in addition to the MSHQ scale were combined along with
other questions to create a survey instrument for this study. A thorough review of the literature informed the creation of an *a priori* theoretical structural equation model. My *a priori* model is shown in Figure 2 on page 55. The observed variable codes and associated scale items are found in Table 1 on page 56. Directional arrows from the observed variables (rectangles) show correlation to the latent variables (ovals). That is, the observed variable “amount consumed” correlates to the latent variable “marijuana use” which in turn impacts academic and social involvement.

The participants in this study were selected from a population of undergraduate students at mid-sized, comprehensive community college in the midwest. Eligible participants ranged in age from 18 to 65 and were asked questions regarding their history of marijuana use, as well as their academic and social involvement on campus. Other demographic data was also collected for users of marijuana.

The estimated total population of undergraduate students at this institution was approximately 4,527 (this value excludes concurrent enrollment and post-secondary enrollment option students). Using Soper’s (2015) *a priori* power analysis software, the minimum sample size needed was approximately 123 students for multivariate analysis at the 95% confidence level with a 5% margin of error. Since marijuana is an illegal substance, I made the assumption that students may be reticent to answer questions regarding the drug’s use. Therefore, in an effort to achieve the minimum sample size of 123 students, the entire eligible population was surveyed regarding their marijuana smoking history, as well as their academic and social involvement.
Upon collection, the data was screened and analyzed using SPSS. Part of the data analysis involved exploratory factor analysis (EFA), which is a form of data reduction to remove factors with weak correlations. The first test as part of the EFA was the Kaiser-Meyer-Olkin (KMO) test which measured sampling adequacy and initial factorability. The next test was Bartlett’s test of sphericity, which assesses if collinearity (that is, high levels of correlation) was expressed or not. Next, the initial communalities and extracted factors were examined using maximum likelihood as an extraction method (since the data were approximately normally distributed). The communalities revealed several scale items with low factor loadings, so refinement of the model was necessary. From there, the a priori model was modified to reflect what was done during the EFA and then tested for fit using Chi-Square measures of fit as well as the comparative fit index (CFI), root mean square error of approximation (RMSEA), p of close fit (PCLOSE).

Using SPSS AMOS, the model was then used to address RQ1 and RQ2 using a path analysis to determine regression weights between the latent variables. Descriptive statistics were used to correlate user demographic data with the data found from the SEM analysis of the scale items. Several independent sample t-tests (after Hartley’s test of equal variance confirmed equal variance) were used to test the significance of the means between non-users as compared to infrequent users, once daily users, and multiple daily users regarding academic and social involvement as outlined in RQ 3.

**Definition of Terms**

Throughout this dissertation, specific academic terminology will be used that is often not found within the field of higher education. To clarify the vocabulary for the reader, the following terms have been defined.
Central Nervous System (CNS). For the purpose of this study, the CNS will be described as the brain and spinal cord of humans. The central nervous system acts as a control center - integrating incoming information and determining any appropriate neurological response (Solomon, Berg, & Martin, 2005).

Academic and Social Involvement. Involvement, academically or socially, is often broadly defined, and their meanings often oscillate between different researchers. For the purpose of this study academic and social involvement will be defined by Pascarella and Terenzini (2005), “the impact of college is largely determined by individual effort and involvement in the academic, interpersonal, and extracurricular offerings on a campus” (p. 602).

Acute use. For the purposes of this study, acute use will refer to brief periods of drug usage i.e. less than one instance per month.

Chronic use. The term chronic in this study will be referring to the prolonged, daily use of a drug for multiple years.

Psychoactive Substance. An example of a psychoactive substance with regards to this study would be marijuana, as it produces changes in mood, perception, and motivation (Goodman & Gilman, 2006).

Amotivational Syndrome. A set of signs and symptoms that can be described as an impaired ability to engage in perceived normal daily activities due to external factors such as substance abuse, depression, and/or relationship issues (Goode, 1971).

Physical Addiction. Physical addiction refers to the compulsive need for a drug or substance in order to prevent the withdrawal symptoms (physical and/or psychological) or due to increased tolerance to the effects of the substance.
**Tolerance.** Is defined by either or all of the following:

1) A need for markedly increased amounts of the substance to achieve intoxication or the desired effect.

2) A markedly diminished effect on the user with continued use of the same amount of the substance

**Behavioral Addiction.** Behavioral addictions are patterns of behavior, which follow a cycle similar to that of substance dependence. Despite the negative consequences of the behavior that may occur, the individual persists with the behavior. Classic examples of behavioral addiction include compulsive gambling and eating disorders.

**Emotional Dysfunction.** Multiple difficulties in emotional functioning and regulation.

**Executive Function.** A psychological concept that loosely describes a series of brain processes that control planning, abstract thinking, rule acquisition, cognitive flexibility, selecting pertinent sensory information, and the ability to inhibit inappropriate actions.

**Δ9-tetrahydrocannabinol (THC).** The active chemical compound found in the marijuana plant (*Cannabis sativa*), and is responsible for the psychotropic and physiological effects on the central nervous system (Goodman & Gilman, 2007).

**Functional magnetic resonance imaging (fMRI).** A variation of traditional magnetic resonance imaging that detects changes in blood flow to assess activity in the brain.

**Schedule I Narcotic.** Substances in this schedule have no currently accepted medical use in the United States, a lack of accepted safety for use under medical supervision, and a high potential for abuse (“Schedules of Controlled Substances,” Title 21 Code of Federal Regulations, Pt. 1308. 2015 ed.).
Schedule II Narcotic. Substances in this schedule have a high potential for abuse which may lead to severe psychological or physical dependence (“Schedules of Controlled Substances,” Title 21 Code of Federal Regulations, Pt. 1308. 2015 ed.).

Schedule III Narcotic. Substances in this schedule have a potential for abuse less than substances in Schedules I or II and abuse may lead to moderate or low physical dependence or high psychological dependence (“Schedules of Controlled Substances,” Title 21 Code of Federal Regulations, Pt. 1308. 2015 ed.).

Schedule IV Narcotic. Substances in this schedule have a low potential for abuse relative to substances in Schedule III (“Schedules of Controlled Substances,” Title 21 Code of Federal Regulations, Pt. 1308. 2015 ed.).

Schedule V Narcotic. Substances in this schedule have a low potential for abuse relative to substances listed in Schedule IV and consist primarily of preparations containing limited quantities of certain narcotics (“Schedules of Controlled Substances,” Title 21 Code of Federal Regulations, Pt. 1308. 2015 ed.).

Summary

Marijuana is a widely use psychoactive substance that has been associated with several cognitive impairments ranging from amotivational syndrome to depression (Goode, 1971). These impairments may be intrinsically linked to the decline in graduation and retention rates within our colleges and universities. The purpose of examining the relationship between marijuana use and academic and social involvement was to assess whether marijuana adversely affects one’s ability to academically perform to the high standards of our colleges and universities, as well as the impact the drug has on one’s ability to socially engage while enrolled in college. The study operated primarily under the auspices of Astin’s (1985) theory of student
involvement with additional guidance provided by Anderson’s (1998) cultural identity theory of drug abuse.

The study was conducted mid-sized, comprehensive community college in the midwest. The students were asked several questions pertaining to their academic and social involvement, as well as questions regarding their use of marijuana throughout their lives. The data was examined using SPSS and SPSS AMOS to yield a SEM to analyze the correlations between the latent constructs “Marijuana Use”, “Academic Involvement”, and “Social Involvement”. Several independent samples $t$-tests were performed to address the differences in academic and social involvement in non-users as compared to several sub-types of users. Policy, research, theory, and practice implications based upon the results of the study are addressed in Chapter 5.

This dissertation is organized into five chapters. The next chapter consists of a thorough literature review regarding the history of marijuana and the wide-ranging effects of marijuana on the human body, as well as the associated impacts on learning, memory, and academic and social involvement. The third chapter outlines the methodology for the study and describes the procedures used throughout the study. The fourth chapter will describe the results of the study. The final chapter interprets the results and links my findings to the current literature as well as discusses the implication my results have on future research, the theories, as well as policy and practice.
CHAPTER II – LITERATURE REVIEW AND THEORETICAL FRAMEWORK

This quantitative, SEM study will focus on the implications of marijuana use with regards to academic and social involvement. In 2006, nearly 33 percent of college students in the United States reported using marijuana within the past year (Johnston, O'Malley, Bachman, & Schulenberg, 2007). Further, daily marijuana use amongst college students was at 3.5 percent in 2007 and has increased to 5.1 percent in 2013 (The Brown University Child & Adolescent Update, 2014). Because marijuana is one of the most widely used recreational drugs on college campuses, it is imperative that educators and administrators understand how marijuana affects college students academically, and how marijuana use and abuse directly impact the overall college experience.

I will begin this chapter by describing the history of marijuana consumption within the United States. The current domestic trends of marijuana use will then be discussed, followed by trends of marijuana use specifically within the realm of higher education. Next, insights into the differences between general use, sometimes referred to as acute usage, and abuse will be delineated. The psychopharmacological effects of the marijuana will then be discussed, including basic pharmacokinetics and pharmacodynamics as well as the effects of marijuana on motor function, memory, and motivation. Specifically, the effects marijuana has on memory and motivation lead to a discussion regarding the effects of both acute marijuana usage and chronic abuse on academic involvement. Next, an in depth discussion regarding a variety of student engagement and involvement theories follows, and will explain why I chose Astin’s (1985) theory of student involvement over the others. An analysis of Anderson’s (1998) cultural identity theory of drug abuse is included and the literature review closes with a discussion as to the creation of the a priori model that guided the study.
History of Marijuana Consumption within the United States

Marijuana has a long and tumultuous history in the United States. During the 19\textsuperscript{th} century, marijuana was wildly accepted as a medicinal herb. Between 1840 and 1900 over 100 articles in American and European journals purported marijuana’s therapeutic values, ranging from the treatment of gout to uterine hemorrhaging (Thomas, 2010). It was not until 1937 that the use of marijuana was restricted (Marihuana Tax Act, 1937). Thirty-three years later, marijuana was classified as a Schedule I narcotic, which are drugs defined as having no currently accepted therapeutic use and a potential for high abuse (Comprehensive Drug Abuse Prevention and Control Act, 1970). In addition to marijuana, heroin, lysergic acid diethylamide (LSD), ecstasy, methaqualone, and peyote are also considered Schedule I narcotics. These drugs are often considered to be the most dangerous drugs, due to the potential for psychological and physiological dependence. As drugs increase in schedule rating, the less dangerous they are considered to be by the federal government. Cocaine, methamphetamine, methadone, oxycodone, and other commonly abused narcotics are classified as Schedule II drugs.

The illegality of marijuana and its Schedule I status has not stopped its use within the United States. According to the 2010 National Survey on Drug Use and Health (NSDUH), 17.4 million Americans claimed to have used the drug within the past month. Marijuana use among young people is still prevalent (Institute for Social Research, 2012). Even though annual marijuana use among 8\textsuperscript{th}, 10\textsuperscript{th}, and 12\textsuperscript{th} graders has been declining since the mid 1990’s, 22.6 percent of high school seniors are considered to be current users, with 17.6 percent and 7.2 percent of sophomores and eighth graders claiming current use, respectively.
Current Domestic Trends in Marijuana Consumption

Marijuana use has demonstrated multiple adverse effects on the human body; ailments ranging from dramatic brain alterations, abnormal development, and even the acquisition of mental illness have been attributed to the drug’s use. On the other hand, the use of medicinal marijuana has been approved in the United States in 23 states, Washington DC, and in a limited number of European nations for some time.

Typically, when medicinally prescribed, marijuana is reserved only for cancer patients due to its anti-nausea effects and glaucoma patients to reduce intraocular pressure (Goodman & Gilman, 2006). However, in 2003, The Netherlands passed a bill to legalize marijuana products for medical research and prescriptions (Engels, de Jong, Mathijssen, Erkens, Herings, & Verweij, 2007). Additionally, the researchers found that medicinal marijuana was not being prescribed as much as was anticipated, with the number of prescriptions prescribed being deemed to be at a “very low level” (Engels, de Jong, Mathijssen, Erkens, Herings, & Verweij, p. 2643). The research team led by Engels (2007) discovered that a majority of patients did not use the legally prescribed marijuana due to high costs and inaccessibility. Furthermore, the team claimed that clinical research on the potential benefits of clinical marijuana were less than expected, and that, “Only sound scientific evidence can put an end to the current ongoing controversy [regarding the medicinal benefits of marijuana]” (p. 2643).

In the United States, however, there have been an increasing number of purported colleges that teach individuals how to prosper within the medicinal marijuana industry. For example, Oaksterdam University, founded in 2007 in Oakland, California, offers training and non-transferable courses in all aspects of the medicinal marijuana industry. A 2010 article in the
Chronicle of Higher Education by Gravois examined the college, and reported that this new institution of post-secondary education is facing scrutiny. Gravois indicates that:

But the real genius of Oaksterdam may lie in the realization that running a respectable trade school—with all the attendant talk of excellence, quality, and standards—is in itself a potently subversive political act. People have been making a living in the marijuana business for decades, but the careers of dealers, smugglers, and guerrilla growers have been defined by deviance and its obscure rituals. In contrast, there’s a powerful social signaling effect that goes along with handing in an application, showing up for lectures, taking tests, and attending labs. It says: This is normal (Gravois, 2010).

With an increasing number of states adopting the legalization of medicinal marijuana, the role of these colleges may change within coming years; changing from a front of subtle politically subversive actions to a mainstream institution of higher learning.

Despite the continued controversy regarding the true medical benefits of marijuana, the legalization process for recreational use has moved forward with great strides. The state of Colorado legalized marijuana for recreational in 2014, allowing persons over the age of twenty-one to purchase and consume marijuana. The state of Washington also legalized marijuana for personal consumption in 2012, followed by Oregon and Washington D.C. in 2015. Despite the fact that those states and the District of Columbia have legalized marijuana, users within those states are still subject to federal prosecution, as federal law takes precedence over state law.

Regardless of one’s opinion on the decriminalization of marijuana, the detrimental educational implications need to be thoroughly studied. Currently, there is some evidence suggesting that marijuana use, be it acute or chronic has negative effects on the human brain and its capacity to learn new information (Ashton, 2001). The extent of these effects and the
magnitude of them on one’s ability to learn have yet to be fully studied, particularly the effects of marijuana consumption on those people aged 25 years and younger due to the brain’s developmental state during those years.

**Marijuana Use versus Abuse**

Nearly every researcher that studies the effects of marijuana on academic performance defines “use” differently, and some researchers interchange the terms “use” and “abuse” indiscriminately. Anderson (1998) attributes this inappropriate terminology usage to the common “Gateway Theory of Drug Use” – which claims that the use of so-called softer drugs leads to the abuse of harder drugs (Anderson, 1998). Further, some researchers fail to describe the transition from “user” to “abuser”. For example, in one study involving eighth graders, of those students who used drugs (21 percent), only 4.6 percent would likely become daily abusers by twelfth grade (Johnston, O'Malley, & Bachman, 1995). The researchers did not explain why only 4.6 percent became daily users, thereby failing to describe the transitions a person undergoes when developing a true drug abuse problem. A 1991 research paper showed that the majority of cocaine users in the United States are only occasional users, and have not developed abuse patterns (Waldorf, Reinarmann, & Murphy, 1991). However, drug use certainly may lead to abuse if a person reaches a crisis stage (Anderson, 1998). With that being said, a strict definition of use must be established for the present study. Marijuana use is to be defined as infrequent ingestion of marijuana that has not led to psychological or physiological dependence (that is, perceived dependence versus physically requiring the drug in order to function normally), or interference in the daily functions of the individual (meaning the individual user can still function normally within social and career contexts).
Marijuana use has been purposely defined in a nebulous fashion to represent those people who do not fall under the category of non-user (a person who has never ingested marijuana) or abuser. Use could be anything from trying the drug once, to occasionally using the drug once or twice every few months. Daily use falls within the realm of abuse. Defining all usage patterns, would lead to several inconsequential variables that hold little to no value, as the more variables that exist within a study, the less powerful connections that can be made. The study’s definition of marijuana abuse is based on Anderson’s (1998) definition of drug abuse. According to Anderson (1998) a person who abuses a drug must meet all of the following parameters: 1) A pattern of heavy and regular use over a significant period of time, 2) a set of drug-related problems (e.g. at work, school, or within the family unit), 3) previous and failed attempts at cessation of consumption, 4) self-identification as to having a drug problem.

**Psychopharmacological Effects of Marijuana**

Of the sixty identified cannabinoids, Δ⁹-tetrahydrocannabinol (THC), is the active chemical compound found in the marijuana plant (*Cannabis sativa*), and is responsible for the psychotropic and physiological effects on the central nervous system (Goodman & Gilman, 2007). All of the cannabinoids, including THC, are found in varying concentrations throughout the entirety of the plant, including the stem, leaves, and the seeds (Ashton, 2001). The effects of THC have long been known to produce a seemingly pleasurable “high” after ingesting marijuana derivatives, making it a very commonly used recreational drug.

Most of the pharmacological research regarding THC concentration was carried out in the 1970s, where typical concentrations of THC in a single marijuana cigarette (joint) ranged between 5-25 mg (World Health Organization, 1997). However, with the increased potency of marijuana via advanced cultivation and breeding techniques, THC concentrations have risen to
upwards of 150 mg (Ashton, 2001). Therefore, today’s marijuana cigarette is roughly equivalent to 6 high potency marijuana cigarettes of the 1970s.

**Pharmacokinetics and Pharmacodynamics**

To fully understand the rapid effects of THC, one must have a basic understanding as to how the chemical is taken up by the body’s systems and how THC is subsequently cleared by the body. Most of the THC that is inhaled as smoke is readily absorbed through the lungs, entering the bloodstream (and the brain) within several minutes (Agurell, et al., 1986). Upon reaching the brain, the psychoactive response occurs within seconds (Goodman & Gilman, 2006). Those who ingest THC orally have a slower onset (but longer duration) of effects, due to slow absorption throughout the alimentary canal. Upon absorption, THC is readily absorbed to other tissue areas at a rate commensurate with blood flow (Agurell, et al., 1986). Due to the high lipophilic nature of THC, the complete excretion of a single dose may take up to thirty days (Ashton, 2001). However, the fate of THC metabolism is associated with a variety of other physiological activities, including but not limited to: hepatic metabolic rate, renal clearance, and adipose concentration throughout one’s body (Goodman & Gilman, 2006). Upon continual ingestion, high concentrations can accumulate within specific regions of the brain, particularly the motor, sensory, and limbic regions of the cerebrum (Ashton, 2001). With regards to learning and academic achievement, special attention is to be paid to the limbic region of the brain where behavior, memory, and motivation are heavily influenced.

**Motor Effects**

The acute and chronic effects of THC on motor function vary greatly throughout the literature. Grant, Gonzalez, Carey, Nata'raj, and Wolfson (2003) concluded that the long-term effects of THC on motor impairment were inconsistent at best, and varied widely depending on
methodology and personal user history. The acute effects of THC have been more widely explored. For example, according to Liguori, Gatto, and Jarrett (2002), acute ingestion of THC has been linked to increased body sway, indicative of a reduced ability to maintain balance. Further, recreational users have shown a lesser ability to perform spatial maze tests (Curran, Brignell, Fletcher, Middleton, & Henry, 2002). To further demonstrate the effects of THC on chronic users Hart et al. (2001) showed that chronic users, which they defined as consuming 24 marijuana cigarettes per week, showed reaction time impairment at high doses (30 mg), but their other abilities were not impaired including attention, memory, visual/spatial processing, reasoning, flexibility, and mental calculation. However, other researchers have found no statistical difference in performance monitoring. Fridberg, Skosnik, Hetrick, and O’Donnell (2013) compared chronic and naïve marijuana users’ executive function and motor control ability by using an electroencephalogram (EEG) and several stimuli based tests. The results of the study showed no statistical difference between groups, and that users and non-users made a similar number of errors throughout the test.

**Memory Effects**

Several studies over the past fifteen years have shown an inverse relationship between marijuana use and abuse regarding memory (Indlekofer, et al., 2008; Lynskey & Hall, 2002; O’Leary et al., 2000, 2002, 2003; Wadsworth, Moss, Simpson, & Smith, 2006). The effects of marijuana consumption on short-term memory are noticeable within 12-24 hours of use. Another study indicated that the frequency and duration of use adversely affect one’s verbal memory (Wagner, Becker, Gouzoulis-Mayfrank, & Daumann, 2010). This team of researchers was able to assess verbal memory in a group of chronic marijuana users by utilizing the Rey Auditory Verbal Learning Test (RAVLT). Upon analysis, the team discovered that a significant
correlation existed between the duration and frequency of use and immediate recall. The results of the study imply that long-term marijuana use has a residual effect on memory and subsequent learning.

The studies of marijuana use and the effects on the brain have recently been taken a step further. Through the use of functional magnetic resonance imaging (fMRI) technology, researchers have been able to “see” how marijuana affects the brain, in both acute and chronic cases. Yalchin, Posner, Nunnally, and Dishion (2010) discovered that after subjecting chronic users to the Attention Network Task, when compared to the control group, the chronic users showed increased reaction time and more frequent errors. These data were captured via the fMRI and visually demonstrated a greater activation of the prefrontal areas of the brain - the section of the brain that controls executive function. This study implies that chronic users must activate this portion of the brain in a greater proportion than non-users to perform what are considered medial conflict resolution tasks.

Additionally, fMRI studies have been conducted regarding the effects of chronic use on the hippocampus. The results of Jager, Van Hell, De Win, Kahn, Van Den Brink, Van Ree, and Ramsey (2007) showed that chronic users displayed lower activation of the para-hippocampal regions of the brain a region that is involved in associative learning. The team went further to assert, “Until now, there is very limited proof for structural brain abnormalities in frequent cannabis users” (pg. 289).

There is now evidence that chronic use inhibits brain function in a multi-faceted fashion. The brain, like any organ, can adapt when met with deficiencies as shown in the study by Abdullaev, Posner, Nunnally, and Dishion (2010) where the prefrontal cortex of chronic users showed stronger fMRI activation during executive functioning tasks versus non-users, showing
the brain’s ability to utilize other parts of the brain to compensate for anatomical deficiencies; however, these studies do not necessarily reveal the true effect of chronic use on one’s ability to learn. Therefore, the genetic and developmental aspect of use must also be examined to gain further insight as to how chronic marijuana usage affects a person’s ability to socially and academically grow.

**Motivational effects**

One hundred twenty three years ago, the Indian Hemp Commission claimed that chronic marijuana use was associated with a lack of motivation (Indian Hemp Drugs Commission, 1893). The 1930s saw marijuana become illegal due to its psychoactive properties, and in the early 1970s, the phrase “amotivational syndrome” was first associated with marijuana use (Goode, 1971). It was thought that marijuana use is directly related to apathy, and overall lack of motivation, particularly in young people (Goode, 1971). Further traits associated with amotivational syndrome include indolence, non-productivity, and lack of vocational and academic interest (Berman, 1971; Miranne, 1979). The early studies conducted on motivation within the purview of academics were solely measured by GPA (Pearlman, 1968; Blum, 1969; Goode, 1971; Hochman & Brill, 1973) and showed that users of marijuana tend to have lower grade point averages and/or lower educational aspirations (Miranne, 1979). Until recently, these early studies were the only body of research that included academic motivation.

One contemporary study of marijuana use and motivation in undergraduate students was conducted by Becker, Collins, and Luciana (2014). The team examined seventy-three college students between the ages of 18 and 20: healthy non-user controls ($n=37$) were compared to combatively healthy, heavy, daily marijuana users who began frequent usage before age 17 ($n=36$). The participants completed a complex neurocognitive battery including tests of: Motor
functioning, processing speed, verbal fluency, verbal attention and working memory, verbal learning and memory, spatial memory, planning, and motivated decision making. These tests were completed by both the control and test groups in a non-intoxicated state.

According the results of Becker, Collins, and Luciana (2014), the test group of marijuana users performed comparatively well on short tasks that were externally motivated. The users of marijuana expressed deficits with regards to memory, motivated decision making, and problem solving. Becker, Collins, and Luciana (2014) hypothesized that the users of marijuana appeared to be less persistent in the absence of motivation-enhancing instruction – thereby suggesting that marijuana users are most impaired with tasks that require intrinsic motivation, and more successful when external motivational cues exist.

Becker, Collins, and Luciana (2014) further suggest that the prolonged and daily use of marijuana increases one’s dependence on external motivational factors as opposed to the more intrinsically driven self-reliance and self-organization. The authors hypothesize that the inverse would also hold true – claiming that prolonged and daily users may excel in situations where external sources of motivation are high.

Another modern study by Bloomfield, Morgan, Kapur, Curran, and Howes (2014) showed a significant (Spearman’s rho = -0.69) inverse correlation between apathy and dopamine production in the brain. Dopamine is a potent neurotransmitter associated with reward-motivated behavior in the cerebrum as well as skeletal muscle movement within the substantia nigra located within the midbrain (Berridge & Robinson, 1998). The results of this study suggest that chronic marijuana use may reduce reward sensitivity and increase amotivational tendencies.

Several older studies (Bradley, 1982; Jessor, Chase, & Donovan, 1980; & Marston et al., 1988) have shown a bidirectional relationship between marijuana use and amotivational
syndrome. The first direction links poor academic motivation directly to substance use, whereas the second claims that those who place a low value on academic performance are more prone to substance abuse (Andrews & Duncan, 1997). Further supporting the claims of the first direction is the effect marijuana has on the brain, particularly the limbic system which is directly associated with motivation (Andrews & Duncan, 1997). Regarding the first hypothesis, that cannabis use is a contributory cause of poor school performance, evidence gathered by Buckner, Ecker, and Cohen (2010) and Caldeira, Arria, O’Grady, Vincent, and Wish (2008) showed that, “. . . among students who reported using marijuana five times or more in the past year, 40.1 percent had difficulty concentrating after using and 13.9 percent overslept and missed class” (p. 404). Additionally, other studies have shown that marijuana use during adolescence may hinder cognitive development and lead to motivational issues as an adult (Miller, 1979).

Evidence for the second direction has been exhibited by studies regarding family culture and peer group association (Brunswick & Messeri, 1984). Other influences, such as a lack of proper drug education, may lead marijuana use as well. In a study conducted in 2006, Henry, Smith, and Caldwell showed that academically poor performing students in a rural community showed a significant increase in marijuana use. The researchers inexplicably attributed this increase in use to a lack of drug prevention strategies within the school. Family culture has also been shown to have positive effects on academic motivation and achievement (Andrews & Duncan, 1997).

In addition to familial and peer culture, mental illness may also play a role in the depressive effects of marijuana. In a 1995 study, Musty and Kaback demonstrated that people who identified as heavy marijuana users who also exhibit symptoms of depression were shown to have lower motivation goals. The study tested 39 university students by having the participants
fill out a detailed questionnaire that discussed a wide range of activities ranging from current
drug use to motivation, affiliation, and power. Additionally, the study found that the quantity of
marijuana smoked did not differ between the “use and “abuse” groups, concluding that the heavy
users, or abusers, were not more tolerant to the drug. They also found that depression was a
necessary condition in order for marijuana users to exhibit amotivational tendencies. This
statement is corroborated by Goodman and Gilman (2006) who claim that confounding factors
such as clinical depression are also characterized by a lack of motivation and should be
considered when determining the effects of marijuana abuse. Further studies have shown that
adolescents who are depressed tend to perform more poorly in school when compared to students
who claim to not be depressed (Fröjd, et. al., 2007). With that being said, the effects of
marijuana on motivation may be a secondary effect of mental illness. Poor academic
performance in students taking depression medications may be attributed to the
pharmacokinetics and dynamics of the drugs they are prescribed as they may interfere with the
normal neurophysiology of young adults (Goodman & Gilman, 2006).

The aforementioned studies provided empirical evidence supporting the claim that
marijuana as an inverse relationship with motivation. However, preexisting mental illness may
play a more significant role with regards to the effects of marijuana and amotivational syndrome.
Once again, however, the studies did not differentiate use from abuse. One of the goals of the
present study is to lend evidence as to how the frequency of marijuana use affects academic
motivation.

**Emotional Effects**

The physiological, neurological, and anti-motivational effects of marijuana have been
rather well documented as demonstrated in the above sections. The effects that marijuana has on
emotional functioning have a less defined relationship. Some researchers have demonstrated a non-statistically significant relationship between marijuana dependence (e.g. abuse) and major depression, anxiety, and suicide attempts among adolescents in New Zealand (Fergusson & Horwood, 1997). On the other hand, Brook (2004) states that,

It is evident…that early marijuana use during childhood and adolescence should not be regarded as benign or without significant consequences, but as a predictor of the later occurrence in young adulthood of [Major Depressive Disorder] MDD, alcohol dependence and substance use disorders. Early marijuana use made the later occurrence of these disorders much more likely, increasing the risk for MDD by 17%, for alcohol dependence by 23% and for substance use disorders by 40% (pg. 88).

Allen and Holder (2014) provide further evidence suggesting the relationship between emotional well-being and marijuana use, stating that a link between marijuana use and depression and anxiety is apparent, but the strength and magnitude of this relationship is nebulous and highly variable. Evidence for this variability as stated in Allen and Holder (2014) is found in Durdle, Lundahl, Johanson, and Tancer (2008) where the abuse of marijuana was linked to major depressive disorder. On the other hand, Degenhardt, Hall, and Lynskey (2001) demonstrated that the abstinence of marijuana use in Australians led to anxiety, and not the other way around.

Further research indicates that some people, who are already afflicted by an emotional disorder, are more prone to seek out and use marijuana. According to a 2008 study conducted by Bonn-Miller, Vujanovic, and Zvolensky, individuals with existing emotional disorders may use marijuana for a wide variety of reasons, ranging from coping to conformity. In this study, the researchers also demonstrated that emotional dysregulation was related to the coping-use
mechanism of marijuana – meaning that people with highly unregulated emotions at multiple levels would use marijuana to cope with perceived emotional stress.

As it stands, this relationship between marijuana use and emotional disturbances are cyclical, and the rhetorical “What causes what?” question remains unanswered. The literature suggests a relationship, although the empirical and theoretical evidence is less than prevalent. Neurological research indicates that learning and memory are optimized when one has relatively low levels of anxiety and/or feelings of depression (Beuzen & Belzung, 1995). If marijuana does demonstrate adverse effects on one’s ability to learn and remember material, the impact on colleges and universities is tremendous.

Marijuana and Academic Achievement

Civil unrest during the 1960s promoted an unprecedented social movement amongst college students, where illicit drug use was becoming more prevalent on college campuses (Thelin, 2011). Wogan (1974) reviewed drug abuse trends in an array of higher education institutions between 1965 and 1971. His longitudinal analysis showed a dramatic rise in marijuana use. For example, in 1965, 4.3 percent of respondents indicated using marijuana, while in 1971 the proportion increased to 42.6 percent - a 38.3 percentage point increase in usage over six years. Girdano (1974) established that 63 percent of students polled at the University of Maryland used marijuana, and that of those 63 percent, 15 percent were identified as daily users – outpacing daily male alcohol consumption by 5 percent.

In 2012, 5.4 million people aged 12 years or older use marijuana daily or near daily within the past year (Substance Abuse and Mental Health Services Administration, 2012), a 2.3 million increase from 2006. Figure 2 shows the increase in daily or near daily marijuana usage by individuals age 12 or older from 2002 to 2012. Overall in 2012, illicit drug use rates
Figure 1. Daily or almost daily marijuana use in the past year or past month among people aged 12 years and older: 2002 – 2012 (SAMHSA, 2012). The plus sign indicates a statistical difference (α=0.05) between 2006 and 2012.

were 22.0 percent among full-time college students (SAMHSA, 2012). Of those college students aged 18-22, 23.5 percent of male full-time college students were current marijuana users compared with 16.1 percent of female full-time college students aged 18 to 22 (SAMHSA, 2012). No further data was collected regarding marijuana usage (i.e. use versus abuse).

Given the large proportion of young people using marijuana, the use of cannabis may directly affect one’s level of academic achievement due to the increasing inability to perform complex tasks and store information in long-term memory (Indlekofer, et al., 2008; Lynskey & Hall, 2002; O’Leary et al., 2000, 2002, 2003; Wadsworth, Moss, Simpson, & Smith, 2006) and have direct implications of academic achievement. Providing further corroborating evidence is a 2005 survey administered by the Substance Abuse and Mental Health Services Administration
(SAMHSA), which found that 17.9 percent of undergraduate students with a past semester GPA of 1.0 or lower had used marijuana in the past month compared 3.1 percent of those with a 3.5 GPA or higher. Once again, use and abuse were not delineated and other factors such as other drug use and alcohol abuse were not considered.

The following sections describe the research conducted in the 1970s through the modern era regarding academic performance. The studies provide the groundwork for the present study regarding academic involvement in undergraduate students.

**Academic achievement in the 1970s**

In the fall of 1970, a Gallup poll of college students nationwide found 43 percent of students had tried marijuana, 39 percent reporting use within the past year, and 28 percent claiming to have used marijuana with the past 30 days (Harrison, Backenheimer, & Inciardi, 1995). Those numbers appeared to be alarming to the academy and spurred several research projects studying the implications of marijuana within American colleges and universities. In 1971, Dr. Erich Goode presented an unpublished paper at the 55th annual meeting of the American Educational Research Association. His research described the differences in GPA between 600 students who identified as casual, heavy, or non-users of marijuana. Dr. Goode defined infrequent marijuana users as those who used one to two times per month, and the heavy user as using 3 or more times per month. The abstinent user was defined as never having tried the drug, even once. Goode statistically controlled for sex, class in college, and familial socioeconomic status. It was discovered that there was a curvilinear relationship between GPA and marijuana consumption; more specifically that the highest grades were obtained by infrequent users, while the lowest grades were achieved by the heavy user or the total abstainer.
Goode’s results corroborated earlier, somewhat sparse research done in the late 1960s. Pearlman’s (1968) study revealed no statistical GPA differences between non-users and users of drugs (marijuana was included in this study, but was not the sole drug studied) with the state colleges of New York. Additionally, a study conducted by Blum (1969) also revealed no statistical differences between non-users and users. Further corroborating Goode’s study, Hochman and Brill’s (1973) study also showed no statistical differences in the GPAs of users and non-users in a cross-sectional, random sample of 10 percent of the UCLA undergraduate population.

Many of the studies throughout the very late 1960s and through the early 1970s show little or no statistical difference in the GPAs of users versus non-users. However, very few studies were longitudinal in nature and only captured students on both coasts, with little to no research done in the Midwest. Further, the marijuana of the 1960s and 1970s contained on average 5 to 25 mg of THC per marijuana cigarette, while modern marijuana has significantly increased the concentration of THC by approximately six times that of the marijuana ingested 50 years ago (Ashton, 2001).

**Psychological Development and Academic Achievement in the 1980s – Present**

In 1980, Pascale, Hurd, and Primavera engaged in a study to assess the effects of chronic marijuana use. Their study explored more than academic performance, examining amotivational syndrome as well as pathological states and aggressive tendencies associated with long-term marijuana use. The researchers assembled a synthesis of the then current literature pertaining to each of the above subcategories and proposed a then current understanding of the effects of chronic marijuana use on one’s psychology.
With regards to amotivational syndrome, LeDain (1972) as stated in Pascale, Hurd, and Primavera (1980) described amotivational syndrome as one related only to adolescents as the data at that time was only collected on that group of people. Further, LeDain (1972) concedes that if amotivational syndrome exists, it there has not been any evidence refuting or supporting its effects on maturational development. This proposition leaves a thirty year gap in the literature regarding the transition from adolescence to adulthood while experiencing the effects of marijuana for an extended period of time. Further, academic achievement was not directly measured in the aforementioned study. It was not until seventeen years later that marijuana use and collegiate academic performance would once be discussed together again.

Bell, Wechsler, and Johnston (1997) conducted a national survey that yielded a 17,592 of students at 140 different colleges and universities within the United States. The team found that of those student surveyed, 24.8 per cent has used marijuana within the past year. Those who were identified as users yielded particular characteristics through multiple regression models. Among those characteristics identified, spending time at parties, socializing with friends, and spending less time studying were prevalent. In terms of academic performance, students who had a grade point average of a “B” or less were more likely to use marijuana as compared to their peers. This data was deemed non-statistically significant and supports the research from the 1960s and 1970s regarding marijuana use and GPA.

Conversely, Bell, Wechsler, and Johnston (1997), obtained data showing that students who spent more than two hours per day socializing, or less than four hours per day studying were statistically more likely to use marijuana. This data serves as another indicator of academic engagement aside from GPA. One could make the argument that academic performance is not
measured solely by one’s GPA, but by one’s study skills and devotion to the academic experience.

In 2013, Arria, Caldeira, Bugbee, Vincent, and O’Grady released the findings of their ten-year longitudinal study of 1,200 college freshmen. In their report, the researchers provided evidence suggesting that alcohol and substance abuse led to short-term academic problems as well as interference with degree completion. The findings related to the short-term academic problems were convoluted by the comorbid use of drugs other than marijuana (i.e. amphetamines and alcohol) and are not pertinent to the present study. The only research findings that were specifically related to marijuana use was degree completion. Of the 1,133 students examined, those who used marijuana very frequently (more than 15 days used per month) were twice as likely as minimal (less than two days per month) users to stop out (i.e. not being enrolled in one or more semesters) of school.

The research over the past fifty years pertaining to marijuana use and academic performance is multifaceted. Several studies ranging scope and complexity have yielded no statistical significance regarding marijuana and GPA. However, since the 1980s, academic engagement shifted forms from a mere measure of GPA to the more complex notion of studying and application. Further, modern studies have shown a marked increase in stop out rates by those students who use marijuana the most. The findings of the aforementioned provide the basis of the academic engagement component of this dissertation. A student’s ability to be academically successful in college is but one part of his or her collegiate experience. The social involvement on campus also plays a role in one’s development as a student and as a graduate.
Marijuana Use and Social Involvement

Marijuana use is typically seen as a deviant social behavior as demonstrated by popular culture and other media sources; however, social groups and their associated norms may play a large role in how people use marijuana. The norms of religious affiliation, social networks, and one’s personal ethical domain impact one’s decision to engage in the use of marijuana. For example, Smith (2003) claims that membership in a religious group augments norm adherence – that is, increasing the likelihood of social conformity within the religious group that does not condone the use of marijuana. This form of positive peer pressure does not allow for deviance through the practicing of behavior that exhibits high moral standards. On the other hand, one could argue that such high pressure social conformity could cause separation from the religious group, and lead one to another social group whose peer pressure is of the opposite persuasion.

From a higher education perspective, Suerken et al. (2014) posit that college freshmen are more likely to engage in illicit drug use, likely due to little direct parental influence and/or the college social environment, where other students may be experimenting with drugs, or they were users upon admittance to college. The notion outlined above was corroborated within the selfsame study (Suerken, et al., 2014) where the researchers examined students from across eleven different institutions within North Carolina and Virginia. The data described a five percent higher marijuana use instigation with students (n=3146) who lived in residence halls as compared those who lived off campus. The researchers made note of the social nature of marijuana use, making the claim that living with or near peers who use the drug likely increase usage rates. The results are extremely limited, as only eleven four year institutions were represented, overlooking the two year institutions. Further, the results likely do not take into account off campus apartment housing, or other forms of off campus community based living.
Involvement on campus has been long associated with a successful academic experience. The following sections describe the theories that have been developed to explain the relationships between not only involvement, but student engagement and integration as well, with regards to student success in college.

**Involvement, Engagement, Integration and Student Success**

There have been three primary theories generated over the past several decades that have attempted to explain student success as it relates to academic and social development over the course of the college experience. The first theory generated was finalized by Astin in 1985. His 1985 theory posits that the amount of psychological and physical energy is directly proportional to the overall academic and social experience in college. The second theory was borne from the work of Pace (1980), Astin’s 1985 theory of involvement, and Chickering and Gamson’s (1987) study of educational bets practices. The engagement theory revolves around two major themes: The first is the amount of time students put into their academic work and other college related experiences, the second being what the institution has done, or is doing, to help encourage students to participate and engage in such activities that promote success (Wolf-Wendel, Ward, & Kinzie, 2009). The final theory of integration was defined by Tinto (1993) and seeks to measure the extent to which students adhere to the institutional culture. This form of academic and social integration was used in Tinto’s departure theory as a means to explain why students leave college.

Each of the above theories overlap and each may help to explain the relationship between the frequency of marijuana use and its effect on academic and social involvement during the college years. The following sections explain each of the three theories in greater detail. The final section explains why Astin’s (1985) involvement theory is the most appropriate for the
present study and transitions to Anderson’s (1995) cultural identity theory of drug abuse which also guides the study from a sociological point of view.

**Astin’s (1985) Theory of Student Involvement**

Astin’s (1985) theory of student involvement was borne out of a desire to explain how students change and develop during their undergraduate careers (Pascarella & Terenzini, 2005). One of the underlying components of how this theory functions is simply that students learn by being involved. How involvement is described and measured is somewhat nebulous, but Pascarella and Terenzini (2005) have succinctly distilled Astin’s (1985) theory of involvement down to five basic components. First, involvement requires some form of investment that is either psychological or physical in nature. For example, the theory of multiple intelligences (Gardner, 1983) breaks down how people learn based up on their investment in what they are learning – that is if a person is a kinesthetic learner, for example, he or she will be the most involved in learning if it involves the physical manipulation of the objects and space in which she or he is learning. Astin’s (1985) second component states that involvement is a continuous concept, and that varying amounts of energy (psychological or physical) will be invested in the object. Thirdly, involvement, according to Astin (1985), has both qualitative and quantitative features – meaning that the data derived from theory testing can be multifaceted, diverse, and complex. Astin’s (1985) fourth component, and perhaps the most important, states that the amount of learning taking place is directly proportional the amount of involvement as well as the quality of involvement – in simpler terms, inputs equal outputs. Lastly, Astin claims that the effectiveness of any educational policy or practice is directly related to its ability to induce student involvement (Astin, 1985, pp.135-136).
In essence, Astin’s (1985) theory of involvement puts the onus on the student to direct the amount and quality of his or her education given the resources (intellectual, physical, etc.) provided to him or her by the institution. Although social involvement is important, researchers have shown that academic involvement in the form of studying, asking questions in class, homework completion, etc., has a greater effect on success (Wolf-Wendel, Ward, & Kinzie, 2009). Due to the psychoactive nature of marijuana, and its ascribed effects on motivation, academic achievement, and social involvement as outlined in the preceding pages, one could hypothesize that marijuana consumption would have a direct and inverse effect on one’s ability to be involved in the collegiate community, and thus have a negative impact on one’s ability to learn.

**Student Engagement Theory**

While Astin’s (1985) theory places the onus on the student to be academically and socially involved, the student engagement theory broadens the scope and focuses not only on what the student does to achieve success, but also focuses on what the institution does as well – thereby creating an “agreement” between the two parties regarding the educational experience (Wolf-Wendel, Ward, & Kinzie, 2009). The concept of engagement has been measured by the National Survey of Student Engagement (NSSE) created by Kuh (2009) along with several notable scholars, including Astin and Chickering (Wolf-Wendel, Ward, & Kinzie, 2009). The goal of the NSSE data (which is generated by students) is to inform universities of their ability to engage students on campus. Theoretically, universities can then make data driven policy decisions with regards to student development services.

Wolf-Wendel, Ward, and Kinzie (2009) differentiated student engagement theory from Astin’s involvement theory by stating that,
Student engagement was not developed as an extension of involvement but as an expression of the importance of more explicitly linking student behaviors and effective educational practice. Engagement differs from involvement in that it links more directly to desired educational processes and outcomes and emphasizes action that the institution can take to increase student engagement (pg. 414).

Therefore, engagement has a greater focus on institutional effectiveness with regard to engagement on campus, where the involvement theory is more focused on the individual student. Engagement theory may play a role in assessing the effects of marijuana use on academic and social involvement, but the present study focuses more on the student and less on the institution. Policy development based on the results of the study may be placed within the context of engagement theory, however.

**Student Integration**

Tinto’s (1993) theory of academic and social integration is a preeminent component of his theory of departure from higher education institutions. His theory on institutional departure was based upon an earlier theory by VanGennep (1960) which addressed rites of passage and suicide theory. In a higher education context, Tinto argued that students need to integrate themselves into the academic culture to be successful; both socially and academically.

Tinto also argued that it was not just the student who responsible departure, but the institution as well. Pascarella and Terenzini (2005) claim that positive encounters (both formal and informal) lead to greater academic and social integration – subsequently decreasing the likelihood of self-chosen departure from the institution and concurrently increasing their commitments to the university itself and their own educational goals.
Integration theory may play a role in drug use within the academy. More specifically, Tinto’s theory of departure may have a drug related identity change component. That is, as one transitions from non-user, to user, and maybe abuser, the likelihood of the student’s affiliation to the academic and social aspects of the institution begin to fade. This notion is mentioned as part of Anderson’s cultural identity theory of drug abuse, and is discussed in the proceeding section.

**Anderson’s Cultural Identity Theory of Drug Abuse**

Much of the literature pertaining to the relationship between marijuana and academic success has revolved around use of the substance, but has failed to fully examine drug related behavior and undergraduate success. The present study will examine the relationship between marijuana use and academic and social involvement using Astin’s (1985) theory of student involvement and supplemented by Anderson’s (1998) cultural identity theory of drug abuse. This section will provide a thorough explanation of Anderson’s (1998) theory beginning with a description of the effects of both personal and social marginalization, as well as association with a specific drug culture and the meaning of drugs, followed by descriptions of the twelve hypotheses found within her theory.

**Personal Marginalization**

According to Anderson (1998), personal marginalization refers to the experiences during adolescent development that severs one from socially acceptable behavior. To date, fourteen major life-events have been hypothetically linked to the identity change from non-user to drug abuser. These life events include divorce or separation of parents (Anderson, 1998), death of someone significant (Hoffman, 1993), frequent geographic moves of the family (Anderson, 1998), inappropriate sexual activity with an adult (Barrett, Trepper, & Stone-Fish, 1991), caretaker responsibilities for siblings or other family members (Anderson, 1998), rigid and
regular domestic responsibilities along with strict guidelines and expectations (Baumrind, 1985), the individual’s early biological reproduction (Anderson, 1998), physical abuse by caretakers (Anderson, 1998), frequent physical or verbal punishment at school along with multiple school suspensions, fights, or placement into different school programs (Anderson, 1998), and/or negative police interaction (Anderson, 1998).

**Social Marginalization**

Anderson (1998) defines social marginalization as a person’s, “disadvantaged or oppressed economic, social, and cultural situation in comparison to important groups and/or entities around him or her” (p. 245). These disadvantages may lead to discomfort with one’s ego, or self. Anderson’s (1998) theory hypothesizes that discomfort with one’s self leads to a drug-related identity change in an effort to become comfortable with one’s self.

**Loss of Control When Defining an Identity**

Baumrind (1983) reported that unrealistic parental expectations and/or extreme authoritativeness lead to the loss of individual control over positive identity construction during childhood and adolescent development. Anderson (1998) posits that the external pressures involved in developing a positive identity lead to higher risk with regards to drug abuse.

**Association with Drug Culture**

Personal and social marginalization as well as loss of control when defining an identity may provide the motivation for a drug-related identity change, but Anderson (1998) believes in order to achieve the transition of non-user to abuser, opportunities must be available to fully elicit that shift of identity. Anderson (1998) claims that educational and economic opportunity, popular culture, and identification with a drug related subcultural group provide the societal opportunity to transition from non-user to abuser.
Anderson’s (1998) theory posits a positive correlation between lower economic opportunity and the identification with a drug subculture - essentially linking poverty with drug abuse. Anderson’s (1998) claim is further substantiated by Bourgois (1989), who claimed that inner city citizens experience higher levels of unemployment, and that the stress of being unemployed may lead to increased drug abuse patterns. Anderson (1998) does include a disclaimer stating that her theory does not claim that middle and upper class people do not become drug users and that further research is needed to modify her existing model.

Similarly, educational opportunity, according to Anderson (1998) follows as similar pattern with regards to drug abuse to that of economic opportunity. Lower-class careers are often low paying, as compared to skilled and professional careers. According to Anderson (1998), lower class students in the P-12 system are often funneled more towards vocational or technical career pathways, where middle- and upper-class students are often steered towards more academic or professional careers, and due to lower economic opportunity tend to engage in more drug related behavior. The bifurcation of social class with regards to educational opportunity will become even more of an issue as the cost of college tuition continues to rise.

Educational and economic disparities may be enough of an impetus to engage in drug related behavior, however popular culture often provides a glimpse into drug related subgroups and erroneously glamourizes the associated behaviors and lifestyle that accompany drug abuse. Gans (1974) claims that social groups (e.g. social class, race, sex, etc.) select cultural forms that define their group’s identity and suit their focal concerns, and children when exposed at a young age, absorb these normative values as their own. With specific regards to marijuana, cinema and print often associate marijuana usage with glass pipes, Reggae and classic rock music, incense, laziness, and a dulled sense of reality. Particular films include the Cheech and Chong movie
series, *Super Troopers, Knocked Up, Half Baked, Animal House, Van Wilder*, and many others. The characters in these movies are often portrayed as dimwitted, humorous, and lackadaisical, which may appeal to some impressionable minds that yearn for a carefree lifestyle. Taking the marijuana culture a step further, the subgroup has its own print and electronic magazine, *High Times*, where one can learn about cultivation techniques, the strains that contain the highest concentration of THC, and even how to import cannabis seeds from Europe (“High Times,” 2014).

The Meaning of Drugs

The use and abuse of drugs may hold multiple meanings, and depending on the user, may not be mutually exclusive. One of the most commonly studied meanings of drug use is affect control, or using drugs to cope with negative feelings about oneself, others, or society at large (Anderson, 1998). The drug allows the user to “escape” from his/her reality and fills an otherwise devoid person with a sense of completeness (Henderson & Boyd, 1992).

In addition to affect control, drugs may hold a sense of material symbolism – that is, allowing the user or abuser to engage in economic activity in which, to the user, is a high powered and often prestigious career (Bourgois, 1989). This fallacious career status is often associated with those users and abusers who liken themselves to characters in popular culture, such as Al Pacino’s Tony Montana in *Scarface* and Bryan Cranston’s Walter White in *Breaking Bad*. Despite the fact that these fictional characters met tragic and untimely deaths, the mind of drug user or abuser does not recognize the potential danger and sees the glorification of the drug culture, which may be attributed the euphoric state associated with many drugs.

Drug euphoria may be related to developing a new sense of identity. According to Anderson (1998), while in the euphoric state, the abuser may reconstruct his or her self and
identify with the perceived positive state of mind associated with drug induced euphoria. This form of identity creation is likely a hybridization of material symbolism and affect control as components of both are required in some degree to develop an amalgamated drug induced identity (Anderson, 1998).

### Structural Model Framework Creation

Given that much of the literature claims that marijuana negatively impacts one’s ability to learn and retain information and that marijuana use has been linked to an amotivational syndrome (Indlekofer, et al., 2008; Lynskey & Hall, 2002; Wadsworth, Moss, Simpson, & Smith, 2006), coupled with the notions found within Anderson’s 1998 theory that use can lead to a drug related identity change and further perpetuate a lack of involvement and Astin’s 1985 theory stating that involvement is linked to a successful college career, I predicted that marijuana use would have a negative effect on both social and academic involvement in undergraduate students. This prediction led to the creation of the structural model shown in Figure 1. The latent constructs of marijuana use, academic involvement, and social involvement are informed by three vetted scales use by other researchers to measure marijuana use, and academic and social involvement, respectively.

The Marijuana Smoking History Questionnaire (MSHQ) developed by Bonn-Miller and Zvolensky (2009) was used and modified for the study. The MSHQ has been successfully used as a measure of marijuana use history and pattern. In addition to the MSHQ, an academic and social involvement scale developed by Sharkness and DeAngelo (2011) was also used and modified. The three scales were combined and this hybrid instrument, in addition to a thorough review of the literature informed the creation of an *a priori* theoretical structural equation model. My *a priori* model is shown in Figure 2. The observed variable codes and associated scale items
are found in Table 1. Directional arrows from the latent variables (ovals) show correlation to the observed variables (rectangles). That is, the observed variable “amount consumed” correlates to the latent variable “marijuana use” which in turn impacts academic and social involvement.

Figure 2. The *a priori* SEM regarding the impact of marijuana on academic and social involvement in undergraduate students. The latent variables SI (Social Involvement) and AI (Academic Involvement) are each informed by six scale components with associated error (Appendix A). Marijuana use is informed by four scale components: USE (30 day usage patterns), AMOUNT (relative amount consumed per occasion), ONSET (age of first use), and YEARS (years of use) with associated error for each scalar component.
Table 1

Descriptions of the sixteen observed variables used in the study

<table>
<thead>
<tr>
<th>Associated Scale</th>
<th>Observed Variable Name</th>
<th>Code</th>
<th>Associated Survey Question</th>
<th>Measurement Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSHQ</td>
<td>30 Day Marijuana Use</td>
<td>30 Day Marijuana Use</td>
<td>14</td>
<td>No use, once per week, once per day, more than once per day</td>
</tr>
<tr>
<td>MSHQ</td>
<td>Amount Consumed</td>
<td>Amount Consumed</td>
<td>15</td>
<td>Small, medium, large, very large</td>
</tr>
<tr>
<td>MSHQ</td>
<td>Age of Onset</td>
<td>Age of Onset</td>
<td>16</td>
<td>&lt; 12, &gt; 12 &lt; 15, &gt; 15 &lt; 18, &gt; 18 &lt; 21, &gt; 21</td>
</tr>
<tr>
<td>MSHQ</td>
<td>Years of Use</td>
<td>Years of Use</td>
<td>17</td>
<td>&lt; 1 year, &gt; 1 &lt; 5 years, &gt; 5 &lt; 10 years, &gt; 10 &lt; 15 years, &gt; 15 years</td>
</tr>
<tr>
<td>Academic Involvement Scale</td>
<td>Support opinions with a logical argument</td>
<td>AI 1</td>
<td>7</td>
<td>Frequently, occasionally, not at all</td>
</tr>
<tr>
<td>Academic Involvement Scale</td>
<td>Evaluate quality/reliability of information</td>
<td>AI 2</td>
<td>8</td>
<td>Frequently, occasionally, not at all</td>
</tr>
<tr>
<td>Academic Involvement Scale</td>
<td>Seeking of alternate solutions</td>
<td>AI 3</td>
<td>9</td>
<td>Frequently, occasionally, not at all</td>
</tr>
<tr>
<td>Academic Involvement Scale</td>
<td>Accessing scientific research</td>
<td>AI 4</td>
<td>10</td>
<td>Frequently, occasionally, not at all</td>
</tr>
<tr>
<td>Academic Involvement Scale</td>
<td>Exploration of topics outside of class</td>
<td>AI 5</td>
<td>11</td>
<td>Frequently, occasionally, not at all</td>
</tr>
<tr>
<td>Academic Involvement Scale</td>
<td>Seek feedback on academic work</td>
<td>AI 6</td>
<td>12</td>
<td>Frequently, occasionally, not at all</td>
</tr>
<tr>
<td>Social Involvement Scale</td>
<td>Isolation from campus life</td>
<td>SI 1</td>
<td>1</td>
<td>Not at all, occasionally, frequently</td>
</tr>
<tr>
<td>Social Involvement Scale</td>
<td>Satisfaction with interactions with other students</td>
<td>SI 2</td>
<td>2</td>
<td>Very satisfied, satisfied, somewhat satisfied, neutral, somewhat dissatisfied, dissatisfied, very dissatisfied, can’t rate/no experience</td>
</tr>
<tr>
<td>Social Involvement Scale</td>
<td>Satisfaction with availability of social activities</td>
<td>SI 3</td>
<td>3</td>
<td>Very satisfied, satisfied, somewhat satisfied, neutral, somewhat dissatisfied, dissatisfied, very dissatisfied, can’t rate/no experience</td>
</tr>
</tbody>
</table>
### Table 1, continued.

<table>
<thead>
<tr>
<th>Social Involvement Scale</th>
<th>Satisfaction with social life</th>
<th>SI 4</th>
<th>4</th>
<th>Very satisfied, satisfied, somewhat satisfied, neutral, somewhat dissatisfied, dissatisfied, very dissatisfied, can’t rate/no experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Involvement Scale</td>
<td>Satisfaction with overall sense of community</td>
<td>SI 5</td>
<td>5</td>
<td>Very satisfied, satisfied, somewhat satisfied, neutral, somewhat dissatisfied, dissatisfied, very dissatisfied, can’t rate/no experience</td>
</tr>
<tr>
<td>Social Involvement Scale</td>
<td>“I see myself as part of the campus community”</td>
<td>SI 6</td>
<td>6</td>
<td>Strongly agree, agree, somewhat agree, neutral, somewhat disagree, disagree, strongly disagree</td>
</tr>
</tbody>
</table>

### Summary

The history of marijuana consumption within the United States is long, and its use has ranged from medicinal “cures” to recreational consumption to escape from everyday life.

Further, marijuana is widely used by the American people. According to the 2010 National Survey on Drug Use and Health (NSDUH), 17.4 million Americans claimed to have used the drug within the past month. Marijuana use among young people is still prevalent. Even though annual marijuana use among 8th, 10th, and 12th graders has been declining since the mid 1990’s, 22.6 percent of high school seniors (Institute for Social Research, 2012) are considered to be current users, many of which will be entering our colleges and universities to further their education.

Given the prevalence of marijuana use amongst young people, one must consider the effects of short-term versus long-term use. Marijuana use is to be defined as infrequent ingestion of marijuana that has not led to psychological or physiological dependence or interference in the daily functions of the individual. Conversely abuse has been defined succinctly as the antithesis of use (i.e. the drug is interfering with the daily functions of the individual).
The psychopharmacological effects of marijuana do not vary when comparing infrequent use versus abuse. The effects of long-term marijuana use to appear to have a significant inverse relationship with regards to memory, motivation, and emotional control, and little effect on motor functionality. The effects marijuana has on memory and motivation led to a specific discussion regarding the effects of both acute marijuana usage and chronic abuse on academic performance. Those discussions informed the use of the survey instrument (Appendix A) questions AI 1-6, which will be described in more detail in the methods section. A discussion regarding the emotional effects of marijuana followed and correlates to the question SI 1 on the survey instrument (Appendix A).

From there, the effects of marijuana on both academic achievement and social involvement were explored, followed by a review of the pertinent involvement and engagement literature, with special emphasis placed on Astin’s (1985) involvement theory. According to several studies published in the 1970s through the late 1990s, there appears to be a non-statistically significant, inverse relationship between academic achievement and marijuana use. More modern studies revealed that heavy marijuana use does impact one’s chances of stopping out during college – thereby hurting the chances of graduating in a timely fashion. Regarding social involvement on campus, there is evidence suggesting that college freshmen are more likely to engage in illicit drug use, likely due to little direct parental influence and/or the college social environment, where other students may be experimenting with drugs, or they were users upon admittance to college (Suerken et al., 2014). Drug use, in turn, may limit students’ ability to positively socially integrate into the campus culture. According to Astin’s (1985) theory of student involvement, the more a student is engaged on campus the greater the likelihood of his or
her success. The effects of marijuana has on one’s motivation may reduce one’s ability to be academically and socially involved while under the influence of the drug.

A thorough analysis of Anderson’s (1998) cultural identity theory of drug abuse was discussed, which describes how one progresses through the stages of drug use (i.e. non-user, to user, to abuser). In the analysis, personal and social marginalization was explained, as well as what it means to lose control as one develops an identity throughout adolescence, all of which may contribute to developing abuse patterns of drug related behavior. The implications of associating with a drug culture as well as the various meanings of drugs were also discussed as it relates to the glamorization of popular drug culture.

The literature review closed with a discussion as to the creation of the structural model that drove the study. The model which shows the \textit{a priori} relationships between marijuana use and academic and social involvement, gave rise to the survey instrument (Appendix A).
CHAPTER III – METHOD

This chapter provides detailed descriptions of the quantitative research methodology that was employed in the study regarding the impact of marijuana on academic and social involvement, and is organized in such a way to frame the study for replication. The purpose of the study is provided, along with the guiding research premise and rationale for the use of a structural equation study format. Additionally, participant selection procedures, data collection methods, detailed research design, data analysis, maintenance of confidentiality, procedures, and limitations of the study are discussed at length.

The goal of this quantitative, structural equation model was to examine the relationship between marijuana use and academic and social involvement. The relevancy of marijuana usage with respect to education is ever increasing as several states within the United States have begun to legalize marijuana for recreational use. Several studies have identified chronic marijuana users as lacking overall motivation, having impaired mathematical and complex problem solving skills, and overall relatively poor academic performance compared to their peers (Indlekofer, et al., 2008; Lynskey & Hall, 2002; Wadsworth, Moss, Simpson, & Smith, 2006). However, few studies have been conducted to explore the correlation between marijuana use and academic and social involvement. The focus of the present study is to determine any potential correlational relationships between marijuana use and academic and student involvement. Therefore, the guiding research questions and associated hypotheses are:

RQ1: Is there a correlation between marijuana use and academic involvement in undergraduate students?

H₀₁: The use of marijuana will have no effect on academic involvement in undergraduate students.
H\textsubscript{a1}: The use of marijuana will decrease academic involvement in undergraduate students.

RQ2: Is there a correlation between marijuana use and social involvement in undergraduate students?

H\textsubscript{02}: The use of marijuana will have no effect on social involvement in undergraduate students.

H\textsubscript{a2}: The use of marijuana will decrease social involvement in undergraduate students.

RQ3: Is there a difference in academic and social involvement between non-users as compared to infrequent users, weekly users, daily users, or more than once-daily users of marijuana?

H\textsubscript{03}: Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana will not have different levels of academic and social involvement.

H\textsubscript{a3}: Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana will have different levels of academic and social involvement.

To effectively answer the aforementioned questions, a SEM study has been chosen as the preeminent method to discover any potential relationships between the independent and dependent variables. According to Kline (2011), SEM consists of a measurement model that defines latent variables using one or more observed variables, and a structural regression model that associates latent variables together. Once established, the variables were analyzed using simultaneous regression equations.

**Participant Selection Procedures**

**Population**

The participants in this study were selected from a mid-sized, comprehensive community college in the mid-west with a population of undergraduate students of approximately 4,527 students (excluding concurrent enrollment and post-secondary enrollment option students).
Eligible participants ranged in age from 18 to 65, and other demographic data regarding gender, race/ethnicity, and number of credits completed was also collected for those who identify as users.

**Sampling**

The population of undergraduate students is 4,527 (excluding concurrent enrollment and post-secondary enrollment option students). Using Soper’s (2015) *a priori* power analysis software for SEM, the minimum sample size needed is approximately 123 students for a structural equation model to detect an effect size of 0.3, with a power level of 0.80 at the 95 percent confidence level. I used three latent variables (marijuana use, academic involvement, and social involvement) in addition to an initial sixteen observed variables (scale items to measure marijuana use, academic involvement, and social involvement). After adjustments were made upon completing an exploratory factor analysis of the data, the observed variable count was reduced from sixteen to nine.

To achieve a minimum sample of 123 students, I surveyed all 4,527 students in an effort to obtain the appropriate number of students. The survey asked about students’ marijuana use and their academic and social involvement. Further, the survey also asked about students’ current and former “other” drug use (Appendix A) thereby allowing me to screen and exclude those students who are not only using marijuana, but other illicit drugs as well. The rationale was that there is a strong potential for the other drugs interacting and causing the observed effect. The goal of the study was to assess the impact of marijuana on academic and social involvement, and by removing as many variables that could have potentially impacted the latent variables the results of the study became more robust.
Confidentiality Maintenance and Institutional Review Board Approval

The true identity of each participant was never known to the researcher (IP addresses and other identifiable markers were not used during data collection), and each of the participants was assured that their identities were to remain anonymous for the duration of the study and throughout the course of publication. All participants were provided a letter of informed consent, indicating that their participation is completely voluntary and they may withdraw from the study at any time (Appendix B). All data in the form of notes, SPSS files, AMOS files, and consent letters are currently stored on a secure jump drive in a locked cabinet accessible only by the researcher. The files, including any written notes, contained within the locked cabinet will be destroyed after a period of five years. Institutional review board (IRB) approval was obtained from the participating institution on December 1st, 2015 and from St. Cloud State University (SCSU) on December 8th, 2015 (Appendices C and D, respectively).

Instrument Design & Validity

The Marijuana Smoking History Questionnaire (MSHQ) developed by Bonn-Miller and Zvolensky (2009) was used and modified for the study. The MSHQ has been used successfully as a measure of marijuana use history and pattern. The MSHQ will measure consumption patterns and will provide an indication of marijuana use on academic and social involvement. To measure academic and social involvement, I used a scale developed by Sharkness and DeAngelo (2011). The scale appropriately measures academic and social involvement as described throughout my literature review. The Sharkness and DeAngelo social involvement scale yields a Chronbach’s alpha of 0.83, and the academic involvement scale demonstrates a Chronbach’s alpha of 0.76. Both coefficients are representative of a good degree of internal consistency and validity.
I obtained permission to use and modify the MSHQ from Dr. Bonn-Miller on 10.29.2015 via e-mail (Appendix E). Additionally, I obtained permission to use the social and academic involvement scales created by Sharkness and DiAngelo from Dr. Eagan, the current director of the Cooperative Institutional Research Program (CIRP) at the University of California, Los Angeles (UCLA) on 11.2.2015 (Appendix F). I then amalgamated all three scales into one survey document. The hybridized survey measured all three of the latent variables (marijuana use, academic involvement, and social involvement) using sixteen observed variables as shown in Table 1 and yielded a Chronbach’s alpha of 0.700, which is again a good degree of internal validity and consistency.

**Data Collection and Initial Analysis**

Qualtrics software was used to administer the survey to the student population at the participating institution. The survey link was initially e-mailed on December 9th, 2015 (Appendix G) with reminder e-mails sent on December 11th, 14th, 15th and again on January 3rd, 2016 (Appendices H through K, respectively). Of the 4,527 students emailed, 605 participated in the research yielding a 13.36% response rate.

Upon collection, the data were analyzed for missing data. If a participant failed to answer less than 80% of the survey questions, that participant was deleted from the study. All other missing values were replaced with the median for each factor. Further, if there were students who identified as having used cocaine, barbiturates, methamphetamine, other non-prescription stimulants (e.g. Adderall), heroin, or any other illicit substance were eliminated from the study. Due to the above factors, 32 students were eliminated from the study. Therefore the final sample size for non-users was 379 and the final sample size for users was 194, meeting the minimum sample size required for SEM analysis.
With that being said, structural equation modeling requires several rounds of modification to ensure that the \textit{a priori} model is accurate and adequate and that it is measuring what it is supposed to be measuring. In my case, the model refinement followed the following three steps:

1) Exploratory Factor Analysis (EFA) – A method of variable reduction to lead to a parsimonious model.

2) Model Modification – Based on the EFA, the inappropriate variables were removed from the model.

3) Model Fit Tests – Several statistical analyses to ensure the model measures what is supposed to measure.

The next section explains how the EFA led to the creation of a modified model that accurately measured the correlation between marijuana use and academic and social involvement.

\textbf{Exploratory Factor Analysis and Model Refinement}

According to Williams, Onsman, and Brown (2010), exploratory factor analysis (EFA) is a complex multivariate technique used for interpreting self-reported questionnaire data. Further, EFA has three major statistical uses, the first being that EFA allows for the reduction of a large number of variables (factors) to a smaller set in an effort to be parsimonious (that is, developing the simplest model with the least amount of assumptions, but with a high level of explanatory power). Secondly, EFA allows for the establishment of unidimensionality between the measured (or observed) variables and the latent constructs. This process also allows for the generation and refinement of theory. Lastly, EFA provides validity to self-reported questionnaire data (Williams, Onsman, & Brown, 2010).
Since the model was born out of three independent scales, I chose to perform exploratory factor analysis to reduce extraneous variables, discover common factors that lent credence to my \textit{a priori} model, and to provide reliability data to bolster the scale for future use. In other words, I sought to determine if the six SI observed variables correlated highly with the latent variable “Social Involvement” and that the six AI variables correlated with the latent variable “Academic Involvement”, and that the four MSHQ variables correlated with the latent variable “Marijuana Use”.

According to Williams, Onsman, and Brown (2010), exploratory factor analysis (EFA) has five steps (Figure 3). The next several subsections will discuss the five basic steps of EFA and will report the results of those steps in each subsection.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{factor_analysis_steps}
\caption{The five basic steps of exploratory factor analysis. Image adapted from Williams, Onsman, and Brown (2010). Used with permission (Appendix L).}
\end{figure}
Data suitability for factor analysis. According to Williams, Onsman, and Brown (2010), several tests ought to be conducted to determine if the data is suitable for factor analysis. The first test performed was the Kaiser-Meyer-Olkin (KMO) test, which measured sampling adequacy and initial factorability. Generally speaking, the KMO index is on a scale of 0 to 1, with anything higher the 0.50 being considered suitable for factor analysis (that is, the sample size was adequate and factorability established). The initial factorability of the 21 scale items (Appendix A) was analyzed using SPSS. To determine sampling adequacy and initial factorability, a Kaiser-Meyer-Olkin (KMO) test was performed. The initial KMO measure of sampling adequacy was found to be 0.759, above the generally acceptable value of 0.50. The next test was Bartlett’s test of sphericity, which assessed if collinearity (that is, high levels of correlation) was expressed or not. Bartlett’s test ought to be significant (p<0.05) for the data to be considered factorable (Williams, Onsman, & Brown, 2010). This test assesses if the variables are perfectly correlated or not. In other words, this test is examining whether or not the variables express noncollinearity (an identity matrix, or in other words that the model is unchanged or not correlated). The determinant of the matrix was then converted to a chi-square statistic and subsequently tested for significance. With this test, one operates under the null hypothesis that the variables are indeed an identity matrix (that is, exhibiting no correlation); therefore, a significant result would be indicative that the variables do exhibit collinearity. The results of the initial Bartlett’s test of sphericity was found to be significant ($\chi^2(210)=786.89$, p<0.001), therefore the null hypothesis that the variables form an identity matrix has been rejected and collinearity has been confirmed.

Factor extraction. With the presence of collinearity established and adequate factorability achieved, I examined the initial communalities (that is, the sum of the squared loadings for that
particular variable) as well as the extracted factors. The primary goal of factor extraction and rotation is to simplify the solution (Williams, Onsman, & Brown, 2010). That is, extract and rotate such that high item loadings exist on one factor, with lower loadings on the others. There are many ways to extract factors, with Principal Components Analysis (PCA) and Principal Axis Factoring (PAF) being the most common in the literature (Henson & Roberts, 2006). However, PCA and PAF are generally recommended when no a priori model exists (Williams, Onsman, & Brown, 2010). Since I did generate an a priori model and my data were relatively normally distributed, I chose maximum likelihood as an extraction method because according to Fabrigar, Wegener, MacCallum, and Strahan (1999):

> If data are relatively normally distributed, maximum likelihood is the best choice because it allows for the computation of a wide range of indexes of the goodness of fit of the model [and] permits statistical significance testing of factor loadings and correlations among factors and the computation of confidence intervals (p. 277).

Principal axis factoring, another common factoring procedure mentioned above was not used due to its merely descriptive nature and lack of significance tests. Using the maximum likelihood extraction method, I generated a communalities table that allowed me to visualize the factor loadings (that is, the correlation of each question, or variable, to the factor, or latent variable). Upon examination, the communalities revealed several items with loadings less than 0.3 and one factor loading of 0.999 (Table 2). I highlighted those factor loadings that are questionable in yellow within Table 2.
Table 2

*Initial communalities* using the maximum likelihood extraction.

<table>
<thead>
<tr>
<th>Question</th>
<th>Initial</th>
<th>Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Since entering this college, how often have you felt isolated from campus life?</td>
<td>.170</td>
<td>.310</td>
</tr>
<tr>
<td>Please rate your satisfaction with this institution in terms of your interactions with other stu...</td>
<td>.577</td>
<td>.653</td>
</tr>
<tr>
<td>Please rate your satisfaction with this institution in terms of the availability of campus social...</td>
<td>.478</td>
<td>.534</td>
</tr>
<tr>
<td>Please rate your satisfaction with this institution in terms of your social life.</td>
<td>.556</td>
<td>.639</td>
</tr>
<tr>
<td>Please rate your satisfaction with this institution in terms of the overall sense of community am...</td>
<td>.623</td>
<td>.732</td>
</tr>
<tr>
<td>Indicate the extent to which you agree or disagree with the statement… I see myself as part of th...</td>
<td>.315</td>
<td>.499</td>
</tr>
<tr>
<td><strong>How often in the past year did you support your opinions with a logical argument?</strong></td>
<td><strong>.300</strong></td>
<td><strong>.999</strong></td>
</tr>
<tr>
<td>How often in the past year did you evaluate the quality/reliability of information you received?</td>
<td>.301</td>
<td>.345</td>
</tr>
<tr>
<td>How often in the past year did you seek alternative solutions to a problem?</td>
<td>.295</td>
<td>.450</td>
</tr>
<tr>
<td>How often in the past year did you look up scientific research articles and resources?</td>
<td>.233</td>
<td>.336</td>
</tr>
<tr>
<td>How often in the past year did you explore topics on your own, even though it was not required fo...</td>
<td>.268</td>
<td>.348</td>
</tr>
<tr>
<td><strong>How often in the past year did you seek feedback on your academic work?</strong></td>
<td><strong>.150</strong></td>
<td><strong>.215</strong></td>
</tr>
<tr>
<td>Do you currently or have you ever smoked marijuana?</td>
<td>.056</td>
<td>.036</td>
</tr>
<tr>
<td>Please rate your marijuana use in the past 30 days.</td>
<td>.422</td>
<td>.725</td>
</tr>
<tr>
<td>Based upon the following images, on average, how much marijuana do you ingest per occasion?</td>
<td>.375</td>
<td>.479</td>
</tr>
<tr>
<td><strong>How old were you when you first smoked marijuana?</strong></td>
<td><strong>.104</strong></td>
<td><strong>.112</strong></td>
</tr>
<tr>
<td>How many years have you been using marijuana?</td>
<td>.291</td>
<td>.336</td>
</tr>
<tr>
<td>What is your gender?</td>
<td>.133</td>
<td>.420</td>
</tr>
<tr>
<td><strong>What is your ethnic background?</strong></td>
<td><strong>.060</strong></td>
<td><strong>.078</strong></td>
</tr>
<tr>
<td>What is your age (years)?</td>
<td>.400</td>
<td>.881</td>
</tr>
<tr>
<td><strong>How many semesters of college have you successfully completed?</strong></td>
<td><strong>.244</strong></td>
<td><strong>.267</strong></td>
</tr>
</tbody>
</table>

a. One or more communality estimates greater than 1 were encountered during iterations. The resulting solution should be interpreted with caution.
Factor loadings less than 0.3 present nominal meaning and the associated variables should be removed from the scale (Kline, 2011). Further, the variable, “How often in the past year did you support your opinions with a logical argument?” yielded a factor loading of 0.999 – which is a red flag to the researcher because perfect (or in this case, near perfect) correlation does not exist. With that being said, that variable ought to be removed from the scale. Additionally, the variables “What is your gender?” and “What is your age (years)?” also should be removed from the scale, even with high factor loadings, because they were not part of the a priori model. Before removing any variables, I generated a pattern matrix using Promax rotation (Table 3).
Table 3

*Initial pattern matrix using maximum likelihood as an extraction method. Promax was used as a rotation method.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
<th>Factor 6</th>
<th>Factor 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please rate your satisfaction with this institution in terms of the overall sense of community am...</td>
<td>.861</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please rate your satisfaction with this institution in terms of your social life.</td>
<td>.814</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please rate your satisfaction with this institution in terms of your interactions with other stu...</td>
<td>.779</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please rate your satisfaction with this institution in terms of the availability of campus social...</td>
<td>.741</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often in the past year did you seek alternative solutions to a problem?</td>
<td>.652</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often in the past year did you look up scientific research articles and resources?</td>
<td>.590</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often in the past year did you explore topics on your own, even though it was not required fo...</td>
<td>.564</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often in the past year did you evaluate the quality/reliability of information you received?</td>
<td>.443</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often in the past year did you seek feedback on your academic work?</td>
<td>.416</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is your age (years)?</td>
<td>.923</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many semesters of college have you successfully completed?</td>
<td>.499</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please rate your marijuana use in the past 30 days.</td>
<td>.823</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Based upon the following images, on average, how much marijuana do you ingest per occasion?</td>
<td>.596</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>How many years have you been using marijuana?</strong></td>
<td>.452</td>
<td>.453</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How old were you when you first smoked marijuana?</td>
<td>-.342</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often in the past year did you support your opinions with a logical argument?</td>
<td>.993</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you currently or have you ever smoked marijuana?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicate the extent to which you agree or disagree with the statement... I see myself as part of th...</td>
<td>.577</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Since entering this college, how often have you felt isolated from campus life?</td>
<td>.562</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is your gender?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.640</td>
</tr>
<tr>
<td>What is your ethnic background?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Rotation method selection. Rotation of the axis maximizes high item loadings and minimizes low loadings, thereby producing a more parsimonious solution (Williams, Onsman, & Brown, 2010). There are several varieties of rotation methods one can use. Broadly speaking, there are two categories of rotations – orthogonal and oblique rotations. Orthogonal rotations generate factor structures that are uncorrelated whereas oblique rotations generate factor structures that are correlated (Williams, Onsman, & Brown, 2010). I chose Promax (an oblique rotation method) as a rotation method because I suspected the data to be somewhat correlated, but wanted to be free of orthogonal constraints (e.g. not forcing factors to be uncorrelated when they are). According to Costello and Osborne (2005), the use of Promax rotation (an oblique rotation method) is superior to Varimax (a commonly used orthogonal rotation method) because, “Using orthogonal rotation results in a loss of valuable information if the factors are correlated, and oblique rotation should theoretically render a more accurate, and perhaps more reproducible, solution [because factors are allowed to correlate]” (pg. 3).

Variable reduction. Table 3 (pg. 71) allowed me to visualize any potential cross-loadings between factors. Cross-loading variables ought to be eliminated as well because if a variable is loading on two factors, there is a correlational error being made. More specifically, the correlation is being “shared” between factors, which typically will show weak correlations on either factor. At any rate, cross loading is not desirable and should be eliminated.

Since the variable “How many years have you been using marijuana” cross-loaded with two factors, it was removed. As mentioned earlier, all variables with loadings less than 0.30 were removed, and the variables associated with the demographic questions in the survey that were not part of the a priori model were also removed. Therefore, a grand total of 12 observed
variables were removed from the model either due to a cross-loading issue, weak factor loadings, or because the variable was not present in the *a priori* model.

Now that 12 scale items were removed, I conducted a second exploratory factor analysis that yielded nine scale items with three factors extracted (which aligned with the *a priori* predicted latent variables (factors) of academic involvement, social involvement, and marijuana use). The final KMO measure of sampling adequacy was 0.739 and the final Bartlett’s test of sphericity was again found to be significant ($\chi^2(36)=475.86, p<0.001$). The final communalities were all well above 0.3 (Table 4) with the exception of the variable, “How often in the past year did you seek alternative solutions to a problem?” I chose to keep this variable in the model, even with a borderline weak factor loading, for two reasons: 1) Oversimplifying a model is considered to be more risky than under simplifying (Kline, 2011) and 2) I felt that is contributed to the academic involvement scale and ought not be ignored.

Table 4

*Final communalities table using maximum likelihood as an extraction method.*

<table>
<thead>
<tr>
<th>Item</th>
<th>Initial</th>
<th>Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please rate your satisfaction with this institution in terms of your interactions with other stu...</td>
<td>.558</td>
<td>.651</td>
</tr>
<tr>
<td>Please rate your satisfaction with this institution in terms of the availability of campus social...</td>
<td>.467</td>
<td>.530</td>
</tr>
<tr>
<td>Please rate your satisfaction with this institution in terms of your social life.</td>
<td>.534</td>
<td>.619</td>
</tr>
<tr>
<td>Please rate your satisfaction with this institution in terms of the overall sense of community am...</td>
<td>.610</td>
<td>.737</td>
</tr>
<tr>
<td>How often in the past year did you support your opinions with a logical argument?</td>
<td>.237</td>
<td>.387</td>
</tr>
<tr>
<td>How often in the past year did you evaluate the quality/reliability of information you received?</td>
<td>.276</td>
<td>.520</td>
</tr>
<tr>
<td>How often in the past year did you seek alternative solutions to a problem?</td>
<td>.202</td>
<td>.310</td>
</tr>
<tr>
<td>Please rate your marijuana use in the past 30 days.</td>
<td>.340</td>
<td>.666</td>
</tr>
<tr>
<td>Based upon the following images, on average, how much marijuana do you ingest per occasion?</td>
<td>.338</td>
<td>.501</td>
</tr>
</tbody>
</table>
As shown in Table 4, the first set of four variables correspond to social involvement scale and survey questions 2, 3, 4, and 5. The second set of variables correspond to the academic involvement scale and survey questions 7, 8, and 9. Lastly, the third set of variables correspond to the marijuana smoking history scale and survey questions 14 and 15. The complete set of survey questions can be found in Appendix A.

**Criteria for determining factor extraction.** Since the goal of factor extraction is primarily a data reduction tool to simply the results, one must provide scale unidimensionality. Based on the final communalities table (Table 4) it became apparent that I had extracted three factors that aligned with the three latent variables (AI, SI, and Marijuana Use) that I developed *a priori*. To ensure that the three emergent factors did indeed explain the variance within my model, I sought to demonstrate that the factors aligned using two extraction rules. I chose the cumulative percentage of variance and also applied the eigenvalue greater than one rule (eigenvalue > 1). While in the hard sciences the suggested threshold of explained variance is 95%, in the soft sciences, total percentage of explained variance is often between 50-60% (Williams, Onsman, & Brown, 2010). The eigenvalue > 1 rule suggests that if a factor has an eigenvalue greater than one, that particular factor explains more variance than a single particular variable.

The initial eigenvalues for the three extracted factors are all greater than one, which means each factor explains more variance than a single particular variable. The final value for total variance explained was a cumulative 54.69% using the three factors extracted (Table 5).
Table 5

Total variance explained showing the initial Eigenvalues using the maximum likelihood extraction method, as well as the extracted SS loadings. The total variance explained by the model is 54.688%.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
</tr>
<tr>
<td>1 (SI)</td>
<td>2.904</td>
<td>32.264</td>
</tr>
<tr>
<td>2 (AI)</td>
<td>1.800</td>
<td>20.005</td>
</tr>
<tr>
<td>3 (MJ)</td>
<td>1.572</td>
<td>17.467</td>
</tr>
</tbody>
</table>

In other words, 54.69% of the common variance is accounted for by the three final factors of social involvement (SI), academic involvement (AI), and Marijuana Use (MJ).

Factor labeling. The now nine observed variables are highly correlated with each respective latent variable, or factor (Table 3 and Table 4, respectively). Composite scores were calculated via summation for each latent factor. For the academic and social involvement scales, a higher value corresponds to lower involvement. For the marijuana use scale, a higher value is representative of higher use. To ensure maintenance of normalization, the composite scores were analyzed for skewness and kurtosis and the social involvement and marijuana use factors were found to be slightly skewed (Table 6), but within the acceptable bounds of +/- 2 for parametric analysis. A reliability analysis was then performed on each of the factors. The Chronbach’s alpha value for social involvement was 0.87, academic involvement was 0.66, and marijuana use was 0.74 (Table 6).
Table 6

Descriptive statistics for the three composite factor items of social involvement (SI), academic involvement (AI), and marijuana use (MJ).

<table>
<thead>
<tr>
<th>Factor</th>
<th>N</th>
<th>Mean</th>
<th>Std. Error</th>
<th>Skewness Statistic</th>
<th>Std. Error</th>
<th>Kurtosis Statistic</th>
<th>Std. Error</th>
<th>Chronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SI</td>
<td>194</td>
<td>13.2031</td>
<td>.47755</td>
<td>1.151</td>
<td>.175</td>
<td>1.228</td>
<td>.349</td>
<td>0.87</td>
</tr>
<tr>
<td>2. AI</td>
<td>194</td>
<td>4.7187</td>
<td>.11282</td>
<td>.751</td>
<td>.175</td>
<td>-.275</td>
<td>.349</td>
<td>0.66</td>
</tr>
<tr>
<td>3. MJ</td>
<td>194</td>
<td>3.0521</td>
<td>.11671</td>
<td>1.514</td>
<td>.175</td>
<td>1.247</td>
<td>.349</td>
<td>0.74</td>
</tr>
</tbody>
</table>

The three extracted factors (SI, AI, & Marijuana Use) noted above correspond to the a priori factors established in the theoretical model. The Chronbach’s values each exhibit a good degree of internal consistency (i.e. they are measuring what they ought to be measuring). With the EFA complete, the model was then ready to be tested for fit.

**Model Modification**

Using the information derived from the exploratory factor analysis, my a priori model was modified for better alignment. I removed the same variables from the SEM that were removed during the EFA. The post hoc model is shown in Figure 4. The final scale items that were used in the model are found in Table 7.
Figure 4. *Post hoc* model after suggested modifications based upon EFA. The observed variables codes are found in Table 7. The latent variable “Social Involvement” is informed by the four observed variables SI 5, 2, 4, and 3. The latent variable “Academic Involvement” is informed by three observed variables AI 1, 2, and 3. The latent variable “Marijuana Use” is informed by the two observed variables “30 Day Use” and “Amount Consumed”. Error terms have been applied to each observed variable. Further, error terms have been applied to the latent variables “Social Involvement” and “Academic Involvement”. The “1’s” represent regression weight constraints.
Table 7

*Descriptions of the final nine observed variables used in the study. These observed variables correspond to the observed variables found within the post hoc model (Figure 4).*

<table>
<thead>
<tr>
<th>Associated Scale</th>
<th>Observed Variable Name</th>
<th>Code</th>
<th>Associated Survey Question</th>
<th>Measurement Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSHQ</td>
<td>30 Day Marijuana Use</td>
<td>30 Day Marijuana Use</td>
<td>14</td>
<td>No use, once per week, once per day, more than once per day</td>
</tr>
<tr>
<td>MSHQ</td>
<td>Amount Consumed</td>
<td>Amount Consumed</td>
<td>15</td>
<td>Small, medium, large, very large</td>
</tr>
<tr>
<td>Academic Involvement Scale</td>
<td>Support opinions with a logical argument</td>
<td>AI 1</td>
<td>7</td>
<td>Frequently, occasionally, not at all</td>
</tr>
<tr>
<td>Academic Involvement Scale</td>
<td>Evaluate quality/reliability of information</td>
<td>AI 2</td>
<td>8</td>
<td>Frequently, occasionally, not at all</td>
</tr>
<tr>
<td>Academic Involvement Scale</td>
<td>Seeking of alternate solutions</td>
<td>AI 3</td>
<td>9</td>
<td>Frequently, occasionally, not at all</td>
</tr>
<tr>
<td>Social Involvement Scale</td>
<td>Satisfaction with interactions with other students</td>
<td>SI 2</td>
<td>2</td>
<td>Very satisfied, satisfied, somewhat satisfied, dissatisfied, neutral, somewhat dissatisfied, very dissatisfied, can’t rate/no experience</td>
</tr>
<tr>
<td>Social Involvement Scale</td>
<td>Satisfaction with availability of social activities</td>
<td>SI 3</td>
<td>3</td>
<td>Very satisfied, satisfied, somewhat satisfied, neutral, somewhat dissatisfied, dissatisfied, very dissatisfied, can’t rate/no experience</td>
</tr>
<tr>
<td>Social Involvement Scale</td>
<td>Satisfaction with social life</td>
<td>SI 4</td>
<td>4</td>
<td>Very satisfied, satisfied, somewhat satisfied, neutral, somewhat dissatisfied, dissatisfied, very dissatisfied, can’t rate/no experience</td>
</tr>
<tr>
<td>Social Involvement Scale</td>
<td>Satisfaction with overall sense of community</td>
<td>SI 5</td>
<td>5</td>
<td>Very satisfied, satisfied, somewhat satisfied, neutral, somewhat dissatisfied, dissatisfied, very dissatisfied, can’t rate/no experience</td>
</tr>
</tbody>
</table>

This model, informed by the EFA, explains the structural relationship between the latent variables of social involvement, academic involvement, and marijuana use as informed by the
nine observed variables obtained from the survey data. With the model re-drawn, it was then ready to be tested for fit.

Model Fit Testing

Structural equation models are tested for fit to ensure that the model can reproduce the data with reasonable consistency (Kline, 2011) In other words, if the model exhibits a good measure of fit, it would allow different data sets to be used in the model without having to re-specify the model based on the new data set. Since I used maximum likelihood as an extraction method (which requires that data to be drawn from a normally distributed population), I was able to use many fit indices to measure the fit of my model.

The first model fit test performed was the chi-square goodness of fit index. In order to conduct this test, one must generate a null hypothesis that the chi-square statistic is equal to zero ($\chi^2=0$), which is indicative of a better fit. In other words, the test measures how "close" the observed values are to those, which would be expected under the fitted model. Further, in order to accept that the model has a good fit, one must generate a non-significant result. For my model, the chi-square goodness of fit index yielded a non-significant result ($\chi^2(21), 17.86, p=0.658$). With such a large $p$-value, I failed to reject the null hypothesis that $\chi^2=0$, showing a model with a good measure of fit.

Next a Comparative Fit Index (CFI) was performed which compared my model to a baseline model that assumes no correlation between the variables. The CFI is measured on a scale of 0 to 1, with zero showing no correlation and one showing high correlation. A CFI of 1.000 was obtained for my model, indicative of excellent fit.

A Root Mean Square Error of Approximation (RMSEA) value was calculated next, which looks for discrepancies between the observed and predicted covariance. Generally
speaking, values below 0.05 are adequate and my model yielded a RMSEA value of 0.000, indicative of exact fit.

The final measure of fit was the $p$-value for the null hypothesis (PCLOSE), which measures the one-sided test of the null hypothesis equal 0.05. My model provided a PCLOSE value of 0.949, indicative of a good fit.

In aggregate, the fit of this model is excellent. However, Kline (2011) argues that good fit does not imply a correct model, only that the model is plausible. I echo those same trepidations throughout the interpretation and use of my model.

**Summary of Model Refinement**

An exploratory factor analysis (EFA) was performed to refine the hypothetical model developed *a priori* in Chapter 2. Throughout the course of the EFA, the original 21 observed variables were reduced to 9 observed variables – thereby leading to a more parsimonious model. Of the remaining nine observed variables, four corresponded to the latent variable “Social Involvement”, three corresponded to the latent variable “Academic Involvement”, and two corresponded to the latent variable “Marijuana Use.” The refined model was then tested for fit using four fitness measurements. The model exhibited excellent fit based upon the results of each fitness test.

**Data Analysis Using the Model**

Now that the model has been modified based upon the EFA and has demonstrated a good measure of fit, it was ready to use to assess the first two research questions:

RQ1: Is there a correlation between marijuana use and social involvement in undergraduate students?
RQ2: Is there a correlation between marijuana use and academic involvement in undergraduate students?

With that being said, the model was used to perform a path analysis on the data to determine the correlation or regression weights between the latent construct “Marijuana Use” on both “Academic Involvement” and “Social Involvement”. A path analysis draws correlations between the latent variables (e.g. the correlation between “marijuana use” and “academic involvement”).

**Data Analysis Using Independent Samples t-Tests**

Although the SEM was a useful tool to measure the regression weights between the latent variables of “Marijuana Use”, “Academic Involvement”, and “Social Involvement” to address the first two research questions, the model was not used to address RQ3, or:

RQ3: Is there a difference in academic and social involvement between non-users as compared to infrequent users, weekly users, daily users, or more than once daily users of marijuana?

To address RQ3, group statistics were gathered for the following five groups for the AI and SI scales:

1. Non-users
2. Infrequent users
3. Weekly users
4. Once daily users
5. More than one daily users

From there, Hartley’s test was conducted on each test group as compared to non-users to ensure equal variance between populations. Equal variance must be established in order to run independent samples t-tests, or one risks breaking statistical rules of parametric analysis. Upon
establishing equal variance, independent samples $t$-tests were performed to test the significance of the means between non-users as compared to infrequent users, once daily users, or multiple daily users regarding academic and social involvement as outlined in RQ 3.

**Generalizability and External Validity**

According to Creswell (2008), the concept of external validity states that the research findings can be transferred or extrapolated to similar populations outside of the population from which the sample was derived. The use of SEM allows for robust and powerful statistical analysis, allowing for potential modeling and forecasting. The idealized sample size is sufficient for the population from which the sample is to be drawn. Due to the nature of the study, however, I surveyed the entire population of eligible students to ensure that I obtained the minimum of 123 students who use marijuana. Due to the robust nature of SEM, the refined model developed in this study could be used in the future with different data sets. From a higher education administration perspective, the use of illicit drugs is disconcerting as academic institutions are continually attempting to identify the reasons for poor academic performance, low graduation rates, and high drop-out and stop-out rates. The results of the study will show that involvement in community college students warrants greater examination – both with and without the influence of marijuana and other drugs.

**Summary**

This chapter provided detailed descriptions of the structural equation modeling research methodology to be employed in the study. The purpose of the study was to ascertain the relationship between marijuana use and academic achievement and student involvement. The research is valid due to the increasing number of states within the union that have legalized marijuana for recreational use. These laws will undoubtedly have an impact on education – and
the goal of the research is to demonstrate the relationship between marijuana use and academic and social involvement. Participants in the study were obtained from the student population, as long as they met the eligibility criteria. The survey was administered via e-mail using Qualtrics software. Data regarding academic and social involvement was collected along with data regarding marijuana and other drug use. Demographic data was collected for marijuana users as well.

The data was analyzed in SPSS and an exploratory factor analysis was performed on the model developed in Chapter 2. This model was created to address the correlation between marijuana use and academic and social involvement. Upon refinement of the model, it was then tested for fit using Chi-Square, CFI, RMSEA, and PCLOSE fitness tests. With fitness established, SPSS AMOS was used to perform a path analysis to determine any correlational relationships between the latent variables “Marijuana Use” and “Academic Involvement” as well as “Social Involvement” thereby addressing RQ1 and RQ2. To address RQ3, multiple independent samples t-tests were used to assess the differences in academic and social involvement between non-users as compared to infrequent, weekly, daily, or more than once daily users.
CHAPTER IV – RESULTS

As demonstrated in Chapter 2, marijuana use has disparate effects on the human body. These effects range from memory recall issues to complete psychosis. From an academic and social involvement perspective, however, the effects are much more nebulous depending on the type of study employed and the decade in which it was administered. Given the nature of involvement and success, one could argue that a student must be involved (academically, socially or both) in order to be successful during the collegiate experience (Wolf-Wendel, Ward, & Kinzie, 2009). Given marijuana’s historical and social status as a drug that promotes lackadaisical behavior coupled with a functional loss of memory and motivation, logic would suggest an inverse relationship between marijuana use and academic and social involvement. Therefore the research questions and associated hypotheses driving the present study are as follows:

RQ1: Is there a correlation between marijuana use and academic involvement in undergraduate students?

H₀₁: The use of marijuana will have no effect on academic involvement in undergraduate students.

Hₐ₁: The use of marijuana will decrease academic involvement in undergraduate students.

RQ2: Is there a correlation between marijuana use and social involvement in undergraduate students?

H₀₂: The use of marijuana will have no effect on social involvement in undergraduate students.

Hₐ₂: The use of marijuana will decrease social involvement in undergraduate students.
RQ3: Is there a difference in academic and social involvement between non-users as compared to infrequent users, weekly users, daily users, or more than once daily users of marijuana?

$H_{03}$: Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana will not have different levels of academic and social involvement.

$H_{a3}$: Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana will have different levels of academic and social involvement.

To address RQ1 and RQ2, a SEM was created to assess any correlation between the latent variables “Marijuana Use”, “Academic Involvement”, and “Social Involvement”. To address RQ3, several independent sample $t$-tests were performed, after equal variance was confirmed using Hartley’s test of equal variance, to assess the statistical difference between the mean AI and SI scores of non-users as compared to infrequent, weekly, daily, and more than once daily users of marijuana.

This chapter has been organized into four sections. The first section describes the demographics of the participants in the study. From there, I will answer the first two research questions regarding the correlation between marijuana use and academic and social involvement using the developed SEM. The third research question regarding the difference in AI and SI between non-users as compared to infrequent, weekly, daily, and more than once daily users is answered using several independent sample $t$-tests, after equal variance was shown using Hartley’s test for equal variance. The chapter closes with a succinct summary of the findings of the study.

**User Demographics**

I determined that demographic descriptive data would be helpful when trying to develop and target policies to certain groups of individuals based on the results of the study. Therefore, I
have included statistics regarding the gender, ethnic backgrounds, age, and number of semesters completed of the users of marijuana in this section. These statistics include both 30-day use patterns as well as the relative amount of marijuana consumed per session.

**Gender**

Of the 194 respondents that used marijuana, 59 (30.3%) identified as male, 135 (69.2%) identified as females, and 1 (0.5%) identified as transgender (Table 8).

Table 8

<table>
<thead>
<tr>
<th>Frequency distribution of user gender.</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>59</td>
<td>30.3</td>
<td>30.3</td>
</tr>
<tr>
<td>Female</td>
<td>135</td>
<td>69.2</td>
<td>99.5</td>
</tr>
<tr>
<td>Transgender</td>
<td>1</td>
<td>.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>194</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

When the respondents were asked about the frequency in which they smoked marijuana, it appears males either infrequently use or use marijuana multiple times per day, where the females tend to use the drug more infrequently (Table 9).

Table 9

<table>
<thead>
<tr>
<th>Cross tabulation of user gender with past 30 day marijuana use.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please rate your marijuana use in the past 30 days.</td>
</tr>
<tr>
<td>In frequent use</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>What is your gender?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Further, it appears that the female respondents tended to consume more marijuana per occasion under the small, medium, and large quantity images as compared to the male
respondents, with the exception of the fourth category, or very large amount where males out-
consumed female respondents (Table 10).

Table 10

Cross tabulation of user gender with amount of marijuana consumed. The marijuana cigarettes depicted below are described as “small”, “medium”, “large”, and “very large” amounts of marijuana.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your gender?</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>27</td>
</tr>
<tr>
<td>Female</td>
<td>95</td>
</tr>
<tr>
<td>Transgender</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
</tr>
</tbody>
</table>

Based upon the following images, on average, how much marijuana do you ingest per occasion?

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>194</td>
</tr>
</tbody>
</table>

To summarize, the majority of the respondents that used marijuana were female, and most of the females who consumed marijuana did so on an infrequent basis. Further, of the female respondents that used marijuana, the majority of them used small amounts of marijuana per occasion. Since there was only one trans-gender student, there were not enough respondents to make comparisons between groups.

Ethnicity

In terms of respondent ethnicity, 3 (1.5%) identified as African American/Black, 2 (1.0%) as Asian/Pacific Islander, 171 (88.1%) as Caucasian, 5 (2.6%) as Hispanic/Latino/Latina, 12 (6.2%) as more than one ethnic background, and 1 (0.5%) preferred not to disclose (Table 11).
Table 11

*Frequency distribution of respondent user ethnic background.*

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American/Black</td>
<td>3</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>2</td>
<td>1.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Caucasian</td>
<td>171</td>
<td>88.1</td>
<td>90.6</td>
</tr>
<tr>
<td>Hispanic/Latino/Latina</td>
<td>5</td>
<td>2.6</td>
<td>93.2</td>
</tr>
<tr>
<td>More than one (1) ethnic background</td>
<td>12</td>
<td>6.3</td>
<td>99.5</td>
</tr>
<tr>
<td>Prefer not to disclose</td>
<td>1</td>
<td>.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>194</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

When the respondents were asked what ethnicity they identified as, it was revealed that those who used marijuana were predominantly Caucasian and used marijuana in all four use clusters more than any other ethnicity or combination of ethnicities (Table 12).

Table 12

*Cross tabulation of user ethnic background with past 30 day marijuana use.*

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Infrequent use</th>
<th>Once per week</th>
<th>Once per day</th>
<th>More than once per day</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your ethnic background?</td>
<td>African American/Black</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Asian/Pacific Islander</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Caucasian</td>
<td>127</td>
<td>14</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Hispanic/Latino/Latina</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>More than one (1) ethnic background</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Prefer not to disclose</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>146</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>194</td>
</tr>
</tbody>
</table>

As shown before, Caucasians consumed more marijuana in each of the four categories as compared to any other ethnicity or combination of ethnicities (Table 13).
Table 13

Cross tabulation of user ethnic background with amount of marijuana consumed. The marijuana cigarettes depicted below are described as “small”, “medium”, “large”, and “very large” amounts of marijuana.

<table>
<thead>
<tr>
<th>What is your ethnic background?</th>
<th>African American/Black</th>
<th>Asian/Pacific Islander</th>
<th>Caucasian</th>
<th>Hispanic/Latino/Latina</th>
<th>More than one (1) ethnic background</th>
<th>Prefer not to disclose</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>105</td>
<td>40</td>
<td>14</td>
<td>11</td>
<td>170</td>
<td>170</td>
<td>122</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
<td>43</td>
<td>16</td>
<td>13</td>
<td>194</td>
<td>194</td>
<td>194</td>
</tr>
</tbody>
</table>

Based upon the following images, on average, how much marijuana do you ingest per occasion?

To summarize, of the respondents that used marijuana, Caucasians consumed marijuana in each of the four 30 day usage categories more than any other ethnicity or combination of ethnicities. Additionally, Caucasians ingested marijuana in all four ingestion categories. Comparisons between different ethnicities could not be made due to low response rates from the ethnic groups.

Age

In terms of age, 54 (27.8%) were between the ages of 18 and 21, 36 (18.6%) between 21 and 24, 19 (9.8%) between 24 and 27, and 85 (43.8%) between 27 and 65 (Table 14).
Table 14

*Frequency distribution of user age in years.*

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Between 18 and 21</td>
<td>54</td>
<td>27.8</td>
</tr>
<tr>
<td>Between 21 and 24</td>
<td>36</td>
<td>18.6</td>
</tr>
<tr>
<td>Between 24 and 27</td>
<td>19</td>
<td>9.8</td>
</tr>
<tr>
<td>Between 27 and 65</td>
<td>85</td>
<td>43.8</td>
</tr>
<tr>
<td>Total</td>
<td>194</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Therefore, these results reflect the age demographics of the larger two of four campuses that comprise the college studied. The second largest campus is comprised of predominately traditionally aged students (using the age scales of this study, 18-21), whereas the largest campus is mostly older than average students (again, using the age scales of this study, 27 and older). These values also reflect national trends. According to the American Association of Community Colleges fact sheet (2016), the average age of community college students is 28 years.

Since most of the respondents that used marijuana were between the ages of 27 and 65, it should be noted that according to the data, even though the majority of the users were older, they primarily engaged in infrequent use (Table 15). The people aged between 18 and 27, however, had several more instances of weekly, daily, and more than once daily use of marijuana (Table 15). These data relate back to the national trends discussed in Chapter 2 (Substance Abuse and Mental Health Services Administration, 2012).
Table 15

Cross tabulation of user age in years with past 30 day marijuana use.

<table>
<thead>
<tr>
<th>What is your age (years)?</th>
<th>Infrequent use</th>
<th>Once per week</th>
<th>Once per day</th>
<th>More than once per day</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between 18 and 21</td>
<td>33</td>
<td>5</td>
<td>10</td>
<td>6</td>
<td>54</td>
</tr>
<tr>
<td>Between 21 and 24</td>
<td>26</td>
<td>7</td>
<td>1</td>
<td>3</td>
<td>37</td>
</tr>
<tr>
<td>Between 24 and 27</td>
<td>16</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Between 27 and 65</td>
<td>71</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>84</td>
</tr>
<tr>
<td>Total</td>
<td>146</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>194</td>
</tr>
</tbody>
</table>

When respondents were asked about their age, it was revealed that people aged between 27 and 65 tended to consume small and medium amounts of marijuana as compared to those between the ages of 18 and 24 who tended to consume larger amounts, on average (Table 16).

Table 16

Cross tabulation of user age in years with amount of marijuana consumed. The marijuana cigarettes depicted below are described as “small”, “medium”, “large”, and “very large” amounts of marijuana.

<table>
<thead>
<tr>
<th>What is your age (years)?</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between 18 and 21</td>
<td>55</td>
</tr>
<tr>
<td>Between 21 and 24</td>
<td>37</td>
</tr>
<tr>
<td>Between 24 and 27</td>
<td>19</td>
</tr>
<tr>
<td>Between 27 and 65</td>
<td>83</td>
</tr>
<tr>
<td>Total</td>
<td>194</td>
</tr>
</tbody>
</table>

In summary, the majority of the respondents that used marijuana were between the ages of 27 and 65. Of those users, most of them consumed marijuana on an infrequent basis. When those users did consume, however, they consumed small and medium amounts of marijuana as
compared to those between the ages of 18 and 27, who in total tended to consume larger amounts of marijuana per occasion.

**Number of Semesters Completed**

Next, I looked at the number of semesters completed by the users of marijuana.

Regarding the number of college semesters completed, 9 (4.6%) have completed zero semesters, 56 (28.9%) have completed 1-2 semesters, 53 (27.3%) 3-4 semesters, 32 (16.5%) 5-6 semesters, 16 (8.2%) 7-8 semesters, 9 (4.6%) 9-10 semesters, 7 (3.6%) 11-12 semesters, and 12 (6.3%) have completed more than 12 semesters of college (Table 17). These data show that 56.2% of respondents who use marijuana have completed 1 to 4 semesters of college successfully.

Table 17

*Frequency distribution of the numbers of semester successfully completed (a grade of “D” or higher) by users.*

<table>
<thead>
<tr>
<th>How many semesters of college successfully completed?</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>9</td>
<td>4.6</td>
<td>4.6</td>
</tr>
<tr>
<td>1-2</td>
<td>56</td>
<td>28.9</td>
<td>33.5</td>
</tr>
<tr>
<td>3-4</td>
<td>53</td>
<td>27.3</td>
<td>60.8</td>
</tr>
<tr>
<td>5-6</td>
<td>32</td>
<td>16.5</td>
<td>77.3</td>
</tr>
<tr>
<td>7-8</td>
<td>16</td>
<td>8.2</td>
<td>85.5</td>
</tr>
<tr>
<td>9-10</td>
<td>9</td>
<td>4.6</td>
<td>90.1</td>
</tr>
<tr>
<td>11-12</td>
<td>7</td>
<td>3.6</td>
<td>93.7</td>
</tr>
<tr>
<td>More than 12</td>
<td>12</td>
<td>6.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>194</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Marijuana use is occurring no matter where people are within their programs. When examining the cross tabulation of the number of semesters completed with the past 30 day marijuana use, it becomes apparent that of most of the infrequent users have completed 1 to 2 semesters of college, whereas the weekly users have completed 3 to 4 semesters, daily users 1 to 2 semesters, and more than once daily users 3 to 4 semesters of college (Table 18).
Table 18

*Cross tabulation of the numbers of semester successfully completed (a grade of “D” or higher) by users with past 30 day marijuana use.*

<table>
<thead>
<tr>
<th>How many semesters of college have you successfully completed?</th>
<th>Infrequent use</th>
<th>Once per week</th>
<th>Once per day</th>
<th>More than once per day</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>1-2</td>
<td>42</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>58</td>
</tr>
<tr>
<td>3-4</td>
<td>33</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>51</td>
</tr>
<tr>
<td>5-6</td>
<td>28</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>7-8</td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>9-10</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>11-12</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>More than 12</td>
<td>10</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>146</strong></td>
<td><strong>17</strong></td>
<td><strong>16</strong></td>
<td><strong>15</strong></td>
<td><strong>194</strong></td>
</tr>
</tbody>
</table>

Students who consumed small, medium, and very large amounts of marijuana per occasion appear to have completed 1 to 2 semesters of college. Those who tend to consume large amounts of marijuana per occasion appear to have completed 3 to 4 semesters of college (Table 19).
Table 1

Cross tabulation of the numbers of semester successfully completed (a grade of “D” or higher) by users and amount of marijuana consumed. The marijuana cigarettes depicted below are described as “small”, “medium”, “large”, and “very large” amounts of marijuana.

Based upon the following images, on average, how much marijuana do you ingest per occasion?

<table>
<thead>
<tr>
<th>How many semesters of college have you successfully completed?</th>
<th>0</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>7-8</th>
<th>9-10</th>
<th>11-12</th>
<th>More than 12</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>122</td>
<td>43</td>
<td>16</td>
<td>13</td>
<td>194</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To summarize, the respondents that use marijuana are using the drug no matter where they are at in the education. The respondents, however, tended to use marijuana infrequently and at relatively small doses.

Summary of User Demographics

The demographic breakdown is helpful when any researcher begins to analyze his or her data as it provides a snap shot as to what type of participants engaged in the study and helps to guide future research. Generally speaking, the majority of the users identified as female, was of Caucasian ethnicity, and aged between 27 and 65 years. Further, the majority respondents that used marijuana did so infrequently and at relatively small doses. The primary goal of this study however, is to address the correlation between marijuana use and academic and social
involvement, regardless of demographic variables. To answers the research questions of the study, a SEM was chosen as the method of analysis for the first two research questions and independent samples t-tests were used to answer the third research question.

**Correlations between Marijuana use and Academic Involvement**

To examine the first research question, “Is there a correlation between marijuana use and academic involvement in undergraduate students?” I performed a path analysis using the modified SEM that was developed in Chapter 2 and refined in Chapter 3. The path analysis revealed correlations between the observed variables (AI 1, 2, and 3) and their associated latent variable (AI). The observed variables AI 1, 2, and 3 correspond to the survey questions 7 (Logical argument), 8 (Evaluate information), and 9 (Alternative solutions), which are also found in Appendix A. The path analysis also shows correlations between the observed variables “Amount Consumed” and “30 Day Use” and their associated latent variable “Marijuana Use”. From there, the regression weights correlating the latent variable “Marijuana Use” to the latent variable “Academic Involvement” are shown. The results of the path analysis are found in Figure 5. The values along the lines are representative of standardized regression weights (β weights) between each variable.
**Figure 5.** The academic involvement half of the entire model is shown here. The full regression analysis is found in Appendix M. On the diagram, the regression weights are listed between the variables. The $\beta$-weight circled in red (-0.05) represents the regression value between the latent variable “Marijuana Use” and the latent variable “Academic Involvement”.

To provide a different perspective, the data from the path analysis have also been collated in a tabular format. The standardized regression weights along with the standard error (SE), critical ratios (CR), and $p$-values are outlined in Table 20. Since standardized regression weights are often used in SEM (Kline, 2011), those are the values that are of importance to this study.

Table 20

*Standardized regression weights for the academic involvement and marijuana use scales. The survey questions can be found in Appendix A.* ***= <0.001

<table>
<thead>
<tr>
<th></th>
<th>$\beta$</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Involvement</td>
<td>Marijuana Use</td>
<td>-.046</td>
<td>.069</td>
<td>-.404</td>
</tr>
<tr>
<td>Q9 (AI 3)</td>
<td>Academic Involvement</td>
<td>.608</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q8 (AI 2)</td>
<td>Academic Involvement</td>
<td>.634</td>
<td>.178</td>
<td>6.127</td>
</tr>
<tr>
<td>Q7 (AI1)</td>
<td>Academic Involvement</td>
<td>.747</td>
<td>.207</td>
<td>6.079</td>
</tr>
<tr>
<td>Q15 (Amount Consumed)</td>
<td>Marijuana Use</td>
<td>.699</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q14 (30 Day Use)</td>
<td>Marijuana Use</td>
<td>.733</td>
<td>.443</td>
<td>2.395</td>
</tr>
</tbody>
</table>
Assessment of the First Null and Alternate Hypotheses

The use of marijuana has no significant effect on academic involvement in undergraduate students within the population studied. To support that claim, the data show a negative, non-significant correlation between marijuana use and academic involvement ($\beta=-0.046$, $n=194$, $p=0.686$), meaning that when the marijuana use score goes up by one standard deviation, the academic involvement score goes down by 0.046 standard deviations (recall that a lower AI score indicates high AI). Based upon the results I must fail to reject my first null hypothesis ($H_{01}$: The use of marijuana will have no effect on academic involvement in undergraduate students). Further, based upon the results I must reject my first alternate hypothesis ($H_{a1}$: The use of marijuana will decrease academic involvement in undergraduate students).

Summary of RQ1 Results

The first research question asked, “Is there a correlation between marijuana use and academic involvement in undergraduate students?” The null hypothesis associated with this question stated that, “The use of marijuana will have no effect on academic involvement in undergraduate students.” Based upon the path analysis performed using the SEM, I failed to reject the null hypothesis. Therefore, the use of marijuana has no effect on academic involvement in undergraduate students.

Correlations between Marijuana use and Social Involvement

To examine the second research question, “Is there a correlation between marijuana use and social involvement in undergraduate students?” I performed a path analysis using the modified SEM that was developed in Chapter 2 and refined in Chapter 3. The path analysis revealed correlations between the observed variables (SI 5, 2, 4, and 3) and their associated latent variable (SI). The observed variables SI 5, 2, 4, and 3 correspond to the survey questions 5
(Community among students), 2 (Interactions with other students), 4 (Social life), and 3 (Social activities) which are also found in Appendix A. The path analysis also shows correlations between the observed variables “Amount Consumed” and “30 Day Use” and their associated latent variable “Marijuana Use”. From there, the regression weights correlating the latent variable “Marijuana Use” to the latent variable “Social Involvement” are shown. The results of the path analysis are found in Figure 6. The values along the lines are representative of standardized regression weights (β weights) between each variable.

**Figure 6.** The social involvement half of the entire model is shown here. The full regression analysis is found in Appendix M. On the diagram, the regression weights are listed between the variables. The β-weight circled in red (0.11) represents the regression value between the latent variable “Marijuana Use” and the latent variable “Social Involvement”.

To provide a different perspective, the data from the path analysis have also been collated in a tabular format. The standardized regression weights along with the SE, CR, and p-values are
outlined in Table 21. Since standardized regression weights are often used in SEM (Kline, 2011), those are the values that are of importance to this study.

Table 21

*Standardized regression weights for the academic involvement and marijuana use scales. The survey questions can be found in Appendix A. *** = <0.001

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Involvement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3 (SI 3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4 (SI 4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2 (SI 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q5 (SI 5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q15 (Amount Consumed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q14 (30 Day Use)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Plainly, the use of marijuana has no effect on social involvement in undergraduate students within the population studied. To support this claim, the data show a positive, non-significant correlation between marijuana use and social involvement ($\beta=0.114$, $n=194$, $p=0.226$), meaning that when marijuana use score goes up by one standard deviation, the social involvement score goes up by 0.114 standard deviations (recall that a high SI score indicates low SI). Based upon these results, I must fail to reject my second null hypothesis ($H_0^2$: The use of marijuana will have no effect on social involvement in undergraduate students). Further, according to the data I must reject my second alternate hypothesis ($H_{a2}$: The use of marijuana will decrease social involvement in undergraduate students).

**Summary of RQ2 Results**

The second research question asked, “Is there a correlation between marijuana use and social involvement in undergraduate students?” The null hypothesis associated with this
question stated that, “The use of marijuana will have no effect on social involvement in undergraduate students.” Based upon the path analysis performed using the SEM, I failed to reject the null hypothesis. Therefore, the use of marijuana has no effect on social involvement in undergraduate students.

**The Difference in Academic and Social Involvement between Non-Users**

**Users of Marijuana**

To address the third research question, “Is there a difference in academic and social involvement between non-users as compared to infrequent users, weekly users, daily users, or more than once daily users of marijuana?”, several independent samples t-test analyses were performed. The analysis was broken down into two components: The comparison of non-users with infrequent, weekly, daily, more than once daily users with regards to academic involvement and the comparison of non-users with infrequent, weekly, daily, more than once daily users with regards to social involvement.

**Academic Involvement Group Statistics**

The AI scale ranges from a score of “3” to a score of “9”, with a “3” being the most academically involved and a “9” being the least academically involved. Weekly users (N=17, \( M=4.941 \), \( SD=1.519 \)) were rather academically involved, scoring on average about 1.9 points higher than the “3” which is indicative of a high academic involvement. Daily users (N=16, \( M=4.750 \), \( SD=1.291 \)), multiple daily users (N=15, \( M=4.467 \), \( SD=1.598 \)), and infrequent users (N=146, \( M=4.719 \), \( SD=1.592 \)) also scored relatively low on the AI scale, indicative of relatively high academic involvement. On the other hand, non-users of marijuana (N=379, \( M=5.1451 \), \( SD=1.586 \)) scored higher in the AI scale, indicative of relatively low academic involvement. A summary of the academic involvement group statistics is found in Table 22.
Summary of the academic involvement group statistics.

<table>
<thead>
<tr>
<th>Group Statistics</th>
<th>$N$</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Use</td>
<td>379</td>
<td>5.145</td>
<td>1.586</td>
</tr>
<tr>
<td>Infrequent Use</td>
<td>146</td>
<td>4.719</td>
<td>1.592</td>
</tr>
<tr>
<td>Weekly Users</td>
<td>17</td>
<td>4.941</td>
<td>1.519</td>
</tr>
<tr>
<td>Once Daily</td>
<td>16</td>
<td>4.750</td>
<td>1.291</td>
</tr>
<tr>
<td>Multiple Times Daily</td>
<td>15</td>
<td>4.467</td>
<td>1.598</td>
</tr>
</tbody>
</table>

Social Involvement Group Statistics

The SI scale ranges from a score of “4” to a score of “32”, with a “4” being the most socially involved and a “32” being the least socially involved. Weekly users ($N=17, M=11.882, SD=5.967$) approximately “satisfied” with their own social involvement. Once daily users ($N=16, M=10.688, SD=3.027$) were slightly more satisfied with their social involvement. More than once daily users ($N=15, M=16.733, SD=7.421$) were relatively “neutral” with their social involvement. Infrequent users ($N=146, M=13.411, SD=6.877$) approximately somewhat satisfied with their social involvement, but to a somewhat lesser degree than non-users. Non-users ($N=379, M=12.504, SD=6.635$) were approximately somewhat satisfied with their social involvement. A summary of the social involvement group statistics is found in Table 23.

Summary of the social involvement group statistics.

<table>
<thead>
<tr>
<th>Group Statistics</th>
<th>$N$</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Use</td>
<td>379</td>
<td>12.504</td>
<td>6.635</td>
</tr>
<tr>
<td>Infrequent Use</td>
<td>146</td>
<td>13.411</td>
<td>6.877</td>
</tr>
<tr>
<td>Weekly Users</td>
<td>17</td>
<td>11.882</td>
<td>5.967</td>
</tr>
<tr>
<td>Once Daily</td>
<td>16</td>
<td>10.688</td>
<td>3.027</td>
</tr>
<tr>
<td>Multiple Times Daily</td>
<td>15</td>
<td>16.733</td>
<td>7.421</td>
</tr>
</tbody>
</table>
Equal Variance Assumptions

Before performing the independent samples $t$-tests, the Hartley test of equal variance must be performed to ensure there is equal variance between the populations being compared. If equal variance was not established, I could not perform or interpret an independent sample $t$-test. As with the chi-square test, one operates under the hypothesis that equal variance exists between the two populations being compared. To test that hypothesis, one uses the $F$ statistic and wishes to have non-significant results. As shown in Table 24, I failed to reject the hypothesis that there was equal variance between the means for all values, with the one exception being the once daily use under social involvement ($F=4.805$, $p=0.0004$) where I must reject the hypothesis that equal variance exists between once daily users and non-users on the social involvement scale. Since equal variance could not be verified for once daily users and non-users on the social involvement scale, an independent samples $t$-test could not be performed.

Table 24

*Summary of the Hartley tests for equal variance.  The double asterisk (**) indicates significance $p<0.05$*

<table>
<thead>
<tr>
<th>Hartley Test for Equal Variance</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AI</strong></td>
<td></td>
</tr>
<tr>
<td>Non-Use</td>
<td>-</td>
</tr>
<tr>
<td>Infrequent Use</td>
<td>1.007</td>
</tr>
<tr>
<td>Weekly Users</td>
<td>1.090</td>
</tr>
<tr>
<td>Once Daily</td>
<td>1.510</td>
</tr>
<tr>
<td>Multiple Times Daily</td>
<td>1.014</td>
</tr>
<tr>
<td><strong>SI</strong></td>
<td></td>
</tr>
<tr>
<td>Non-Use</td>
<td>-</td>
</tr>
<tr>
<td>Infrequent Use</td>
<td>1.074</td>
</tr>
<tr>
<td>Weekly Users</td>
<td>1.236</td>
</tr>
<tr>
<td>Once Daily</td>
<td>4.805</td>
</tr>
<tr>
<td>Multiple Times Daily</td>
<td>1.251</td>
</tr>
</tbody>
</table>
Assessment of the Third Null and Alternate Hypotheses

Non-users as compared to infrequent, weekly, daily, and more than once daily users of marijuana have different levels of academic and social involvement. I am able to support that claim with independent samples t-tests that compared non-users to weekly, daily, more than once daily, and infrequent user groups under the AI scale. I was also able to perform independent sample t-tests for weekly, more than once daily, and infrequent use to non-users on the SI scale. Of all the analyses performed, two were deemed significant. There was a significant difference in the AI scores for infrequent users \((M=4.719, SD=1.592)\) and non-users \((M=5.1451, SD=1.586)\) conditions; \(t(523)=-2.754, p=0.006\). These results suggest that infrequent users saw a significant increase in academic involvement as compared to non-users (recall that a lower score on the AI scale indicates greater AI). Further, there was a significant difference in the SI scores for multiple daily users \((M=16.733, SD=7.421)\) and non-users \((M=12.504, SD=6.635)\) conditions; \(t(392)=2.410, p=0.016\). A summary of independent samples t-tests is found in Table 25.

Table 25

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Use</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Infrequent Use</td>
<td>-2.754</td>
<td>523</td>
<td>0.006**</td>
</tr>
<tr>
<td>Weekly Users</td>
<td>-0.519</td>
<td>394</td>
<td>0.604</td>
</tr>
<tr>
<td>Once Daily</td>
<td>-0.982</td>
<td>393</td>
<td>0.327</td>
</tr>
<tr>
<td>Multiple Times Daily</td>
<td>-0.678</td>
<td>392</td>
<td>0.105</td>
</tr>
<tr>
<td><strong>SI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Use</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Infrequent Use</td>
<td>1.389</td>
<td>523</td>
<td>0.165</td>
</tr>
<tr>
<td>Weekly Users</td>
<td>-0.379</td>
<td>394</td>
<td>0.705</td>
</tr>
<tr>
<td>Once Daily</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Multiple Times Daily</td>
<td>2.410</td>
<td>392</td>
<td>0.016**</td>
</tr>
</tbody>
</table>

**=significance \(p<0.05\).
These results suggest that multiple daily users saw a significant decrease in social involvement as compared to non-users (recall that a higher score on the SI scale indicates lower SI). Therefore, based upon the results, the third null hypothesis has been rejected (H\textsubscript{03}: Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana will not have different levels of academic and social involvement). Subsequently, based upon the results I failed to reject the third alternate hypothesis (H\textsubscript{a3}: Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana will have different levels of academic and social involvement).

**Summary of RQ3 Results**

The third research question asked, “Is there a difference in academic and social involvement between non-users as compared to infrequent users, weekly users, daily users, or more than once daily users of marijuana?” The null hypothesis associated with this question stated that, “Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana will not have different levels of academic and social involvement.” Based upon the results of the independent samples t-tests, I rejected the null hypothesis. Therefore, non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana have different levels of academic and social involvement.

**Summary**

This study examined the impact of marijuana use on academic and social involvement using SEM. The study also investigated if there was a statistical difference between non-users as compared to infrequent, weekly, daily, and more than once daily users of marijuana regarding academic and social involvement. The results of the vetted SEM path analysis revealed a positive, non-significant correlation between marijuana use and social involvement (recall that a
high SI score indicates low SI). Further, the data showed a negative, non-significant correlation between marijuana use and academic involvement (recall that a lower AI score indicates high AI). Additionally, there was a significant difference between the AI scores for infrequent users and non-users, suggesting that infrequent users saw a significant increase in academic involvement as compared to non-users (recall that a lower score on the AI scale indicates greater AI). Further, there was a significant difference between the SI scores for multiple daily users and non-users. These results suggest that multiple daily users saw a significant decrease in social involvement as compared to non-users (recall that a higher score on the SI scale indicates lower SI). All three research questions, associated null hypotheses, and answers are succinctly summarized in Table 26.

Table 26

<table>
<thead>
<tr>
<th>Question</th>
<th>Null Hypothesis</th>
<th>Reject/Fail to Reject?</th>
<th>Answer to Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ 1: Is there a correlation between marijuana use and academic involvement in undergraduate students?</td>
<td>The use of marijuana will have no effect on academic involvement in undergraduate students.</td>
<td>Fail to Reject</td>
<td>The use of marijuana has no effect on academic involvement in undergraduate students.</td>
</tr>
<tr>
<td>RQ 2: Is there a correlation between marijuana use and social involvement in undergraduate students?</td>
<td>The use of marijuana will have no effect on social involvement in undergraduate students.</td>
<td>Fail to Reject</td>
<td>The use of marijuana has no effect on social involvement in undergraduate students.</td>
</tr>
<tr>
<td>RQ 3: Is there a difference in academic and social involvement between non-users as compared to infrequent users, weekly users, daily users, or more than once daily users of marijuana?</td>
<td>Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana will not have different levels of academic and social involvement.</td>
<td>Reject</td>
<td>Non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana have different levels of academic and social involvement.</td>
</tr>
</tbody>
</table>

A discussion regarding the impact of marijuana use on academic and social involvement in undergraduate students is outlined in Chapter 5. The discussion chapter also will address the
implications of these results on research, theory, policy, and practice. Limitations of the study and sources of error and bias will also be addressed followed by a summary of the research as a whole.
CHAPTER V – DISCUSSION

Throughout most of the 20th century, marijuana has been viewed as a drug abused by many people, particularly college students, that leads to a host of ill-toward effects ranging from missing class, slipping grades, and perhaps an overall lack of motivation to accomplish one’s originally intended goals. As the sands of the political landscape continued to shift at the turn of the century, marijuana’s status has changed as well. In fact, the use of medicinal marijuana has been approved in the United States in 23 states, Washington DC, and in a limited number of European nations for some time. Further, Oregon, Washington, Colorado, Alaska, and Washington D.C. have legalized marijuana for recreational consumption, whereas many other states have decriminalized the use of the drug. On the other hand, federal laws still classify marijuana as a Schedule I narcotic and its use, even if deemed legal in a particular state, is illegal under federal statute and may be enforced by federal officers.

Proponents of legalization have long claimed that marijuana use was less harmful than that of alcohol, a drug to which marijuana is often compared in terms of health hazards. Those claims were supported by Lachenmeier and Rehm (2015) who conducted a comparative risk assessment of several drugs, including marijuana and alcohol. Their findings suggested that margin of exposure (MOE), a ratio of toxicological threshold and estimated human intake, for ethanol, nicotine, cocaine, and heroin was high risk (MOE<10) whereas marijuana had a MOE of greater than 10,000, or a very low risk.

On the other hand, a synthesis of the research on cognitive function showed that the effects of long-term marijuana use to appear to have a significant inverse relationship with regards to memory, motivation, and emotional control, and little effect on motor functionality (Liguori, Gatto, & Jarrett, 2002; Curran, Brignell, Fletcher, Middleton, & Henry, 2002; Hart et.
al., 2001; Indlekofer, et al., 2008; Lyskey & Hall, 2002; O’Leary et al., 2000, 2002, 2003; Wadsworth, Moss, Simpson, & Smith, 2006; Wagner, Becker, Gouzoulis-Mayfrank, & Daumann, 2010; Yalchin, Posner, Nunnally, & Dishion, 2010; Jager, Van Hell, De Win, Kahn, Van Den Brink, Van Ree, & Ramsey, 2007; Abdullaev, Posner, Nunnally, & Dishion, 2010; Becker, Collins, and Luciana, 2014; Bloomfield, Morgan, Kapur, Curran, & Howes; 2014; Caldeira, Arria, O’Grady, Vincent, & Wish, 2008; Bradley, 1982; Jessor, Chase, & Donovan, 1980; Marston et al., 1988; Fergusson & Horwood, 1997; Durdle, Lundahl, Johanson, & Tancer, 2008; & Beuzen & Belzung, 1995). With regards to learning and the college experience, according to several studies published in the 1960s through the early 1970s (Pearlman, 1968; Blum, 1969; Goode, 1971; & Hochman & Brill, 1973), there appears to be a non-statistically significant, inverse relationship between academic achievement and marijuana use. Regarding social involvement on campus, there is evidence suggesting that college freshmen are more likely to engage in illicit drug use, likely due to little direct parental influence and/or the college social environment, where other students may be experimenting with drugs, or they were users upon admittance to college (Suerken et al., 2014). With that being said, marijuana use, in turn, may limit students’ ability to positively socially integrate into the campus culture and according to Astin’s (1985) theory of student involvement, the more a student is engaged on campus the greater the likelihood of his or her success, both in and out of the classroom.

To summarize the literature, there is evidence to suggest marijuana is one of the least dangerous drugs to one’s health; however, long-term use has been associated with a decrease in memory functionality, motivation, and emotional control. Additionally, marijuana use may or may not hinder one’s ability to be academically successful. The effects marijuana has on one’s motivation may or may not reduce one’s ability to be academically and socially involved while
using the drug. Based on the literature, it becomes apparent that the effects marijuana may have on academic and social involvement are nebulous at best.

In an effort to seek answers and add clarity to the literature, I devised three research questions that served as the basis of my study, the first being, is there a correlation between marijuana use and academic involvement in undergraduate students? That first question yielded the hypothesis that the use of marijuana will have no effect on academic involvement in undergraduate students. I failed to reject my first null hypothesis because the data suggest a negative, non-significant correlation between marijuana use and academic involvement ($r=-0.046$, $n=192$, $p=0.686$), keeping in mind that a lower AI score indicates high academic involvement. Therefore, the use of marijuana has no effect on academic involvement in undergraduate students within the population studied.

The second research question asked if there is a correlation between marijuana use and social involvement in undergraduate students. This question generated the hypothesis that the use of marijuana will have no effect on social involvement in undergraduate students. I failed to reject my second null hypothesis because the findings indicate a positive, non-significant correlation between marijuana use and social involvement ($r=0.114$, $n=192$, $p=0.226$), remembering that a higher SI score is indicative of low social involvement. Therefore, the use of marijuana has no effect on social involvement in undergraduate students within the population studied.

The third research questions asked if there is a difference in academic and social involvement between non-users as compared to infrequent users, weekly users, daily users, or more than once daily users of marijuana. The subsequent null hypothesis generated was that non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana
will not have different levels of academic and social involvement. I rejected my third null hypothesis because the independent samples t-test yielded two significant results when comparing AI and SI between non-users, infrequent, weekly, daily, or more than once daily users of marijuana. There was a significant difference in the AI scores for infrequent users \((M=4.719, SD=1.592)\) and non-users \((M=5.1451, SD=1.586)\) conditions; \(t(523)=-2.754, p=0.006\). These results suggest that infrequent users saw a significant increase in academic involvement as compared to non-users. Further, there was a significant difference in the SI scores for multiple daily users \((M=16.733, SD=7.421)\) and non-users \((M=12.504, SD=6.635)\) conditions; \(t(392)=2.410, p=0.016\). These results suggest that multiple daily users saw a significant decrease in social involvement as compared to non-users. Therefore, non-users as compared to infrequent, weekly, daily, or more than once daily users of marijuana have different levels of academic and social involvement.

The above results present many opportunities for discussions regarding further research and effects on policies within colleges. To address the above prospects, this chapter is organized into several sections. First a discussion regarding the importance of the findings as well as a comparison to the existing body of knowledge on the effects of marijuana on the collegiate experience is presented. Next, the limitations of the study will be addressed and considerations for future research will be explored. Third, the implications of the results on Astin’s student involvement theory will be addressed as well as how my results aligned with Anderson’s cultural identity theory of drug abuse. Finally, the implications for policy will be addressed followed by a summary of the entire research endeavor.
Discussion

Astin’s (1985) theory of student involvement and Anderson’s (1998) cultural identity theory of drug abuse provided the conceptual framework for this study. According to Astin’s (1985) theory, students learn best when involved both academically and socially on campus. The overall goal of this dissertation was to assess the effects that marijuana use has on academic and social involvement in undergraduate students. According to the SEM path analysis conducted, the use of marijuana was not significantly correlated with a decrease in social or academic involvement. However, an independent sample t-test revealed a positive, significant difference in academic involvement in infrequent users of marijuana as compared to non-users. Further, another independent sample t-test revealed a negative, significant difference in social involvement between multiple daily users and non-users.

Since no significant correlation was discovered between marijuana use and academic involvement, my research is in line with the works of Pearlman (1968), Blum (1969), Goode (1971), and Hochman and Brill (1973) that all found no significant difference in GPA between users and non-users of marijuana, assuming that one’s GPA is informed by one’s academic involvement. These results are interesting since a 2005 survey conducted by SAMHSA claimed that 17.9 percent of undergraduate students with a past semester GPA of 1.0 or lower had used marijuana in the last month as compared to 3.1 percent of those with a 3.5 GPA or higher. The results of my independent sample t-test also run counter to the claim set forth by SAMHSA in 2005 as I discovered a statistically significant increase in academic involvement in infrequent users of marijuana as compared to their non-user counterparts. These results are interesting and lead to many questions. Was this statistical significance a mere phenomenon? Alternatively, is there some effect that those who use marijuana infrequently benefit academically? Does the use
of marijuana have a calming effect on the student? On the other hand, perhaps these students use marijuana as a “reward” for doing well academically?

On the other hand, the results of my independent sample $t$-test complement that data compiled by Arria, Caldeira, Bugbee, Vincent, and O’Grady (2013) which suggested that students who used marijuana more than 15 days per month were twice as likely as minimal users to stop out of school, assuming that a decrease in social involvement is related to users stopping out of school.

When my results are examined through the lens of Astin’s (1985) student involvement theory, my research shows that infrequent users of marijuana are more academically involved as compared to non-users, and according to Astin’s theory would have a more successful college experience. The reasons to why infrequent users are more academically involved have yet to be explored in depth, but it is my opinion, based on the synthesis of the literature presented in this dissertation, that the infrequent use of marijuana would help the student, from an academic perspective, relax and lessen the stress of the collegiate experience.

Regarding social involvement and marijuana use, Bell, Wechsler, and Johnston (1997) indicated in a national study that users of marijuana were more likely to spend time at parties, socialize with friends, and spend less time studying. The results of my study indicated that those who used marijuana more than once per day were less likely to be socially involved on campus. These results, when examined under the lens of Astin’s (1985) theory of student involvement indicate that heavy marijuana use reduces the likelihood of being socially involved on campus, thereby limiting the success one would experience during one’s undergraduate career. The results resonate and align with Anderson’s (1998) cultural identity theory of drug abuse; particularly the component of her theory that discussed social marginalization and withdrawal
from society at large to escape and fill the otherwise devoid student with a sense of completeness (Henderson & Boyd, 1992).

Given the relatively weak correlations between marijuana use and academic and social involvement, my study is in line with the current body of literature in which contradictory findings and nebulous results are commonplace. However, the deleterious effects of marijuana on academic involvement manifested in my research, although deemed non-significant, at the weekly, daily, and more than once daily use intervals. Further, the fact that heavy users of marijuana experienced less social involvement may lead a student down a path to a drug related identity change, as shown by Anderson in her 1998 cultural identity theory of drug abuse. This identity change could be facilitated by social withdrawal due to a lack of social involvement during the undergraduate experience. Further studies need to be conducted with larger samples from more diverse areas using the model developed in this study.

Limitations

The limitations of the present study were multifaceted. An overarching concern within the whole study is the reliance on self-reported data. With that being said, participants may have falsified their past and/or current usage rates of marijuana. Additionally, participants may have chosen not to disclose particular aspects of their drug use during the survey with a potential fear of reprisal, thereby eliminating those participants from the study. Within that vein, it is of particular interest that students of color did not have similar marijuana usage rates as compared to the Caucasian students. I fear that the reason for why our students of color did not respond to questions relating to drug use may be due to social upheaval currently being expressed within this country. When one considers the Black Lives Matters movement, it becomes apparent that our students of color could be fearful of the judicial system and fear prejudicial reprisal. On the
other hand, perhaps the low response rates of students of color pertain to the homogeneity of the region in which the study was conducted. Without a follow-up study, it is difficult to ascertain those questions.

Additionally, during the design of the survey using the Qualtrics software, I inadvertently prevented the collection of non-user demographics by having them stop the survey at question 13 (Appendix A). Since I had all of my demographic questions at the end of the survey, those who were not users were not permitted to answer those questions. If I was to conduct the study again, I would have the demographic questions at the very beginning of the survey.

Further, I have little personal experience with marijuana and its associated culture. With that being said, there could be potential drug cultural norms and markers that are omitted during the experimental design of the study.

Due to the illegal status of marijuana, I predicted that it would be difficult to obtain the sample of 123 students who use the drug for this study. Therefore, I chose to survey all students within the institution in an effort to obtain the desirable sample of 123. All students who were users of marijuana, but no other illegal substances, were used in the study. Although the minimum sample size was achieved, I would strive for a greater sample of users in future studies that would employ the same model. I feel that many of the t-test results would have been found to be significant if the numbers were larger. On the other hand, I did not take into account that medical marijuana is legal in Minnesota. There may have been students who were legally using the drug and therefore may have changed the course of the study.

Further, it is my opinion that since only one community college was chosen that the results are not representative of all undergraduate students even though the four campuses that make up the college represent a broad geographic and cultural distribution of students.
Additionally, it is likely that community college students are intrinsically less involved on
campus due to the fact that many students commute to school and do not live on campus (only
one of the four has residential housing options). With that being said, I believe that community
college student involvement is understudied. In the future, I would like to apply the vetted SEM
to undergraduates at other community colleges and then at public and private universities and
compare those results with those obtained from this community college population.

Moreover, the application of Astin’s (1985) student involvement theory really only
pertains to those students who are of “traditional” age (i.e. 18-24 years of age). Since my study
had many respondents over the age of 27, Astin’s theory may not be the most appropriate lens
through which to examine the impact of marijuana on academic and social involvement. Perhaps
a better theory to apply in future research could be Knowles’ Adult Learning Theory, for
example.

With that being said, a potential lack of generalizability to other institutions exists based
on geography, institutional culture, demographics, and institution type. This study was
conducted within a single, mid-sized mid-western community college and I caution that the
results of the study do not imply causality, but are meant merely as an explanation of the
relationship between marijuana use and academic and social involvement as shown within this
particular population.

**Implications for Research and Policy**

While the present study examined the effects of marijuana on academic and social
involvement in community college students in Minnesota, it seems logical that the university
students in Minnesota should also be studied as well. To gather a wide array of students, all of
the institutions within MnSCU could be sent the same survey and the data would be imputed into
the vetted SEM developed during this dissertation process. From there, I envision sampling private institutions within the state, and from there expanding the study to a national level to thoroughly address the academic and social implications of marijuana use on undergraduate students, including other community colleges, across the United States.

Perhaps more telling than a national study would be a qualitative study designed to explore marijuana use on a personal level. That is, why do those students who use, use? How does it help them in college? How does it hinder them? What negative consequences have those students experienced? I believe that a properly designed qualitative study would help paint a more robust and complete picture of the effects marijuana has on undergraduate students.

Given the fact that marijuana use has become more socially acceptable and presidential candidates, such as Senator Bernie Sanders of Vermont, advocating for lifting the federal ban on marijuana consumption, the study of marijuana and its effects are more important than ever. Marijuana use, although admittedly less dangerous than portrayed in the early 20th century, still has tangible, ill toward effects on cognitive and psychological development. If legalization comes to pass, our citizenry as well as our students, are entitled to accurate information regarding the effects, both short and long-term, that marijuana will have if they choose to consume the drug.

The policy implications regarding marijuana use at the college and university level ought to be reflective of the times we live in. College students have been using marijuana in various capacities for many decades, and the trend does not appear to be changing any time soon. Utilizing the prevalent literature and the research presented in this dissertation, it is my opinion that campus drug policies treat marijuana use as they do alcohol, and not in the same category as other narcotics on the federal schedule. In light of the results of the present study, I feel that
students need to be made more aware of the effects of the drug as it related to their academic and social involvement on campus. That is, as marijuana usage increases, the negative effects on one’s college experience may also increase. The fact that this study generated nebulous results that correspond and support the vague and indecisive literature that already exists, is telling. It tells us that marijuana has difficult to study effects and since it is difficult to study, policies and laws are difficult to support or refute in a data driven manner.

On the other hand, the demographic data collected in my study could help to strategically target specific groups for prevention and/or intervention strategies if marijuana ever shows demonstrable, ill-toward effects. Based on my data, Caucasian females between the ages of 27 and 65 who have completed 1-2 semesters of college use marijuana are the most “at-risk” group studied within this population. However, females tend to use smaller amounts of marijuana more infrequently as compared to males who have lesser consumption rates yet ingest more marijuana per month as well as higher quantities of marijuana per occasion. Further, younger people aged 18-21 tended to consume larger amounts of marijuana as compared to the other age groups. This particular finding is of great importance since recent literature indicates that the brain is most susceptible to changes under the age of 25 due to the fact that the brain, on average, is not fully developed until then (Johnson, Blum, & Giedd, 2009).

Therefore, it is my recommendation that any prevention or intervention strategy be aimed at students between the ages of 18-21. For male students, I would address the larger and more frequent consumption issue, and with females I would address the percentage of students who use. From there, I would note the negative effects of heavy marijuana of social involvement on campus. More appropriately, perhaps, would be to present all of our students with the data that is irrefutable: The brain is not fully developed until age 25 and whatever choices are made before
that age may have long-lasting, if not permanent effects with the cognitive domain (Johnson, Blum, & Giedd, 2009).

**Conclusions**

This study examined the effects of marijuana on academic and social involvement in undergraduate students using a structural equation model. Overall, the study showed no significant correlation between marijuana use and academic and social involvement. Although no significant correlation was discovered, the study provided a vetted SEM for future research projects and independent t-tests showed that heavy users of marijuana are less socially involved on campus as compared to their non-users counterparts. Further, the study showed that infrequent users of marijuana were slightly more academically involved than their non-user comrades.

In addition, this study helped to support long-standing research that demonstrates ill toward effects when one consumes heavy amounts of marijuana, and also supported research from the mid twentieth century that claims no difference in academic achievement between users of marijuana and non-users. The study did, however, unveil a new concept that infrequent use of marijuana may actually increase academic involvement. The results, however, were relatively weak and are in line with the present body of research in the field, where research is contradictory and nebulous, and no clear correlations exist.

Although not as dangerous any many perceive, marijuana’s effects on one’s mind are far from innocuous. Heavy marijuana has been attributed to not only a lack of social involvement, but a whole host of physiological and psychological effects unbecoming to advancing one’s mind. As with everything, moderation, it seems, is the key to the future of marijuana use within America’s colleges and universities.
References


Appendix A

Survey Instrument

1. Since entering this college, how often have you felt isolated from campus life? (SI 1)
   a. Not at all
   b. Occasionally
   c. Frequently

2. Please rate your satisfaction with this institution in terms of your interactions with other students. (SI 2)
   a. Very satisfied
   b. Somewhat satisfied
   c. Satisfied
   d. Neutral
   e. Somewhat dissatisfied
   f. Dissatisfied
   g. Very dissatisfied
   h. Can’t rate/no experience

3. Please rate your satisfaction with this institution in terms of the availability of campus social activities. (SI 3)
   a. Very satisfied
   b. Somewhat satisfied
   c. Satisfied
   d. Neutral
   e. Somewhat dissatisfied
   f. Dissatisfied
   g. Very dissatisfied
   h. Can’t rate/no experience

4. Please rate your satisfaction with this institution in terms of your social life. (SI 4)
   a. Very satisfied
   b. Somewhat satisfied
   c. Satisfied
   d. Neutral
   e. Somewhat dissatisfied
   f. Dissatisfied
   g. Very dissatisfied
   h. Can’t rate/no experience

5. Please rate your satisfaction with this institution in terms of the overall sense of community among students. (SI 5)
   a. Very satisfied
   b. Somewhat satisfied
   c. Satisfied
   d. Neutral
   e. Somewhat dissatisfied
   f. Dissatisfied
   g. Very dissatisfied
   h. Can’t rate/no experience
6. Indicate the extent to which you agree or disagree with the statement... I see myself as part of the campus community. (SI 6)
   a. Strongly agree
   b. Agree
   c. Disagree
   d. Strongly disagree

7. How often in the past year did you support your opinions with a logical argument? (AI 1)
   a. Frequently
   b. Occasionally
   c. Not at all

8. How often in the past year did you evaluate the quality/reliability of information you received? (AI 2)
   a. Frequently
   b. Occasionally
   c. Not at all

9. How often in the past year did you seek alternative solutions to a problem? (AI 3)
   a. Frequently
   b. Occasionally
   c. Not at all

10. How often in the past year did you look up scientific research articles and resources? (AI 4)
    a. Frequently
    b. Occasionally
    c. Not at all

11. How often in the past year did you explore topics on your own, even though it was not required for class? (AI 5)
    a. Frequently
    b. Occasionally
    c. Not at all

12. How often in the past year did you seek feedback on your academic work? (AI 6)
    a. Frequently
    b. Occasionally
    c. Not at all

13. Do you currently or have you ever smoked marijuana?
    a. Yes
    b. No (If no, do not complete the remainder of the survey)

14. Please rate your marijuana use in the past 30 days. (30 Day Marijuana Use)
    a. No use
    b. Once per week
    c. Once per day
    d. More than once per day
15. Based upon the following images, on average, how much marijuana do you ingest per occasion? (amount consumed)

   a. 
   
   b. 
   
   c. 
   
   d. 

16. How old were you when you first smoked marijuana? (age of onset)
   a. < 12
   b. > 12, < 15
   c. > 15, < 18
   d. > 18, < 21
   e. > 21

17. How years have you been using marijuana? (years of use)
   a. < 1 year
   b. > 1, < 5 years
   c. > 5, < 10 years
   d. > 10, < 15 years
   e. > 15 years

18. What is your gender?
   a. Male
   b. Female
   c. Transgender

19. What is your ethnic background?
   a. African American/Black
   b. Asian/Pacific Islander
   c. Caucasian
   d. Hispanic/Latino/Latina
   e. More than one ethnic background
   f. Prefer not to disclose

20. What is your age?
   a. < 18
   b. > 18, < 21
   c. > 21, < 24
   d. > 24, < 27
   e. > 27, < 65
21. How many semesters of college have you successfully completed?
   a. 0
   b. 1 – 2
   c. 3 – 4
   d. 5 – 6
   e. 7 – 8
   f. 9 – 10
   g. 11 – 12
   h. > 12

22. Within the past 30 days, have you used other illicit, non-prescription drugs? Check all that apply.
   a. Cocaine
   b. Methamphetamine
   c. Adderall, Ritalin, etc.
   d. Barbiturates
   e. Heroin
   f. Other
Appendix B

Approved Informed Consent Letter

Informed Consent to Participate in Educational Research

You are requested to participate in a research study regarding your academic and social involvement on campus as well as any past or current drug (including marijuana) use. All students at Minnesota State Community and Technical College (MSCTC) were invited to participate in this research. The study is being conducted by Matthew J. Borcherding, a faculty member at MSCTC and a doctoral candidate at St. Cloud State University (SCSU) to satisfy the requirements of a Doctor of Education Degree in Higher Education at SCSU. This survey should take about 3 to 5 minutes of your time to complete. Participation is voluntary and responses will be kept completely anonymous. No identifiable characteristics, including your IP address, will be collected about you. There will be no follow up surveys. The risks to your physical, emotional, social, professional, or financial well-being are considered to be 'less than minimal'. The only benefit you will receive by participating in this survey is the knowledge that you are helping educators gain further insight as to what factors impact academic and social involvement within this institution. If you are interested in seeing the results of the survey, please e-mail me directly at matthew.borcherding@minnesota.edu and I will e-mail the results upon completion of the study.

You have the option to not respond to any or all of the questions that you choose. Participation or nonparticipation will not impact your relationship with Minnesota State Community and Technical College (MSCTC) or St. Cloud State University (SCSU). Submission of the completed survey will be interpreted as your informed consent to participate and that you affirm that you are at least 18 years of age.

If you have any questions about the research, please contact Matthew J. Borcherding via email at matthew.borcherding@minnesota.edu or Dr. Steven L. McCullar at slmccular@stcloudstate.edu. If you have questions about the treatment of human subjects, contact the Office of Research and Sponsored Programs at osp@stcloudstate.edu or by phone at (320) 308-4932.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), you are encouraged to contact Dr. Carrie Brimhall at carrie.brimhall@minnesota.edu, Minnesota State Community and Technical College, 1414 College Way, Fergus Falls, MN 56537, (218)-736-1504.
Appendix C
MSCTC IRB Approval Form

Minnesota State Community and Technical College

RESEARCH REVIEW PROTOCOL

PART I. Cover Sheet.

Original Submission: ____ Proposal Modification: __ Renewal: __

IRB USE ONLY
Date Received: 11/7/15 Approval Date: 12/1/15 Protocol Number: 2015-32
Signed: ______________________ Re-approval Date: __________

This application is to be submitted to and approved in writing by the IRB prior to the initiation of any investigation involving human subjects, data or material.

A. Principal Investigator

Name: Matthew J. Borchering
Title: Faculty
Department/Program: Biology
Telephone: 218.736.1592

Adviser (if PI is a student):

Name: Steven McCollar
Title: Asst. Professor
Department/Program: Higher Education Administration, SCSU
Telephone: 320.308.4727

Project Title: A Structural Equation Model Regarding the Impact of Marijuana Use on Academic and Social Involvement in Undergraduate Students

Beginning Date: 12.1.2015 Ending Date: 12.15.2015

Parts II and III of the protocol must be completed in detail for board review. Please submit an electronic version that has all signatures on it. Attach all relevant materials. If you are coconducting this study at other institutions also include approval from the IRBs as well.

D. Statement of assurance: I/We will inform the IRB if significant changes are made in the proposed study.

Signature of PI Date Signature of Sponsor Date

11.17.2015
Appendix D

SCSU IRB Approval Form

Institutional Review Board (IRB)

Name: Matthew Borchering
Address: 317 Oakland Place
        Fergus Falls, MN 56537 USA
Email: matthew.borchering@minnesota.edu

Project Title: A Structural Equation Model Regarding the Impact of Marijuana Use on Academic and Social Involvement in Undergraduate Students
Advisor: Steven McCullar

The Institutional Review Board has reviewed your protocol to conduct research involving human subjects. Your project has been APPROVED.

IRB Notified of Data Collection change from "Survey Monkey" to "Qualtrics" - Approved

Please note the following important information concerning IRB projects:
- The principal investigator assumes the responsibilities for the protection of participants in this project. Any adverse events must be reported to the IRB as soon as possible (ex. research related injuries, harmful outcomes, significant withdrawal of subject population, etc.).
- For expedited or full board review, the principal investigator must submit a Continuing Review/Final Report form in advance of the expiration date indicated on this letter to report conclusion of the research or request an extension.
- Exempt review only requires the submission of a Continuing Review/Final Report form in advance of the expiration date indicated in this letter if an extension of time is needed.
- Approved consent forms display the official IRB stamp which documents approval and expiration dates. If a renewal is requested and approved, new consent forms will be officially stamped and reflect the new approval and expiration dates.
- The principal investigator must seek approval for any changes to the study (ex. research design, consent process, survey/interview instruments, funding source, etc.). The IRB reserves the right to review the research at any time.

Good luck on your research. If we can be of further assistance, please contact the Office of Research and Sponsored Programs at 320-308-4932 or email ldonnay@stcloudstate.edu. Use the SCSU IRB number listed on any forms submitted which relate to this project, or on any correspondence with the IRB.

Institutional Review Board:

Linda Donnay
IRB Administrator
Office of Research and Sponsored Programs

St. Cloud State University:

Marilyn Hart
Interim Associate Provost for Research
Dean of Graduate Studies

OFFICE USE ONLY

SCSU IRB 1521-1582
1st Year Approval Date: 12/8/2015
1st Year Expiration Date: 12/7/2016
Type: Exempt Review
Today's Date: 12/11/2015
2nd Year Approval Date:
2nd Year Expiration Date:
3rd Year Approval Date:
3rd Year Expiration Date:
Appendix E

MSHQ Use Approval

Matthew Borcherding

From: Matthew Borcherding
Sent: Thursday, October 29, 2015 6:40 PM
To: Marcel Born-Miller
Subject: Ret: MSHQ

Greetings,

Wonderful - thank you very much!

Matt

>>> Marcel Born-Miller <mibornmi@gmail.com> 10/29/2015 6:36 PM >>>
Hey Matthew,

Please find attached the article on the MSHQ as well as a copy of the measure. Just FYI, the attached measure is the most recent version of the one in the article (there are slight updates and modifications).

In addition to my measure, if you want to rule out dependence issues, you might consider adding the revised version of the Cannabis Use Disorders Identification Test (attached).

The article: http://www.ncbi.nlm.nih.gov/pubmed/20467312

Please let me know if you have any additional questions or need anything else.

Thanks for your interest,

-M

On Thu, Oct 29, 2015 at 2:29 PM, Matthew Borcherding <Matthew.Borcherding@minnesota.edu> wrote:

Dr. Born-Miller,

I am writing to ask permission to use the Marijuana Smoking History Questionnaire for my dissertation regarding the impact of marijuana on academic and social involvement in undergraduate students. Further, what is the Cronbach's alpha of this scale? Thank you for your consideration.

Sincerely,

Matthew J. Borcherding
Matthew J. Borcherding, MAT
Biology Faculty
MSGF - Fergus Falls, Chapter President
matthew.borcherding@minnesota.edu
218.736.1582

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Appendix F

Social and Academic Involvement Scales Use Approval

---

Matthew Borcherding

From: Matthew Borcherding
Sent: Tuesday, November 05, 2015 9:19 AM
To: Kevin Eagan
Subject: Re: CIRP Involvement Scales

Hi Kevin,

Thank you much! I appreciate it. I’m hoping for an interesting study. Thanks again.

Matt

Matthew J. Borcherding, MAT
Biology Faculty
MSCF - Fergus Falls, Chapter President
matthew.borcherding@minnesota.edu
218.736.1592

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Duluth Lakes, eCampus, Fergus Falls, Moorhead, Wadena.

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877.450.3322 >> Kevin Eagan <keagan@ucsd.edu> 11/2/2015 6:26 PM >>
Hi Matt:

You can use those scales for your dissertation study. Let me know if I can be of further assistance.

Best,

Kevin

--
Kevin Eagan, Ph.D.
Assistant Professor in Residence, GSE&ED
Director, CIRP
Interim Managing Director, HEI
University of California, Los Angeles
310-206-3440

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1
On Mon, Nov 2, 2015 at 10:28 AM, Matthew Borcherding <Matthew.Borcherding@umn.edu> wrote:

Dr. Bagan,

Jessica Szkolka referred me to you regarding the use of an academic and social involvement scale that she worked on while at CRP. I am conducting a dissertation study regarding the impact of marijuana on academic and social involvement in undergraduate students and I would like to incorporate the scales that she worked on into my instrument design. Therefore, I am asking permission to use those scales. For reference, I have attached the piece that Angela worked on. Thank you in advance for your time,

Matt

Matthew J. Borcherding, MAT
Biology Faculty
MSCF - Fergus Falls, Chapter President
matthew.borcherding@umn.edu
218/781-1992

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Appendix G

Initial e-mail (12/09/2015) Invitation to Participate in Research

Matthew Borcherding

From: Matthew Borcherding
Sent: Wednesday, December 09, 2015 4:51 PM
Subject: Invitation to Participate in Academic Research

Importance: High
Flag Status: Flagged
Categories: Red Category

*** This message is being sent to all M State Students. The full informed consent form is found within the survey itself. ***

Dear Students,

You are requested to participate in a research study regarding your academic and social involvement on campus as well as any past or current drug (including marijuana) use. All students at Minnesota State Community and Technical College (MCTC) were invited to participate in this research. The study is being conducted by Matthew J. Borcherding, a faculty member at MCTC and a doctoral candidate at St. Cloud State University (SCSU) to satisfy the requirements of a Doctor of Education Degree in Higher Education at SCSU. This survey should take about 5 to 8 minutes of your time to complete.

Please click on the following anonymous (your IP address will not be collected) link to complete the survey.

https://minnesota.zpli.qualtrics.com/SE/?CID=6V3wQPeLm6Ez4TT

Please complete the survey by December 18th, 2015.

If you have questions or concerns, please e-mail me directly at matthew.borcherding@minnesota.edu

Thank you for your participation.

Matthew J. Borcherding, MAT
Biology Faculty
MSCF - Fergus Falls, Chapter President
matthewborcherding@minnesota.edu
218.796.1592

Minnesota State Community and Technical College (M State)
Appendix H

First Reminder e-mail (12/11/2015) to Participate in Research

Matthew Borcherding

From: Matthew Borcherding
Sent: Friday, December 11, 2015 8:56 AM
Subject: Reminder: Invitation to Participate in Academic Research

Importance: High
Flag Status: Flagged
Categories: Red Category

*** This message is being sent BC to all M State Students. The full informed consent form is found within the survey itself. ***

Dear Students,

This message serves as a reminder that you are requested to participate in a research study regarding your academic and social involvement on campus as well as any past or current drug (including marijuana) use. If you have taken this survey already, please disregard this message.

All students at Minnesota State Community and Technical College (MSCCTC) were invited to participate in this research. The study is being conducted by Matthew J. Borcherding, a faculty member at MSCCTC and a doctoral candidate at St. Cloud State University (SCSU) to satisfy the requirements of a Doctor of Education Degree in Higher Education at SCSU. This survey should take about 3 to 5 minutes of your time to complete.

Please click on the following anonymous (your IP address will not be collected) link to complete the survey:

https://minnesota.myl.surveymonkey.com/r/SID=EV_JeQQvLemo6E4TT

Please complete the survey by Tuesday, December 15th, 2015.

If you have questions or concerns, please e-mail me directly at matthew.borcherding@minnesota.edu

Thank you for your participation.

Matthew J. Borcherding, MAT
Biology Faculty
MSCF - Fergus Falls, Chapter President
matthew.borcherding@minnesota.edu
218-736-5922

Minnesota State Community and Technical College (M State)
Appendix I

Second Reminder e-mail (12/14/2015) to Participate in Research

Matthew Borcherding

From: Matthew Borcherding
Sent: Monday, December 14, 2015 8:07 AM
Subject: Survey Ends Tomorrow! Invitation to Participate in Academic Research

Importance: High
Flag Status: Flagged
Categories: Red Category

***This message is being sent BC to all M State Students. The full informed consent form is found within the survey itself.***

Dear Students,

This message serves as a reminder that you are requested to participate in a research study regarding your academic and social involvement on campus as well as any past or current drug (including marijuana) use. If you have already taken this survey, please disregard this message.

All students at Minnesota State Community and Technical College (MCTC) were invited to participate in this research. The study is being conducted by Matthew J. Borcherding, a faculty member at MCTC and a doctoral candidate at St. Cloud State University (SCSU) to satisfy the requirements of a Doctor of Education Degree in Higher Education at SCSU. This survey should take about 3 to 5 minutes of your time to complete.

Please click on the following anonymous (your IP address will not be collected) link to complete the survey:

https://minnesota.xel.co/8OE/MDoBY_SxQQeLanceoE4TT

Please complete the survey by Tuesday, December 15th, 2015.

If you have questions or concerns, please e-mail me directly at matthew.borcherding@minnesota.edu

Thank you for your participation.

Matthew J. Borcherding, MAT
Biology Faculty
MCTC - Fergus Falls, Chapter President
matthew.borcherding@minnesota.edu
218.736.1992

Minnesota State Community and Technical College (M State)
Appendix J

Third Reminder e-mail (12/16/2015) to Participate in Research

Matthew Borcherding

From: Matthew Borcherding
Sent: Wednesday, December 16, 2015 4:27 PM
Subject: Invitation Extended until January!
Importance: High
Flag Status: Flagged
Categories: Red Category

All,

Due to popular demand, the survey regarding academic and social engagement has been extended. If you have taken this survey already, please disregard this message.

Please click on the following anonymous (your IP address will not be collected) link to complete the survey:

https://minnesota.qualtrics.com/SE/?SID=SV_3xQOvLerna6E4TT

All students at Minnesota State Community and Technical College (MCTC) were invited to participate in this research. The study is being conducted by Matthew J. Borcherding, a faculty member at MCTC and a doctoral candidate at St. Cloud State University (SCSU) to satisfy the requirements of a Doctor of Education Degree in Higher Education at SCSU. This survey should take about 3 to 5 minutes of your time to complete.

Please complete the survey by Friday, January 8th, 2016.

If you have questions or concerns, please e-mail me directly at matthew.borcherding@minnesota.edu

Thank you for your participation.
Appendix K

Final Reminder e-mail (01/03/2016) to Participate in Research

Matthew Borchering

From: Matthew Borchering
Sent: Sunday, January 03, 2016 8:15 PM
To: All-Registered-Students-DL, All-Registered-Students-campus, All-Registered-Students-FP, All-Registered-Students-MND, All-Registered-Students-WAD
Subject: Final Invitation to Participate in Academic Research

Dear All,

This message will serve as the final reminder to complete a survey regarding your academic and social involvement on campus, as well as past marijuana use.

Please click on the following anonymous (your IP address will not be collected) link to complete the survey:

http://minnesota.mn.eaHomepage.com/3Q/SID=5V-3eQOAlqF8RMT

All students at Minnesota State Community and Technical College (MSCCTC) were invited to participate in this research. The study is being conducted by Matthew J. Borchering, a faculty member at MSCCTC and a doctoral candidate at St. Cloud State University (SCSU) to satisfy the requirements of a Doctor of Education Degree in Higher Education at SCSU. This survey should take about 3 to 5 minutes of your time to complete.

Please complete the survey by Friday, January 8th, 2016.

If you have questions or concerns, please e-mail me directly at matthew.borchering@minnesota.edu

Thank you for your participation.

Matthew J. Borchering
Biology Faculty,
Minnesota State College Faculty Chapter President,
Academic Planning Co-Chair,
Chemical Hygiene Officer, Fergus Falls Campus

matthew.borchering@minnesota.edu
218.796.1592

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Appendix L

Permission to use the “Five basic steps to EFA” on pg. 67

Re: Permission to use figure?

Brett Williams <brett.williams@monash.edu>
Ph: 3/18/2016 8:22 PM
To: Matthew Borchering <Matthew.Borchering@minnesota.edu>

Hi Matthew,

You have my approval yes.

All the best with your research.

Brett.

On Saturday, 19 March 2016, Matthew Borchering <Matthew.Borchering@minnesota.edu> wrote:

Dr. Williams,

I am working on my dissertation and I used EFA as part of my study. My committee wants more clarity as to the steps done in the EFA. I recently read your article, “Exploratory factor analysis: A five-step guide for novices” from 2010 and found it to be very helpful. Further, I liked the first figure used to describe the five steps of the process. May I reproduce that figure to put into my study to help add clarity for the reader? I have included a screen shot of the figure I am referring to. Thank you for your time.

Regards,

Matt

Matthew J. Borchering
Biology Faculty,
Appendix M

The figure below shows the full path analysis regarding the impact of marijuana on academic and social involvement in undergraduate students. The values on the lines are representative of the standardized regression weights. The values in the upper right hand corner of the observed variables are the $R^2$ values. The latent variables are represented by ovals, and the observed variables are represented by rectangles. The observed variable codes are found in Appendix A.