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# Incorporating Alternative Sources of Reinforcement through Online CRA Goal Setting and the Effect on Substance Use in College Students

Shirley Mae Crotwell

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**INCORPORATING ALTERNATIVE SOURCES OF REINFORCEMENT  
THROUGH ONLINE CRA GOAL SETTING AND THE EFFECT ON  
SUBSTANCE USE IN COLLEGE STUDENTS**

**by**

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DISSERTATION

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**ABSTRACT**

Emerging adulthood is a transition period where many college students choose to engage in high-risk substance use (e.g., binge drinking). This choice to misuse substances occurs during a developmental period when students are faced with an increased responsibility to structure and manage their time across multiple personal (and potentially competing) goals. The current study approached the problem of college drinking by using two procedures from the Community Reinforcement Approach (CRA). Rating current happiness and coupling it with goal setting was evaluated as a potential means of increasing substance-free reinforcement that could compete with (i.e., reduce) alcohol use. Males and females ages 18-25 years who consumed alcohol in the last 30 days were randomized to either a control condition ( $n = 89$ ) or a goal-setting condition ( $n = 79$ ). Both conditions reported their substance use and levels of happiness at

baseline and during a one-month follow up. In the goal-setting condition, the most commonly selected goal was “physical exercise.” Participants in this condition increased their happiness and reduced their alcohol consumption over the course of the study. Overall, the goal-setting condition reported a greater reduction in alcohol use when compared to the control group. Additionally, this study found that more time spent in academic activities or volunteering/charity work (among the experimental condition) was correlated with lower levels of alcohol use at baseline. An increase in the amount of time spent in academic activities or spiritual activities was correlated with lower levels of alcohol consumption at follow up. This study also evaluated the Pleasant Activities List (PAL), a modern survey instrument that has not yet been used with U.S. college students. It was found that alcohol-related reinforcement was highly correlated with measures of alcohol use. The PAL was also highly correlated with the Adolescent Reinforcement Survey Schedule (ARSS), a survey instrument commonly used with college students in the U.S. Social activities, especially those that involve friends or a potential romantic partner, were found to be highly reinforcing with alcohol while individual activities, such as self-care and physical fitness, were low in alcohol-related reinforcement. The implications of a reinforcement-based approach are discussed.

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## Chapter 1:

### Introduction

#### College Substance Use

In the United States, attending college is seen as a transition period in which an individual is given the opportunity to expand in knowledge and cultivate an independent lifestyle. Unfortunately for many, the college experience also involves a time-specific exacerbation of alcohol use (White, Labouvie, & Papadaratsakis, 2005). College students show a greater increase in heavy, episodic drinking post high-school graduation, and are statistically more likely to meet criteria for alcohol dependence, when compared to their non-student peers (Dawson, Grant, Stinson, & Chou, 2004). Two out of five U.S. college students are classified as heavy drinkers, defined as five or more drinks in a row in the past two weeks (O'Malley & Johnston, 2002). Wechsler, Dowdall, Davenport, and Castillo (1995) used a large, representative sample of students on 140 campuses (n = 17,592) and found that 44% of the students (50% of the men and 39% of the women) engaged in binge drinking (i.e., five or more drinks per occasion for males and four or more drinks for females). In 2013, the Campus Office of Substance Abuse and Prevention (COSAP) at the University of New Mexico (UNM) conducted an anonymous survey (UNM Student Lifestyles Survey) in order to summarize student behavior and attitudes regarding substance use. This 15-minute survey used a convenience sample across multiple disciplines and was matched with UNM undergraduate demographics (gender, ethnicity, age). The survey reported that 63% of students consumed alcohol in the past month,

and 35% of students reported binge drinking. Risky drinking is seen across college campuses, and the perception that peers are supportive of drinking is associated with higher levels of alcohol use (Kuther & Timoshin, 2003).

Although alcohol is the primary drug of choice among college students, other drug use is also common. About 30% of college students smoke cigarettes and 20% currently use marijuana (O'Malley & Johnston, 2002). In a more recent study, Currell and Jeglic (2010) found that 78.5% reported using alcohol and 36.9% reported recreational drug use at some point in their lives. When asked about recent drug use only, this behavior was endorsed by 11.6% percent of the sample. According to the UNM Student Lifestyles Survey (2013), 24% of students reported marijuana use in the past 30 days. College student drug users also tend to use multiple substances. Mohler-Kuo, Lee, and Wechsler (2003) reported that 98% of illicit drug users were also binge drinkers or used multiple illicit drugs.

Alcohol intoxication puts an individual at increased risk for harm in many ways, as intoxication impairs both cognitive and motor abilities (White & Hingson, 2014). In a study involving over 17,000 college students, it was determined that 47% of binge drinkers experience five or more drinking-related problems, such as health problems, injuries, risky decision-making, and decreased academic performance (Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994). Frequent binge drinkers are seven to ten times more likely to engage in unprotected sex, experience difficulties with campus police, damage property, or get injured. Approximately 2.7 million college students (ages 18-24) drive under

the influence of alcohol and 1,800 students die each year in the United States as a result of unintentional, alcohol-related injuries (Hingson, Zha, & Weitzman, 2009).

The negative consequences of substance use are not limited to one particular sample of students. Currell and Jeglic (2010) recruited an ethnically-diverse sample of 372 college students and found that substance users across ethnicities report higher levels of delinquent behavior than non-users. When college students abuse substances, non-using peers experience negative consequences as well. Wechsler and colleagues (1994) found that students who do not engage in binge drinking but attend colleges with high binge rates are more likely to experience problems such as being assaulted, experiencing unwanted sexual advances, or having their property damaged when compared to colleges with low binge rates. Other secondhand effects include study or sleep interruptions (60%), having to care for an inebriated student (48%), and being insulted or humiliated (29%; Wechsler, Lee, Kuo, Seibring, Nelson, & Lee, 2002).

### **Current Substance Use Interventions in College Populations**

Institutions of higher education are aware of the problems caused by alcohol and other illicit drug use, and many have incorporated prevention and intervention strategies. Common strategies include providing alcohol education, attempting to change the way students perceive substance use among peers, providing short-term counseling, and imposing greater sanctions for substance-related offenses (Wechsler et al., 2002). Larimer and Crouce (2007) categorized current prevention and intervention strategies into three main groups:

educational/awareness, cognitive-behavioral plus skills-based, and motivational/feedback-based. These approaches vary in their degree of effectiveness and acceptability to students.

Educational or awareness programs strive to give students facts about rates of substance use in the college population and provide information about the potential negative consequences. These efforts typically incorporate some form of “social re-norming,” an intervention in which the expectations and behaviors from various reference groups are compared (Barnett, Far, Mauss, & Miller, 1996). These educational/awareness programs are designed to reduce substance use by correctly pointing out that the majority of college students do not engage in heavy substance-use, and those who do engage in this behavior experience negative consequences. This normative information is important because college students, particularly males, perceive that their peers are supportive of drinking, and social cognitive variables account for 76% of the variance in alcohol use (Kuther & Timoshin, 2003).

Despite increased prevention efforts such as these, the level of binge drinking among college students has not decreased. A study which investigated the trends in college binge drinking between 1993 and 2001 found an interesting polarization whereby the percentages of *both* abstainers and frequent binge drinkers increased (Wechsler et al., 2002). Students also reported an increase in alcohol-related harm over the eight-year period. This increase in consumption and negative consequences was seen despite an increase in exposure to alcohol education programs. In fact, more than half of all students reported that their

schools had provided information on college rules and other alcohol-related education. In 2007, Larimer and Cronce reviewed prevention and treatment strategies used in the college population from 1999-2006 and discovered little support for education/knowledge only approaches, but found evidence in favor of interventions that incorporated skills building or personalized feedback.

Cognitive-behavioral or skills-based programs rely on self-monitoring, challenging typical alcohol expectancies, and occasionally offering general life skills training. Challenging alcohol expectancies is important because adults with positive alcohol expectancies (e.g., believing that alcohol will enhance socialization, sexuality, and relaxation) are more likely to drink frequently (Fromme, Stroot, & Kaplan, 1993), consume more alcohol (Christiansen, Smith, Roehling, & Goldman, 1989), and display more signs of problem drinking (Werner, Walker, & Green, 1993) compared with individuals without positive alcohol expectancies. Cognitive-behavioral approaches have demonstrated higher levels of effectiveness compared to traditional alcohol information alone (Darkes and Goldman, 1993; Larimer & Cronce, 2002).

Motivational approaches strive to increase intrinsic motivation for behavior change through the use of personalized feedback or values clarification. Personalized feedback helps provide objective information about how a particular student's substance use compares with the use of other students, and points out personal consequences of substance abuse. Values-based interventions help students identify personal values (e.g., family or career success), which are often incongruent with substance abuse. The highlighted discrepancy between

personal values and the choice to use substances in a problematic way enhances motivation to change (McNally, Palfai, & Kahler, 2005).

Although students report the greatest enjoyment and benefit as a result of brief, individualized approaches (Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001), considerable limitations remain. While some students temporarily reduce their consumption in response to brief interventions, many students do not maintain their treatment gains long-term (Larimer & Crouse, 2002; Roberts, Neal, Kivlahan, Baer, & Marlatt, 2000). Additionally, although college substance use is a significant problem, few college students seek substance abuse treatment (Knight et al., 2002). Wechsler and colleagues (2002) reported that from 1993 to 2001, the proportion of students who sought help for alcohol problems decreased from 2.4% to 1.5%. This suggests that college students rarely seek out resources on their own to help decrease their substance use.

When comparing across current interventions designed for college students, it appears that one major deficit is the limited focus on the students' environment more broadly by failing to fully account for the behavioral variables that influence substance use (Murphy, Correia, Colby, & Vuchinich, 2005). Although it is uncommon for college students to pursue treatment for substance-related issues (Knight et al., 2002), it can be hypothesized that students may be more interested in enhancing their lives more generally (i.e., feel open to exploring alternative sources of reinforcement) due to the major life changes that accompany the transition to college. Approaching college substance use with a focus on reinforcers takes into account the important role of the environment and

individual differences. Current interventions are successful (at least temporarily) when attempting to increase intrinsic motivation and readiness for change, but seem to fall short at addressing the alterations that need to be made in the student's environment so that the student can receive reinforcement through means other than substance use. Without this adjustment in substance-free sources of reinforcement, it is unlikely that treatment gains will be maintained.

### **The Conceptualization of Substance Use According to Reinforcement Principles**

B.F. Skinner explained the concept of reinforcement in his theory of operant conditioning (Skinner, 1938). Based on Thorndike's Law of Effect (1905), Skinner understood behavior as something that can be strengthened or weakened based on the manipulation of three specific operants: neutral operants, punishers, and reinforcers. Neutral operants are environmental responses that neither increase nor decrease the probability of a behavior being repeated, while punishers and reinforcers decrease or increase this likelihood, respectively. Therefore, in terms of reinforcement, substance use is understood as a behavior that is likely to be repeated when a benefit is gained (i.e., positive reinforcement) or when something aversive, like anxiety, is removed (i.e., negative reinforcement).

Given the understanding that reinforcers increase the likelihood of a behavior being repeated, an important next step involves defining reinforcement in such a way that the reinforcement value of different environmental contingencies can be compared. The reinforcement potential of a given activity

has been operationally defined as the cross product between frequency of engagement in the activity and subjective pleasure experienced during the activity (Correia, Carey, Simons, & Borsari, 2003). Activities that are engaged in frequently and are subjectively rated as very enjoyable are considered highly reinforcing. Frequency and enjoyment ratings independent of one another do not accurately capture the degree of reinforcement received. A person may engage in a certain behavior frequently but find it very unpleasant and vice versa; a person may report great enjoyment from a behavior that is not accessible on a regular basis (i.e., low frequency). However, the cross product, which takes into account both frequency and enjoyment, captures the likelihood of a behavior being repeated.

Murphy and colleagues (2005) further conceptualized the reinforcement value of substance use as a function of the relative reinforcing value of drugs or alcohol compared to substance-free activities. Relative reinforcing value is defined as the proportional resource allocation and enjoyment from substance-related reinforcers compared with non-substance related reinforcers in the environment (Murphy et al., 2005). The relative reinforcing value of substance use can be used to predict future substance use behavior. This assertion was empirically tested in 2005 using a sample of 54 heavy drinking college students (69% female). They found that women who derived a smaller proportion of their total reinforcement from substance use showed lower levels of drinking six months after baseline (even after controlling for baseline level of consumption). Additionally, for both male and female students who reduced their drinking, there

was a proportional increase in reinforcement from substance-free activities. Similar predictions, based on quantifying deficits in substance-free sources of reinforcement, have also received empirical support in studies on other drugs (e.g., cocaine, heroin, nicotine; Higgins, Heil, & Lussier, 2004).

Murphy and colleagues (2005) used this relative reinforcement concept in combination with a Behavioral Theory of Choice (BTC; Herrnstein, 1970; Premack, 1965; Rachlin, Green, Kagel, & Battalio, 1976) to explain how a certain behavior is chosen among many options. They reported that the concept of reinforcement is pivotal in understanding substance use because substance use is a choice, and an evaluation of reinforcement is largely guiding this decision. BTC, based on behavioral economics (McDowell, 1988; Vuchinich & Tucker, 1996), explains that the decision to consume alcohol or use illicit drugs is based on the relative value of substance use versus other available reinforcers. BTC posits that the reinforcing properties of substance use occur in a context. Identifying other potentially reinforcing activities and making them readily available impacts the decision to choose alcohol or drugs. For example, Higgins, Bickel, and Hughes (1994a) demonstrated that money could act as a competing reinforcer when researchers allowed participants to choose between intranasally administered cocaine and varying amounts of money. College substance use is also a choice occurring in a context in which the relative reinforcing value of substances is evaluated in comparison with the reinforcing value of other activities.

## **The Rationale for Exploring Reinforcement in College Students**

Interestingly, when college students were asked to suggest potential improvements in alcohol-related actions or policies on campus, the most popular suggestions were clarifying alcohol-related rules (93%) and providing more alcohol-free recreational and cultural opportunities (89%; Wechsler et al., 2002). In other words, students themselves recognize that the threat of punishment makes the choice to use alcohol less desirable, and alternative substance-free sources of reinforcement must be made available to compete with substance use. Sensitivity to reinforcement seems to play a larger role in drinking behavior among college students than sensitivity to punishment (O'Connor & Colder, 2005), which may be one reason why increased awareness of punishment may be less effective than identifying sources of reinforcement that can compete with substance use.

Reinforcement is particularly important to address in college students because students report many positive consequences of substance use, such as increased socialization, enhanced sexuality, and stress relief. Furthermore, positive experiences more strongly influence future intentions than negative experiences (Park, 2004). Of critical importance is the finding that high rates of substance use are linked with a lack of substance-free sources of reinforcement, and substance use declines with an increase in alternative reinforcers (e.g., Murphy et al., 2005). Increasing the availability of substance-free reinforcement can reduce the rate of initial drug use (prevention effect) as well as reduce the rate of drug use among current users (treatment effect; Higgins et al., 2004).

Another important reason to approach college substance use with an understanding of reinforcement is the finding that the degree of reinforcement obtained by substances (relative to substance-free activities) is an indicator of risk above and beyond level of alcohol consumption (Murphy & Vuchinich, 2002; Tucker, Vuchinich, & Rippins, 2002). Individuals with higher levels of substance-free reinforcement report lower levels of substance-related problems (Murphy et al., 2005). Many researchers continue to use baseline level of substance use as the primary predictor of future substance use and related problems, but an analysis of reinforcement value would add improved accuracy to this prediction. For example, even though two groups of college students may report the same level of consumption at baseline, some of the students will continue to engage in risky substance use post-graduation while others will significantly decrease their use once they leave the college environment. One likely difference between these two groups is the relative degree of reinforcement obtained from substance-related activities compared with sober activities. If an individual derives the majority of his/her reinforcement from substance use, many changes will be needed in order to adopt a sober, reinforcing lifestyle.

In summary, understanding the choice to use substances through an analysis of reinforcement is an essential construct to address in the college population. Substance use is an operant behavior that is malleable based on context-dependent reinforcers (Higgins et al., 2004). Students report many desirable consequences resulting from substance use, such as increased social interaction and decreased anxiety. Furthermore, high rates of substance use are

associated with a deficit in substance-free reinforcement. Importantly, the relative reinforcing value of substances is an indicator of risk above and beyond level of alcohol consumption. Increased knowledge in this area can address limitations in current interventions by identifying alternative, substance-free sources of reinforcement that can compete with substance use, which can then be coupled with interventions designed to enhance student motivation for change.

### **Alternative Sources of Reinforcement for College Students**

Research has identified several categories of activities that are negatively correlated with substance use among college students. These activities include academic activities, employment, spiritual activities, volunteering or charity work, physical exercise, time spent with family, non-drinking social activities, and substance-free leisure activities enjoyed alone.

**Academic activities.** Achieving academic success is incompatible with problematic substance use, in that substance use negatively impacts academic performance (Singleton, 2007; Wechsler et al., 1994). Students who study more than four hours a day are also less likely to engage in binge drinking (Wechsler et al., 1995). College students appear to be aware of the short-term negative impact of substance use on academic performance, given that most alcohol consumption occurs Thursday through Saturday (Finlay, Ram, Maggs, & Caldwell, 2012).

Murphy and colleagues (2012) attempted to increase the salience of academic/career success in order to decrease substance use among college students. Using tools like personalized feedback and goal setting, the authors

found that participants who completed the substance-free activity session, which was focused on increasing academic success, reported significant reductions in heavy drinking and fewer alcohol problems at follow-up. Participants who had lower levels of substance-free reinforcement or more depressive symptoms at baseline showed greater reductions in heavy drinking following the substance-free activity session. Their work suggests that if college students focus their attention on academic/career success, modifications to their substance use will coincide. A major limitation of the work by Murphy and colleagues (2012) was the assumption that all college students would highly value academic/career success. Other important areas of reinforcement were not considered.

**Employment.** Finding employment is an important part of establishing a reinforcing lifestyle that does not include the abuse of substances (Azrin, 1976). Higgins et al. (2008), proponents of contingency management, have encouraged therapists to discuss employment-based reinforcement with their substance-abusing clients. Essentially, clients who become employed are setting up their own form of financially-based contingency management, in which abstinence is reinforced with a paycheck, and this reward is removed as a consequence of substance use. Even if employees are not regulated by drug tests, substance use is associated with negative work behaviors (i.e., withdrawal and antagonistic activities; Lehman & Simpson, 1992). More generally, the behaviors required for occupational success (e.g., regular attendance and quality work) are incompatible with problematic substance use. Additionally, in order to receive

job-related reinforcement, one must devote a considerable amount of time to work that might otherwise be available for substance use.

In addition to the role of being a student, 65% of students report off-campus employment ranging from five to 60 hours a week (average of 24.4 hours/week), according to a survey conducted at a southeastern, urban university (Furr & Elling, 2000). These researchers also found that students who work part-time have less time for extracurricular activities. Students who work less than two hours a day are more likely to engage in binge drinking than peers who work more than two hours a day (Wechsler et al., 1995). Reducing available free time appears to be advantageous when considering reduced substance use as the target.

**Spiritual activities.** Spiritual and religious beliefs are often associated with less alcohol use, but the relationship between beliefs and other drug use (e.g., cocaine, LSD, ecstasy) is more variable (Stewart, 2001). While religiosity is not entirely synonymous with spirituality, higher religiosity has shown some protective effects against alcohol and marijuana use (White et al., 2006). With respect to attitude toward religion, undergraduates who report that religion is “not at all important” have a much higher likelihood of binge drinking compared with other undergraduates (Wechsler et al., 1995). Using a sample of 444 college students, Coccoma and Anstadt (2001) found a significant inverse relationship between greater daily spiritual discipline and endorsement of substance abuse criteria. However, the relationship between spirituality and substance use is not always unidirectional. For example, some spiritual practices may encourage

substance use to enhance mystical experiences (Stewart, 2001). Therefore, it is important for research to identify if increasing spiritual reinforcement, among students who value spirituality, is associated with a decrease in substance use. Research is also needed to identify which particular spiritual activities effectively compete with (rather than encourage) substance use.

**Volunteering/charity work.** Wechsler and colleagues (1995) found modest effects for student attitudes toward community service, in that students who view these activities as “not important” or only “somewhat important” are more likely to engage in binge drinking as compared with students who report participation in community service as highly valuable. In addition to attitudes about volunteering, the amount of time spent volunteering is negatively correlated with substance use. Among a highly diverse sample of college freshmen, Finlay and colleagues (2012) found that students who spend more time involved in volunteering activities report less alcohol use. Additionally, Weitzman and Kawachi (2000) found that binge drinkers are more likely to report no time volunteering, while the choice to volunteer is associated with a five percent decrease in risk for binge drinking (after accounting for age, sex, race, and parents’ education). Although there seems to be an inverse relationship between volunteering and substance use, college students spend very little time involved in the former. According to Weitzman and Kawachi (2000), only 20-25% of college students report any time volunteering, and binge drinkers are more likely to report no time volunteering in the last 30 days when compared to non-binge drinkers. It is unclear whether those students who engage in volunteer

activities are characteristically different from non-volunteers in some way that affects substance use (e.g., values). Research is needed to determine if increasing the amount of time volunteering will have the subsequent effect of decreasing substance use.

**Physical exercise.** Investigation into the influence of physical activity and athletics on substance use has produced mixed results. While Wechsler and colleagues (1995) found that students who highly value participation in athletic activities are more likely to engage in binge drinking, two empirical studies have investigated whether engaging in physical activity as a substance-free alternative can reduce substance use. Murphy, Pagano, and Marlatt (1986) randomized 60 heavy drinking college students into one of three conditions: an exercise intervention, a meditation intervention, or a no-treatment control group. Both during the eight-week intervention and at the six-week follow-up, the exercise intervention showed the greatest reduction in alcohol consumption. Correia, Benson, and Carey (2005) looked at substance users more generally (although primarily drinkers) and assigned participants again to one of three conditions: instructions to reduce substance use by 50%, instructions to increase physical and creative activities by 50%, or a no-instruction control. After four weeks of intervention, the physical/creative activities group significantly reduced their substance use. It is difficult, however, to tease apart the effects of physical activities from creative activities in the design of this particular study. Although somewhat promising, these two studies are limited in external validity because

they did not evaluate other potential sources of reinforcement, and students certainly vary in the degree to which they find physical exercise reinforcing.

**Family time.** The role of familial reinforcement is important to explore because the number of family members in an individual's social network is inversely correlated with degree of substance use (Reifman, Watson, & McCourt, 2006; Fondacaro & Heller, 1983). Many college students receive considerably less familial reinforcement as they move away from home to attend college, but the role of familial reinforcement in the college years is likely influenced by individual variables such as the role culture plays in self-identification (e.g., collectivistic vs. individualistic cultures). Students who maintain integration with their families and continue to live at home are less likely to engage in binge drinking, whereas students who have greater exposure to campus life (e.g., living in dormitories) are more likely to binge drink (Wechsler et al., 1995). Spending time with family may also increase the salience of certain personal values that are incompatible with substance use.

Although increased reinforcement from family time is a potential competitor with substance use, the correlation between substance use and time spent with family is not always negative. The substance use behavior of family members is also important to consider, because having a parent who drinks is a strong predictor of binge drinking in college students (Wechsler et al., 1995). Additionally, student perceptions of higher parental alcohol use are associated with positive alcohol expectancies, which are related to future intentions to drink (Glanton & Wulfert, 2013). If a student chooses to increase time with family

members who abuse substances, the student may also increase his/her substance use.

**Substance-free social activities.** College life is an environment in which social interaction is developmentally and psychologically important. Results from the University of California Undergraduate Student Experience Survey (UCUES) indicate that undergraduates spend more than 40 hours a week on social/leisure activities (Brint & Cantwell, 2008). Social motives seem to play an important role in the decision to use substances among college students (Lee et al., 2007), and therefore social reinforcement has received the greatest research attention. Nezlek, Pilkington, and Bilbro (1994) reported an inverted-U-shaped relationship between alcohol consumption and quality of social relationships, in that students who reported zero binge drinking episodes per week and those who reported more than three binge episodes per week reported less intimacy in their relationships. Wechsler et al. (1995) also reported that students who spend more than two hours a day socializing are more at risk for binge drinking than students who socialize less.

The composition of one's social network is an important consideration because the addition of "drinking buddies" to a student's social network is associated with increased alcohol use at later follow up, but the removal of perceived drinking partners is related to decreased use over time (Reifman, Watson, & McCourt, 2006). Additionally, amount of social contact, network density and degree of social competence are positively associated with level of alcohol consumption (Fondacaro & Heller, 1983). Residence in a fraternity or

sorority and adopting a “party-centered lifestyle” are two variables with a large social reinforcement component that strongly predict college binge drinking (Wechsler et al., 1995; Reifman, Watson, & McCourt, 2006).

Murphy, Barnett, and Colby (2006) suggest that social activity and alcohol consumption may be complementary reinforcers, such that increasing opportunities for social interaction among college students may increase levels of consumption. Similarly, students who reduce their substance use have been shown to simultaneously decrease their level of reinforcement from substance-free peer interactions (Murphy et al., 2005). Increased socialization (even substance-free) seems to be correlated with substance use, therefore the relationship between substance-free social reinforcement and substance use warrants further investigation.

Skidmore and Murphy (2010) found that heavy drinkers, regardless of gender, have higher substance-free peer and sexual reinforcement than light drinkers. These findings might suggest that substance users have reinforcement deficits in many areas (e.g., family, employment, academics) but may not show a deficit in reinforcement from social activities. Skidmore and Murphy lacked a comparison group of students who did not engage in substance use, so it is unclear whether heavy drinkers receive more social and sexual reinforcement than non-drinkers. However, based on the inverted-U-shaped relationship between alcohol consumption and quality of social relationships reported by Nezlez et al. (1994), it can be hypothesized that non-drinking college students experience lower levels of substance-free, social reinforcement compared to

moderate drinkers. Clearly properties of social networks are correlated with substance use, and future research with college students is needed to identify means for keeping social reinforcement high while decreasing substance use.

**Substance-free individual activities.** On an average weekday, full-time college students spend approximately four hours in leisure or sport activities, which is slightly more than the time spent on academic activities (3.3 hours) or employment (2.4 hours; Bureau of Labor Statistics, 2015). Leisure activities account for the greatest proportion of time in a given day after accounting for time spent sleeping (8.7 hours). More time spent in individual-based, leisure activities, like using media, have been associated with decreased alcohol use among college students (Finlay et al., 2012).

There is a great deal of variability in the types of leisure activities that are available to college students, therefore valid survey instruments play an important role in comparing the reinforcement value of specific activities. In 2008, Roozen and colleagues released a modern assessment tool called the Pleasant Activities List (PAL). The 139-item PAL was made using both the Pleasant Events Schedule (MacPhillamy & Lewinsohn, 1982) and the Leisure Interest Checklist (Rosenthal, Montgomery, Shadish, & Lichstein, 1989). Activities assessed include social activities, sensation-seeking activities, domestic activities, activities relevant to culture/science/traveling, passive/relaxing activities, sport-related activities, and activities that involve intimacy/personal attention. These 139 activities are rated on frequency of participation and degree of enjoyment experienced while engaging in the activity in the past 30 days.

Roozen and colleagues (2008) found that treatment-seeking adults show deficits in substance-free reinforcement received from leisure activities as compared to controls.

### **Community Reinforcement Approach**

The Community Reinforcement Approach (CRA) is a reinforcement-based treatment designed to reduce substance use. Originally developed as a treatment for alcoholism (Hunt & Azrin, 1973), CRA conceptualizes substance use as a behavior that is both maintained and changed through the influence of environmental contingencies. In order to discourage substance use, a non-use lifestyle must become both available and more rewarding in order to compete with the reinforcing properties of substance use. One advantage over standard contingency management is that CRA aims to change the client's natural environment. The CRA model attempts to utilize social, recreational, familial, and vocational forms of reinforcement to create a more rewarding substance-free lifestyle (Azrin, 1976; Hunt & Azrin, 1973; Meyers & Smith, 1995).

One foundational component of CRA is the completion of a functional analysis, which relies heavily on the concept of reinforcement. In addition to describing the amount of substances used and identifying antecedents, the functional analysis aids in clarifying the positive and negative consequences that result from substance use. Understanding the personally-relevant negative consequences helps to guide motivational enhancement, and knowing what each individual identifies as the positive consequences of use provides insight into the motives behind the choice to use alcohol or drugs. Understanding the function of

substance use gives important directions for identifying salient and effective substance-free alternatives (i.e., sources of reinforcement that are likely to be used and most likely to compete with the effects of substances).

Two central tools utilized during the implementation of CRA include the Happiness Scale and the Goals of Counseling form. The Happiness Scale is a ten-item questionnaire that asks clients to rate their happiness (on a ten point scale) in each of the following areas: sobriety, job or educational progress, money management, social life, personal habits, marriage/family relationships, legal issues, emotional life, communication, and general happiness (Meyers & Smith, 1995). The same 10 areas from the Happiness Scale are highlighted on the Goals of Counseling form. Using information from the Happiness Scale, clinicians collaborate with clients to identify areas where happiness can be improved through goal setting and achievements. The CRA clinician is critical in helping the client set specific, measurable, and time-specific goals. Importantly, the necessary steps for accomplishing the goals are outlined and discussed as well. Incorporating goals to improve key areas of the client's life is fundamental to the CRA approach because the objective is to increase the client's natural sources of substance-free reinforcement. Unhappiness in certain areas may have contributed not only to the etiology but also to the current maintenance of the person's reliance on substance use. Substance-free reinforcers often provide a healthier avenue for coping with negative affect and provide a source of positive affect. After specific goals have been set, the CRA-based clinician can incorporate skills building, which is necessary to achieve goals and increase

happiness scores (e.g., communication skills training, problem-solving training, and drink/drug refusal training).

Two areas of happiness (and sources of reinforcement) that are heavily emphasized during CRA are employment and recreation. Important skills are taught in order to help a person secure and/or maintain a job, and social/recreational training helps individuals identify satisfying activities (either alone or in the company of others) that can compete with substance use. Although there is no standardized assessment for identifying potential reinforcers, CRA-based clinicians are encouraged to ask questions like, “Who are three people you really admire? What do these individuals do for recreation?” (Meyers & Smith, 1995). Another technique is to have clients generate a list of five to ten recreational activities and agree to experiment with one for the week (Meyers & Smith, 1995). This approach is very client-centered, in that clients are encouraged to self-identify potential sources of reinforcement.

Although CRA has not been evaluated in a primarily college student sample, CRA has strong scientific support in terms of efficacy and cost-effectiveness in reducing substance use behavior among treatment-seeking adults (Azrin, 1976; Finney & Monahan, 1996; Hunt & Azrin, 1973; Mallams, Godley, Hall, & Meyers, 1982; Miller, Wilbourne, & Hettema, 2003; Miller, Zweben, & Johnson, 2005; Sisson & Azrin, 1986; Smith, Meyers, & Delaney, 1998). Pantaloni, Chawarski, Falcioni, Pakes, and Schottenfeld (2004) investigated which particular CRA procedures mediated the relationship with client outcomes, specifically abstinence and retention. Higher rates of providing a

rationale, which is encouraged for every CRA procedure, and discussing goals of counseling showed a significant positive relationship with abstinence. Therefore successfully reaching goals and understanding the rationale behind increasing happiness are critical to the Community Reinforcement Approach.

In light of CRA's success with adult populations, CRA has been modified for use with adolescents. Adolescent Community Reinforcement Approach (A-CRA; Godley et al., 2001) takes into account adolescents' patterns of use and age-appropriate sources of reinforcement. A-CRA also includes procedures for caregivers (Godley et al., 2001). This modified version of CRA is considered a highly effective treatment for decreasing adolescent substance use (Dennis et al., 2004; Godley et al., 2002; Godley et al., 2007). Using a sample of 399 adolescents (majority 15-16 year old Caucasian males), Garner et al. (2009) demonstrated that exposure to A-CRA procedures accounted for 29% of the variance in post-treatment drug use and 43% of the variance in substance-related problems.

The success of A-CRA demonstrates that CRA can be effectively modified to the unique environmental context of a particular person or group (e.g., adults versus adolescents). A reinforcement-based program for college students would need to take into account the patterns of use and the environmental context of transitional youth who are situated between adolescent and adult stages of development (i.e., emerging adulthood). A typical day in the life of a college student is different from his/her peers who are not attending college. Reinforcing activities that are available and salient need to be identified for this particular

group, as does the function of substance use for college students. Importantly, the Happiness Scale and goal setting components of CRA could be used to help students identify areas of life that are important to them, and aid them in setting goals and taking steps to increase reinforcement in domains of life that compete with substance use. These two tools are advantageous because they can be administered online, which would greatly increase delivery to college students. In the U.S., this population reports connecting to the Internet many times a day. In fact, 50 percent of college males and 33% of college females report being online more than three hours each day (Jones, Johnson-Yale, Millermaier, & Perez, 2009).

Recently, work has been done to investigate the effectiveness of a computerized version of CRA. Bickel, Marsch, Buchhalter, and Badger (2008) randomly assigned opioid-dependent patients to one of three groups: (1) therapist-delivered CRA plus vouchers, (2) computer-delivered CRA plus vouchers, and (3) standard care. The CRA treatment included several training modules, such as self-management planning, drug-refusal training, recreational counseling, social skills training, relapse prevention, etc. The therapist-delivered CRA and computer-assisted CRA resulted in similar abstinence outcomes, which shows promise for computer-assisted delivery with respect to outcome, cost effectiveness, and treatment fidelity. Additionally, Internet-based programs (e.g., assessment, feedback, motivational exercises) have been shown to significantly reduce number of drinks per week and number of alcohol-related problems (Hester, Delaney, Campbell, & Handmaker, 2009; Hester, Squires, & Delaney,

2005). Hester and Delaney (1997) evaluated a computer-based behavioral self-control training program, which included components such as goal-setting, developing alternatives to drinking, and relapse prevention. They found that the effect sizes for drinking variables were comparable to a face-to-face format. Given college students' propensity to spend several hours a day online, Internet-based modules (as opposed to in-person interventions) appeared worthy of exploration.

### **Understanding Individual Differences**

The reinforcement value of an activity is not entirely dependent on the properties of the activity itself, but is also influenced by individual-difference variables. Gender, age, and sensitivity to reward are a few important individual-difference variables to consider.

**Gender.** Men and women differ in their experiences relative to substance use and in their enjoyment of substance-free activities. Park (2004) found that men report greater positive and negative consequences from alcohol use, but women report that negative experiences with alcohol have a greater effect on intentions to drink in the future. Unlike the impact of negative consequences, men and women do not differ in the extent that positive experiences predict future intentions.

In terms of reinforcement from substance-related activities, college men find social activities that incorporate substance use more reinforcing than substance-free peer interactions. Women, however, seem to experience certain substance-free peer interactions and substance-related activities as equally

enjoyable. Men are less likely to engage in alcohol-free activities that include peers and report less enjoyment related to alcohol-free activities than do women (Murphy et al., 2006). Murphy and colleagues (2006) also found a positive relationship between number of peers involved with an activity and level of alcohol consumption regardless of gender. Although this relationship was present for both men and women, data reported by men showed a stronger relationship than the reports from women. A contextual variable that increased enjoyment of alcohol-related activities for women was presence of a romantic partner, while an important contextual variable for men was number of peers.

Gender also seems to be important in identifying enjoyable alternatives to substance use. Men report greater substance-free school reinforcement and greater substance-related family reinforcement than women (Murphy et al., 2005). Murphy and colleagues (2006) found that men rated certain substance-free activities as very enjoyable, like watching and playing sports, while women rated time with family and time spent outdoors as very enjoyable. Therefore, gender is an important factor to consider when comparing reinforcement from various domains (e.g., social, familial, recreational).

**Age.** Age is an important individual-difference variable to consider because older students are more likely to be employed, thereby having access to a higher income but also having the smallest amount of free time available for extracurricular activities (Furr & Elling, 2000). Older students also are more likely to have additional sources of reinforcement, like families, hobbies, and well-developed social networks. Although one might expect younger college students

to avoid alcohol because of legal age drinking laws, Wechsler and colleagues (1995) found that drinking laws had little impact on binge drinking, with binge drinking being the highest among younger college students.

Age also predicts stage of life. Typical college students are in a risky period of human development; a time when they are leaving adolescence (where structure was imposed through family, education, etc.) and entering adulthood (where individuals become more independent and responsible for establishing their own structure/routine). Brain maturation during late adolescence increases the likelihood of risky decision-making due to the preferential development of subcortical regions over cortical regions important for cognitive control (Casey, Jones, & Hare 2008). In other words, the behavior of college students who are transitioning out of adolescence may be guided more by emotion and pleasure-seeking than by executive, top-down control. The typical college student is likely to be motivated by short-term reinforcement and to show inhibited delayed gratification (Kollins, 2003). Due to the processes of brain maturation, particularly in the frontal cortex, emotion-guided behavior is likely to be more pronounced in younger college students, making age an important individual-difference variable.

**Sensation seeking and delayed discounting.** Borsari, Murphy, and Barnett (2007) identified sensation seeking as a major predictor of alcohol use during the first year of college. Sensation seeking is a personality trait in which an individual shows a preference for novel experiences and arousal (Stephenson, Hoyle, Palmgreen, & Slater, 2003). Students with higher levels of sensation seeking are more likely to engage in heavy drinking (Borsari, Murphy,

& Barnett, 2007), and students with lower levels of sensation seeking are less likely to increase their marijuana and alcohol use during the transition from high school to college (White et al., 2006).

Additionally, students vary in their preference for short-term versus delayed rewards. The study of behavioral economics has led to the realization that the value of delayed reinforcement and effect of severity of reinforcement varies between individuals with substance abuse problems and controls. Bickel and Marsch (2001) found that the former prefer smaller, immediate reinforcement over larger, delayed sources of reinforcement, and in general show greater devaluing (“discounting”) of delayed rewards compared to controls (Madden & Bickel, 2010). This highlights the importance of considering whether certain competing activities deliver reinforcement in the short- or long-term. Work based on behavioral economics suggests that college students not only choose to use substances because of the reinforcing properties of substance use, but that larger, delayed reinforcers (like graduating from college) are less likely to compete with more immediate reinforcement received from substance use (e.g., stimulant effects).

Kollins (2003) used a sample of college students to explore the relationship between delay discounting and substance use by having students make a choice between immediately receiving a small amount of money or choosing a larger amount to be delivered after a range of delays. The researcher found that discounting the value of future rewards was associated with a number of substance use variables, including the number of times a student “passed out”

from alcohol and the total number of illicit drugs used. Since students high in delayed discounting prefer more immediate forms of reinforcement, delayed discounting, in addition to the aforementioned individual difference variables (e.g., gender, sensation seeking), is important to consider when identifying alternative reinforcing activities that can compete with substance use.

### **The Current Study**

Current interventions to decrease college substance use focus on increasing motivation to reduce use but do not address the alterations that need to be made to the students' environment in order for changes to be maintained. The purpose of the current study was to approach the problem of college substance use by viewing the behavior as a function of reinforcement principles. Previous research has shown that substance-abusing individuals show a deficit in substance-free reinforcement compared to non-users, and substance use can be conceptualized as a choice among available and competing reinforcers. Given that the majority of college drinkers are not inclined to seek out methods to reduce their alcohol consumption, this study was designed to help college drinkers increase the level of substance-free reinforcement and happiness in domains of life that are known to negatively correlate with substance abuse. The objectives of the current study were to: (1) evaluate the utility of a modified, online version of the CRA Goal Setting procedure for increasing substance-free reinforcement, (2) extend information from correlational studies to better understand the causal relationship between increased participation in incompatible activities (e.g., academics, volunteering, spirituality) and substance

use, (3) understand the role of individual-difference variables (e.g., gender, ethnicity, sensation seeking, delayed discounting) in the desire to engage in alternative activities, and (4) evaluate the utility of a reinforcement survey instrument called the Pleasant Activities List (PAL; Roozen et al., 2008) in a United States college student sample.

**Aim #1 Implementing Online CRA Goal Setting.** CRA Goal Setting procedures were implemented in an online format in order to (1) identify areas of reinforcement that college students were interested in exploring/changing, (2) encourage students to make changes in the way they spent their time by setting goals, and (3) explore factors that influenced the completion of goals. This online approach to enhancing substance-free sources of reinforcement was particularly important for a college population because very few college students are interested in receiving an intervention directly targeting substance use. Improving happiness in other, self-selected areas was assumed to be more appealing. The online modality was desirable because of increased accessibility and anonymity (Griffiths, 2005).

**Hypotheses.** (1) Because the college experience is a time during which many students are establishing a new social network while applying themselves in a new academic setting, it was hypothesized that establishing goals to increase happiness in “academic activities” and “social activities” would be most common. (2) Completion of the CRA Happiness Scale/Goal Setting modules would result in significant changes in the way students allocated their time at follow-up (with the exception of time spent in employment, which is less flexible).

Degree of activity participation (i.e., the number of hours spent on an activity) would also be associated with happiness at follow-up.

**Aim #2 Identifying Competing Activities.** In order to determine which activities were most likely to compete with alcohol use, the plan was to correlate activity participation with changes in alcohol use at follow-up.

**Hypotheses.** (1) Students who engaged in high levels of alcohol use would report lower levels of happiness at baseline in all domains of the Happiness Scale-CSV (with the exception of substance-free social activities). (2) Heavy drinkers would show deficits in alcohol-free reinforcement compared to low/moderate drinkers according to reinforcement inventories (i.e., PAL and ARSS-AUV). (3) Among heavy drinkers, increased happiness in the domains of the Happiness Scale-CSV at follow-up would be associated with a significant decrease in alcohol use. (4) Goal-setting achievements would result in increased alcohol-free reinforcement at follow-up.

**Aim #3 Exploration of the Pleasant Activities List (PAL).** The original development of the PAL was based on a Dutch, inpatient, addiction treatment sample (Roozen et al., 2008). Therefore, the third aim of this study was to evaluate the utility of the PAL in a U.S. college sample. Not only was the PAL designed specifically for CRA, but it is brief (i.e., can be completed in approximately 30 minutes), it explores behaviors with a short reinforcement schedule, and it contains up-to-date activities (e.g., items that reflect current culture and technology).

**Hypotheses.** (1) The full, 139-item version of the PAL would have a strong positive correlation with a shorter, 57-item version of the PAL. (2) Scores from the PAL would correlate with the Adolescent Reinforcement Survey Schedule-Alcohol Use Version (ARSS-AUV), a reinforcement inventory commonly used in United States college student populations. (3) Scores from both the full version and the shorter version of the PAL would correlate with degree of alcohol use among college students, in that lower alcohol-free reinforcement would be positively associated with higher alcohol use.

## Chapter 2:

### Method

#### Participants

Male and female college students between the ages of 18-25 years old were recruited from the University of New Mexico (UNM), a large, public university in the southwestern U.S. This specific age range was selected in order to represent the developmental period of “emerging adulthood” (Arnett, 2000) and to gather information on “typical college students”; namely, those who recently transitioned from high school to college. In addition to the age requirement, only students who consumed alcohol in the last 30 days were invited to participate in the baseline assessment. Because all parts of this study were completed online, only students with a computer and Internet had access to the study. Participants were recruited through class announcements and a web posting on the Psychology Department’s online research credit system. All students were enrolled in psychology classes at UNM which offered extra credit or course credit for research participation. In addition to course credit, students were either entered into a drawing for a \$25.00 gift card (one gift card for every 24 participants; fall 2015 and winter 2016 semesters) or each received a \$10.00 gift card for completing the follow up assessment (spring 2016 semester).

Out of 1042 students assessed for eligibility, 452 were excluded for not meeting eligibility requirements or not providing enough information during the screen. A total of 590 participants were invited to participate in the main study. Of these 590 participants, 386 were heavy drinkers and 204 were light drinkers. A

male “heavy drinker” was defined as a male who consumed five or more standard drinks on a single occasion and/or consumed more than 14 standard drinks per week. A female “heavy drinker” was defined as a female who consumed four or more standard drinks on a single occasion and/or more than seven drinks in a week. This definition was chosen because it included criteria for quantity on a specific occasion and also accounted for weekly totals. (The National Institute on Alcohol Abuse and Alcoholism [NIAAA] has used these drinking limits to categorize individuals who are at higher risk for developing an Alcohol Use Disorder.)

Of the 590 students invited to participate, 357 expressed interest in the main study. Participants were randomized to either a control group or the experimental group (with goal setting). Three hundred and eight participants provided complete baseline data and 168 participants provided complete data at all time points (screeener, baseline and one-month follow up). When the number of drinks consumed during a typical week at baseline was compared between those who completed all time points ( $M = 4.37$ ,  $SD = 5.33$ ) and those who did not complete the study ( $M = 5.12$ ,  $SD = 5.60$ ), the difference was not significant,  $t(585) = -1.50$ ,  $p = .134$ ,  $d = 0.14$ . Similarly, when the number of drinks consumed during the heaviest week at baseline was compared between those who completed all time points ( $M = 9.24$ ,  $SD = 7.61$ ) and those who did not complete the study ( $M = 10.68$ ,  $SD = 9.11$ ), the difference was not significant,  $t(585) = -1.81$ ,  $p = .072$ ,  $d = 0.17$ . Please refer to the CONSORT flow diagram (Figure 1) for a breakdown of participation at each phase of the study.

## CONSORT Flow Diagram

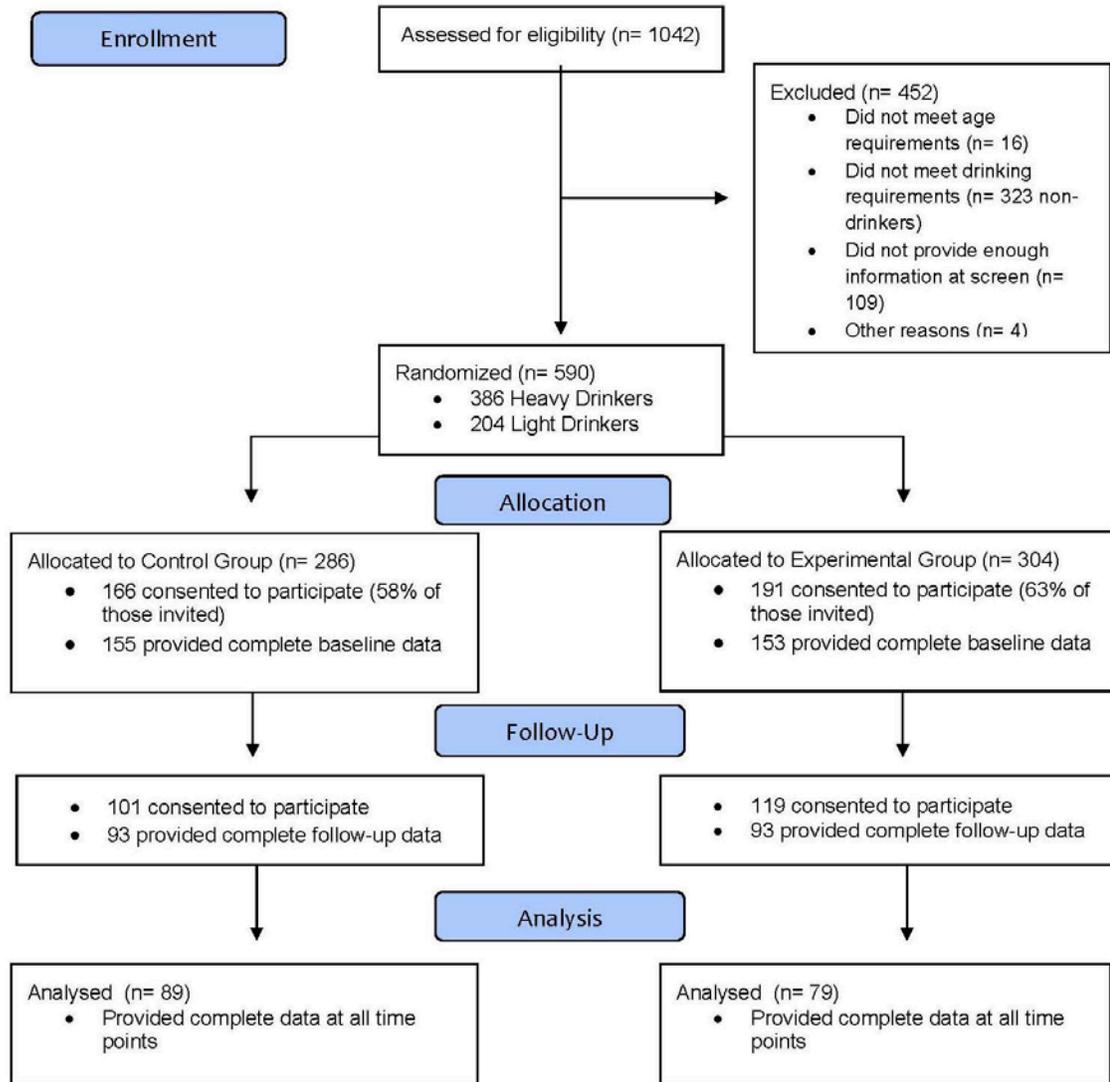


Figure 1. CONSORT flow diagram of participation.

### Measures

**Individual difference variables.** The following instruments were used to account for individual differences.

**Demographics Questionnaire.** This questionnaire asked participants to give information about gender, age, ethnicity, year in school, enrollment status (i.e., number of credit hours for current semester), residence (i.e., on-campus dorms, off-campus dorms, or off-campus), relationship status, number of children, number of hours employed each week, involvement in on-campus and off-campus organizations, and substance use status of peers and family members.

**Brief Sensation Seeking Scale-4 (BSSS-4; Stephenson, Hoyle, Palmgreen, & Slater, 2003).** Degree of sensation seeking is an individual difference variable that affects the way college students seek reinforcement. Stephenson and colleagues (2003) modified the Sensation Seeking Scale- Form V (Zuckerman, Eysenck, & Eysenck, 1978), a 40-item measure, to create the four-item Brief Sensation Seeking Scale-4. The BSSS-4 has been used to define level of sensation seeking in other studies using college students (e.g., Skidmore & Murphy, 2011) and is desirable due to its brevity. Participants were asked to rate how much they agreed with each of four statements on a five-point scale from “strongly disagree” (1) to “strongly agree” (5). The four statements included: (1) I would like to explore strange places. (2) I like to do frightening things. (3) I like new and exciting experiences, even if I have to break the rules. (4) I prefer friends who are exciting and unpredictable. Points from each question were summed and higher scores indicated higher levels of sensation seeking. Stephenson and colleagues (2003) found that the BSSS-4 showed convergent validity with longer sensation seeking scales (e.g., Impulsive Sensation Seeking

from the Zuckerman-Kuhlman Personality Questionnaire [Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993]), and the internal consistency of this four-item measure was very good for both males and females. In the current sample, Cronbach's alpha using the four items was 0.70, which is considered an "acceptable" level of reliability. Stephenson and colleagues (2003) found that scores on this assessment were positively correlated with tobacco, alcohol, and marijuana use among adolescents.

***Monetary Choice Questionnaire (MCQ; Kirby, Petry, & Bickel, 1999).***

The MCQ was chosen as an indicator of an individual's degree of discounting for delayed rewards; an important individual difference variable that affects an individual's decision to use substances (Bickel & Marsch, 2001). Other researchers have used the MCQ to quantify delayed discounting among college students (e.g., Murphy et al., 2012). As part of the MCQ, participants are given 27 opportunities to choose between two hypothetical amounts of money. For each of the 27 questions, participants are asked if they would prefer a smaller amount of money today or a larger amount of money in a specified number of days. Two examples include: "Would you prefer \$54 today, or \$55 in 117 days?" and "Would you rather have \$31 today or \$85 in 7 days?" The monetary reward and specified length of delay is varied in each of the 27 items. The degree of discounting for delayed rewards is represented by a discounting rate parameter known as "k" (Kirby et al., 1999). As k increases, the participant discounts future rewards more steeply (i.e., the participant demonstrates a greater preference for the smaller, immediate reward). Kirby, Petry, and Bickel (1999) found that the

MCQ was valid in differentiating opioid-dependent patients from controls (in that the patients had significantly higher  $k$  values) and  $k$  was positively correlated with impulsivity scales. Using a sample of undergraduates, Kirby (2009) demonstrated the temporal stability of the MCQ by establishing test-retest reliability over a one-year period. Kaplan and colleagues (2014) created an automated scorer that can calculate the discounting rate parameter produced by the MCQ. In the current sample, Cronbach's alpha between the 27 items was 0.92, which indicates "excellent" reliability.

**Substance use.** The following assessments were used to assess substance use.

***Daily Drinking Questionnaire – Revised (DDQ-R; Kruse, Fromme, & Corbin, 2005).*** Modified from the original Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985), the DDQ-R was used to gather information about each student's alcohol use both during a typical week and during the heaviest drinking week in the past 30 days. Before beginning this questionnaire, students were directed to a website provided by the National Institute on Alcohol Abuse and Alcoholism (NIAAA), where students learned the definition of a "standard drink" (i.e., 14 grams of pure alcohol which can be found in a 12 oz. beer, 8-9 oz. of malt liquor, 5 oz. of table wine, or 1.5 oz. of 80-proof distilled spirits). Providing information on what constitutes a "standard drink" was necessary in order to standardize reporting by participants. The student was shown a one-week calendar (i.e., a 7-day block; Monday-Sunday) and was asked to estimate the number of standard drinks and the number of hours spent

drinking on each day during a typical week. After quantifying a typical week, each participant was given the same blank calendar and was asked to estimate the number of standard drinks and the number of hours spent drinking on each day during the heaviest drinking week in the last month. Finally, participants were asked to answer three questions: (1) How often did you drink during the last month? (Seven answer choices range from “I did not drink at all” to “Once a day or more”), (2) Think of a typical weekend evening (Friday or Saturday) during the last month. How much did you drink on that evening? (3) Think of the occasion (any day of the week) you drank the most during the last month. How much did you drink? In the current sample, Cronbach’s  $\alpha$  for these three questions was 0.79, which is considered an “acceptable” level of reliability between the items. Cronbach’s alpha between the total number of drinks in a typical week and the total number of drinks in the heaviest week was 0.85 (considered “good” in terms of reliability). The DDQ-R has been widely used to quantify alcohol consumption in college populations, which justified its use in the current study (e.g., Neal, Corbin, & Fromme, 2006; Palmer, Corbin, & Crouse, 2010).

**Daily Drug-Taking Questionnaire (DDTQ; Parks, 2001).** The DDTQ has been used previously to assess drug use in college populations (e.g., Neighbors et al., 2013). The DDTQ was used to gather information about each student’s drug use both during a typical week and during the heaviest week of drug use in the past 30 days. This questionnaire gathered information on the use of tobacco, marijuana, powder cocaine, crack cocaine, amphetamines, methamphetamine, club drugs, heroin, methadone, other opiates (or “pain killers”), barbiturates,

sedatives/hypnotics, inhalants, and hallucinogens. Each participant was first asked whether he/she used a particular substance in the last 30 days. If the participant answered “no,” the questionnaire moved on to the next substance. If the participant answered “yes,” he/she was given a one-week calendar on which the student indicated whether or not the substance was used on each day in a typical week. Next the participant was asked to estimate the amount of substance used and the total number of hours spent using or under the influence of that substance for each day. This process was completed once for a typical week in the last month and again for the week of heaviest use. In the current sample, Cronbach’s alpha between the total number of hours using marijuana (the most commonly used drug) in a typical week and the number of hours during the heaviest week was 0.96.

**Happiness/Life Satisfaction.** The following assessment was used to quantify each participant’s level of happiness within domains of life that are most salient to college students.

***Happiness Scale-College Student Version (Happiness Scale- CSV).***

This measure was a modified version of the CRA Happiness Scale designed for treatment-seeking adults (Meyers & Smith, 1995). The original Happiness Scale is a 10-item questionnaire that asks clients to rate their current happiness on a scale from 1-10, where 10 equals the highest level of happiness. The original Happiness Scale assesses the following areas: sobriety, job or educational progress, money management, social life, personal habits, marriage/family relationships, legal issues, emotional life, communication and general happiness.

Dijkstra and Roozen (2012) found that Cronbach's  $\alpha$  for all items of the Happiness Scale was 0.90, and that each area correlated with overall happiness (correlation coefficients ranged from 0.27 for money management to 0.81 for personal habits) in a sample of treatment-seeking adults. In order to create the college student version, the adult Happiness Scale was modified to include nine domains of life that are relevant to college students and that have the potential to compete with substance use (Finlay et al., 2012; Fondacaro & Heller, 1983; Nezelek, Pilkington, and Bilbro, 1994; Singleton, 2007; Stewart, 2001; Wechsler et al., 1994; Wechsler et al., 1995; Weitzman & Kawachi, 2000; White et al., 2006). The nine domains included: (1) academic activities, (2) employment, (3) spiritual activities, (4) volunteering or charity work, (5) physical exercise, (6) time spent interacting with family (in-person, phone, or via computer), (7) substance-free social activities (with "social" defined as engaging in an activity with at least one other individual for the purpose of enjoyment/leisure), (8) substance-free individual leisure activities, and (9) substance-involved activities (specifically alcohol and illicit drugs). Similar to the format of the original Happiness Scale, participants were asked to rate their current happiness in each domain on a 1-10 scale, where 1= completely unhappy and 10= completely happy. In the current sample, Cronbach's alpha for the nine items was 0.79 ("acceptable" range for reliability). Each area of the happiness scale was highly correlated with the calculated average (overall) happiness score, with Pearson's  $r$  (correlation coefficient) ranging from 0.43 for employment to 0.78 for substance-free social activities.

**Reinforcement surveys.** The following assessments were used to quantify the amount of reinforcement received from various activities.

***Pleasant Activities List (PAL; Roozen et al., 2008).*** The PAL, a reinforcement survey instrument, was created by combining the 320 items from the Pleasant Events Schedule (PES; MacPhillamy & Lewinsohn, 1982) and the 135 items from the Leisure Interest Checklist (LIC; Rosenthal, Montgomery, Shadish, & Lichstein, 1989). After a process of removing unnecessary items (e.g., those that were overlapping, mood-related, or specifically related to substance use), the PAL was created with 139 items. Example items include watching TV, charity work, taking care of a pet, shopping, and going to a sports event. This fairly new reinforcement instrument was chosen over other reinforcement measures (e.g., Pleasant Events Schedule) because the items are more modern/applicable (e.g., reflect technological developments) and it can be completed in less than 30 minutes. To further lower the response cost, 57 of the PAL items have been differentiated for a brief version of the PAL based on activities that are common among college students in the Netherlands (Centraal Bureau Statistiek, 2003). These items include social activities, passive/relaxing activities, intimacy and personal attention activities, and sport-related activities.

The PAL measures two parameters of reinforcement: amount of time spent engaged in the activity and subjective enjoyment of the experience. A five-point rating scale from 1 = “not at all” to 5 = “very much” is used for both frequency and enjoyment ratings. Roozen and colleagues (2008) investigated the psychometric properties of the PAL by comparing scores from a control sample

(comprised of “healthy” adults from a community sample) to a sample of patients receiving addiction treatment. Individuals with substance addiction gave lower ratings for frequency, enjoyment, and cross-product scores compared to healthy controls, which was consistent with the theory that substance abusers report a deficit in substance-free reinforcement. Exploratory factor analyses of frequency scores resulted in the seven subscales, which accounted for 33.8% of the variance. These seven subscales include: Social Activities (SA – 29 items), Sensation Seeking Activities (SSA – 10 items), Domestic Activities (DA – 7 items), Culture/Science/Traveling (CST – 12 items), Passive/Relaxing Activities (PRA – 6 items), Sport-Related Activities (SRA – 8 items), and Intimacy/Personal Activities (IPA – 14 items). Cronbach’s alpha ranged from .67 to .94 for frequency, while the values for enjoyment ranged from .69 to .96. Overall, subscales were highly correlated and the correlation between frequency and enjoyment of each item ranged from .41 to .80 (Roozen et al., 2008).

Participants in the current study were asked to rate frequency and enjoyment of each of the 139 items twice: once to describe when alcohol was involved and once to describe when the activity was alcohol-free. In the current sample, Cronbach’s alphas were in the “acceptable” to “excellent” range (0.71 - 0.94) for 22 of the 28 frequency and enjoyment subscales. (There are seven subscales and each activity was rated twice for frequency and twice for enjoyment.) However, four subscales were in the “questionable” range: frequency of sensation seeking activities with alcohol ( $\alpha = 0.61$ ), frequency of passive, relaxing activities with alcohol ( $\alpha = 0.65$ ), enjoyment of domestic

activities with alcohol ( $\alpha = 0.67$ ), and frequency of passive, relaxing activities without alcohol ( $\alpha = 0.69$ ). Two subscales were in the “poor” – “unacceptable” range: enjoyment of passive, relaxing activities without alcohol ( $\alpha = 0.57$ ) and frequency of domestic activities with alcohol ( $\alpha = 0.38$ ).

Alcohol-related Reinforcement (AR) was calculated by summing the cross products of frequency and enjoyment of an activity when alcohol was involved. Alcohol-Free Reinforcement (AFR) was calculated by summing the cross products of frequency and enjoyment of an activity when alcohol was *not* involved. The Reinforcement Ratio is the degree of alcohol-related reinforcement to alcohol-free reinforcement (AR/AFR). Larger values on this ratio reflect more alcohol-related reinforcement compared to alcohol-free reinforcement. Total Reinforcement is another ratio, which reflects proportion of total reinforcement that was accounted for by alcohol-related reinforcement (AR/[AR + AFR]). The larger the value on total reinforcement (i.e., the closer the ratio gets to 1), the more alcohol-related reinforcement contributed to the total reinforcement value.

***Adolescent Reinforcement Survey Schedule- Alcohol Use Version (ARSS-AUV; Hallgren, Greenfield, & Ladd, 2016).*** The Adolescent Reinforcement Survey Schedule (ARSS; Holmes et al., 1991) is another instrument that has been used to quantify the reinforcement value of 45 activities. Example activities include going on dates, riding around in a car with friends, studying, and going to a movie. It was included in the current study because it has been used extensively with U.S. college students and therefore makes a

good comparison for the PAL. A modified version of the ARSS, the ARSS-Substance Use Version, was used to assess reinforcement in a college sample by measuring participation and enjoyment twice: when alcohol or drugs were involved and when participation was substance-free (Murphy, Correia, Colby & Vuchinich, 2005). In 2016, Hallgren, Greenfield and Ladd investigated the psychometric properties of an alcohol use version (i.e., not “substances” more generally). Participants rated their frequency of engagement and enjoyment twice, once to reflect participation with alcohol and once to reflect participation without alcohol. Participants rated their frequency of participation over the past 30 days on a five-point Likert scale (0 = “0 times” to 4 = “more than once a day”). Participants also rated their enjoyment of the activity on a five-point Likert scale (0 = “unpleasant or neutral” to 4 = “extremely pleasant”). The frequency and enjoyment ratings were multiplied to create a cross-product score, which reflected the reinforcement value for a given activity (Correia, Carey, Simons, & Borsari, 2003).

Hallgreen, Greenfield and Ladd (2016) found that alcohol-related reinforcement calculated using the ARSS-AUV was best conceptualized by three factors: interactions with friends, interaction with potential romantic partners, and interactions with family members. Alcohol-free reinforcement was represented by a four factor model, including the three factors found with alcohol-related reinforcement plus communication with friends that was not in-person (e.g., text messages, letters). In the current study, Cronbach’s alpha was in the “excellent” range for frequency and enjoyment scales (0.92 – 0.97).

## Procedure

The UNM Institutional Review Board (IRB) approved the protocol for this study. All consent procedures were completed online and Internet-based assessments were completed using survey software, Opinio, provided by the university. There were three major phases to this study: screener, baseline and one-month follow up. During the pre-enrollment screening, participants completed the demographics questionnaire, the Daily Drinking Questionnaire-R, and the Daily Drug-Taking Questionnaire. Only participants who consumed alcohol in the last month were invited to participate and randomized to a baseline assessment. Please refer to *Figure 2* to view measures administered at each time point and to each group (control vs. experimental).

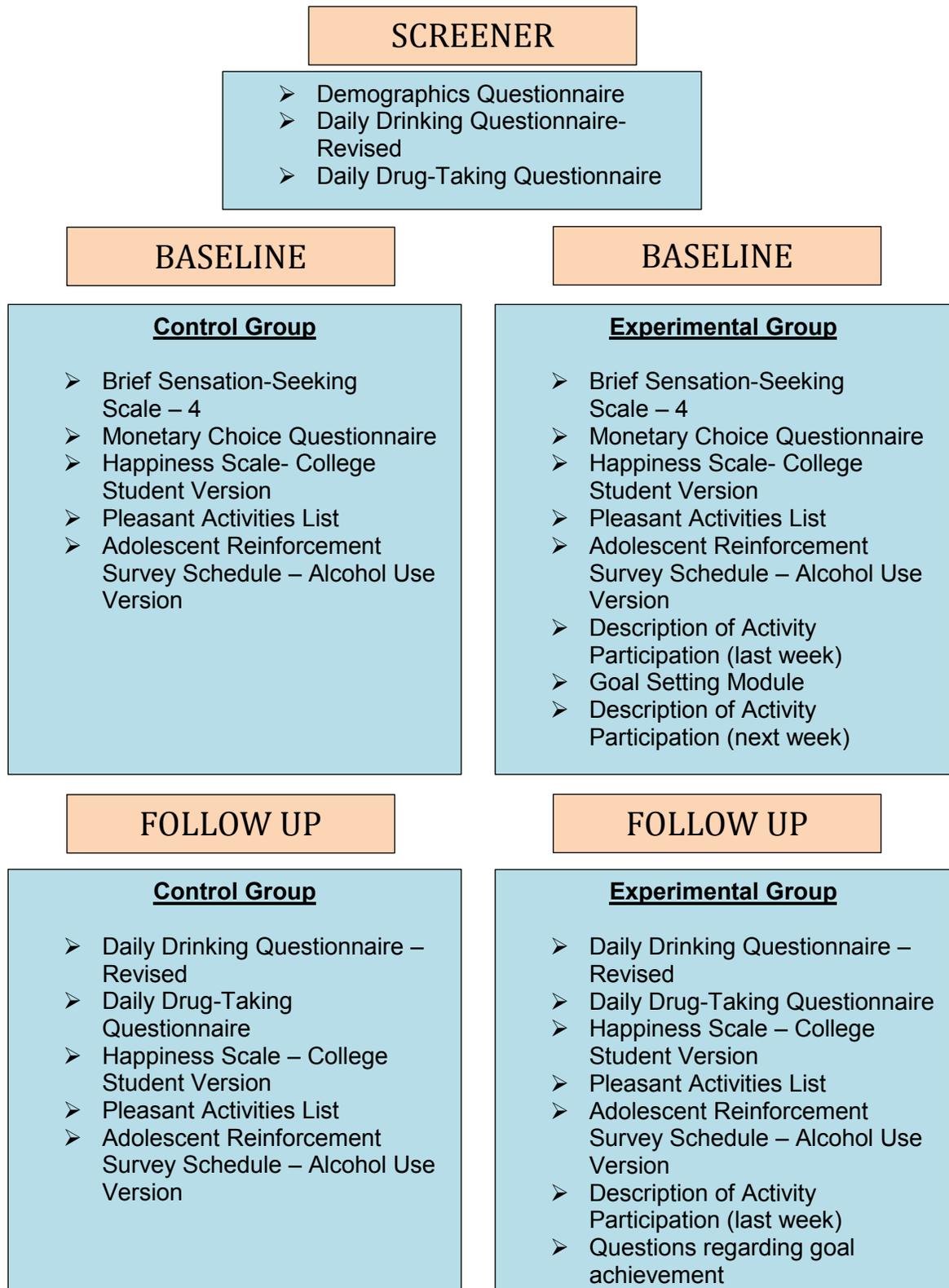


Figure 2. Measures administered.

**Baseline.** Participants in the control condition were asked to complete the Brief Sensation Seeking Scale-4, the Monetary Choice Questionnaire, the Happiness Scale-College Student Version, the Pleasant Activities List and the Adolescent Reinforcement Survey Schedule-Alcohol Use Version. Participants in the experimental group completed the same questionnaires in addition to an online, goal-setting module. In other words, the only difference between the control group and experimental group at baseline was the completion of goal setting (experimental group only). The baseline assessment required about two hours of participation, which seemed to present a burden to participants. Midway through the study, enough responses had been collected with the PAL to satisfy the original aims of the study, so the PAL was removed from the baseline assessment in order to increase completion and follow up rates.

**Goal-Setting Module.** During the goal-setting module, participants were first asked to estimate their activity participation in nine areas of activity participation: (1) academic activities, (2) employment, (3) spiritual activities, (4) volunteering or charity work, (5) physical exercise, (6) family time (in-person, phone or via computer), (7) substance-free social activities (with “social” being defined as engaging in an activity with at least one other individual for the purpose of enjoyment/leisure, (8) substance-free individual leisure, and (9) substance-involved activities (specifically alcohol and illicit drugs). For each day during the previous week, participants indicated the times of day when they engaged in each activity and the total number of hours spent (see *Figure 3*).

The next set of questions will ask you to reflect on your activity participation in the last week.

37. Think about **MONDAY** of last week. During what time(s) of day did you engage in **Academic Activities** (e.g., attending class, completing homework, studying for exams) on this particular day?

(You can select more than one time of day.)

Early Morning (before 9am)

Late Morning (9am - 12pm)

Early Afternoon (12pm - 3pm)

Late Afternoon (3pm - 6pm)

Early Evening (6pm - 9pm)

Late Evening (after 9pm)

Not at all on this day

38. How many hours (total) did you spend engaged in **Academic Activities** on **MONDAY** of last week?

You can use decimals to indicate a portion of an hour (e.g., 1/2 hour would be 0.5)

Figure 3. Example of activity participation assessment.

After reviewing the way they spent their time in the previous week, participants rated their happiness (1-10 scale) in each of the nine areas of activity listed above. Participants were asked to review their happiness scores and notice the difference in happiness between areas. Participants were instructed to pick one of the nine areas in order to set goals to improve happiness in that area. Participants were encouraged to pick an area of moderate unhappiness because it is easier to start with less difficult goals. Areas of moderate unhappiness have *some* things that are going well on which to build (i.e., not totally unhappy). Also, picking an area of moderate unhappiness was more likely to lead to success and build motivation to work on more difficult tasks in the future. Despite this suggestion to pick an area of moderate unhappiness, students were allowed to pick any of the nine areas in which to set goals. Next, students were asked to

consider what would have to change in their lives in order for their level of happiness in the chosen area to increase (e.g., move up from a “5” to a “7”).

Participants learned the elements of a SMART goal (Specific, Measurable, Achievable, Realistic, and Timed) and were given an example of a goal containing each of these elements (see *Figure 4*). Students were then provided with text boxes in which to type their goals, steps to achieve goals, time frame to accomplish goals, potential obstacles, and plans to overcome potential obstacles. Students were encouraged to print this page to use as a reference over the next month.

With their goals in mind, participants completed the goal setting module by describing their *planned* activity participation for the following week. Similar to what they completed at the beginning of the module, students indicated the times of day and the total number of hours they planned to spend in each of the nine categories over the next week. Participants were told that they would be asked to provide follow up information in one month.

Here's an example of goal setting in the area of physical exercise that uses the SMART elements

Specific Goal	Actions to achieve them (a to-do list)	Time frame	Potential Obstacle	Plan to overcome
To work every day to become more physically fit.	Walk the dog every morning before work for at least 20 min.	Daily	Having trouble getting out of bed early enough	Put my alarm clock across the room so I have to get out of bed to turn it off
	Hike or run for 30 min. three days a week	Weekly	Bad weather	Go to an indoor gym
	Eat 3 healthy meals a day	Daily	No time to prepare meals in advance	Buy fast food but try to select a relatively healthy option
	Take a vitamin and meds. as directed	Daily	Sometimes I'm too busy and I forget	Set a reminder on my phone
	Get to bed by 10pm and up at 6am	Daily	It's hard to get up early on the weekends	Plan a morning activity that I enjoy so I feel more motivated to get out of bed
	Practice a relaxation exercise 10 min. twice daily	Daily	On busy days at work, I forget to take breaks	Download an app on my phone that provides relaxation exercises and reminders

In this example, each action is concrete, measurable, achievable, realistic, and has a time frame.

Figure 4. SMART goal-setting example.

**Follow Up.** One month after completing the baseline assessment, participants were sent an email asking them to complete the follow up assessment. At the one-month follow up, all participants once again described their substance use, rated their current happiness, and completed reinforcement survey instruments. In addition, participants in the experimental group described activity participation in the last week and completed questions assessing their success at meeting set goals (i.e., Were you successful in reaching your goals? If yes, what contributed to your success? If no, what got in the way of your goal? If you were to attempt this goal again in the future, what would you do differently in order to increase your likelihood of achieving your goal?).

### **Statistical Analyses**

All analyses were performed using IBM SPSS Statistics Package (Version 23). Alpha was set at 0.05 to test for statistical significance.

#### **Aim #1.** Implementing Online CRA Goal Setting

**Hypothesis 1.** Frequency analyses were used to describe the differences in goal selection between participants.

**Hypothesis 2.** Paired Samples *t*-Tests were used to evaluate differences in hours spent in goal domains over time. Paired Samples *t*-Tests also were used to determine if significant changes occurred in happiness over time, while Independent Samples *t*-Tests were used to compare happiness ratings between groups. Pearson's product-moment correlation, *r*, was calculated to estimate the strength of the linear relationship between hours spent in an activity and happiness ratings at follow up.

## **Aim #2.** Identifying Competing Activities

**Hypothesis 1.** Independent Samples *t*-Tests were used to compare ratings of happiness between heavy drinkers and light/moderate drinkers. Pearson's product-moment correlation, *r*, was calculated to estimate the strength of the linear relationship between happiness ratings and degree of alcohol use. Correlations were also calculated to estimate the relationship between hours of activity participation and alcohol use. Linear regression was used to describe the relationship between happiness scores and alcohol use, and Analysis of Variance (ANOVA) calculations quantified the degree of variance in alcohol use that was explained by happiness ratings.

**Hypothesis 2.** Independent Samples *t*-Tests were used to compare degree of substance-free and substance-related reinforcement between heavy drinkers and light/moderate drinkers. Linear regression was also used to describe the relationship between substance-free and substance-related reinforcement and alcohol use. ANOVA calculations quantified the degree of variance in alcohol use that was explained by reinforcement variables.

**Hypothesis 3.** Pearson's product-moment correlation, *r*, was calculated to estimate the strength of the linear relationship between change in alcohol consumption over time and change in happiness ratings over time.

**Hypothesis 4.** Independent Samples *t*-Tests were used to compare degree of substance-free reinforcement between control and experimental groups, and between goal achievers and those who did not achieve their goals. ANOVA calculations quantified the degree of variance in alcohol-free

reinforcement that was explained by group assignment. Independent Samples *t*-Tests also were used to compare change in alcohol use between the control group and the experimental group. Finally, ANCOVA was used to evaluate main effects (e.g., group assignment) and interaction effects on alcohol use at follow up after controlling for baseline levels of alcohol use.

**Aim #3.** Exploration of the Pleasant Activities List

**Hypothesis 1.** Pearson's product-moment correlation, *r*, was calculated to estimate the strength of the linear relationship between scores on the full version of the PAL and scores produced by the shorter, 57-item version of the PAL.

**Hypothesis 2.** Pearson's product-moment correlation, *r*, was calculated to estimate the strength of the linear relationship between scores on the PAL and scores on the ARSS-AUV.

**Hypothesis 3.**

Using the PAL, reinforcement derived from each activity was calculated by multiplying the frequency of participation by enjoyment experienced in the last month. The Reinforcement Ratios were also calculated. (Please refer back to page 47 for more information about the scores and ratios produced by the PAL.)

Pearson's product-moment correlation, *r*, was calculated to estimate the strength of the linear relationship between reinforcement values from the PAL and alcohol use. Linear regression also was used to test the strength of the association between reinforcement values and degree of alcohol use. ANOVA results were used to compare the two versions of the PAL to the ARSS-AUV in order to determine which measure accounted for the greatest degree of variance

in alcohol use. Finally, reinforcement values from the PAL and the ARSS-AUV were calculated at the item level in order to compare activities on the reinforcement derived with and without alcohol.

## Chapter 3:

### Results

#### Characteristics of the Sample

The sample was predominantly female students [122 females (73%) and 46 males (27%)] with a mean age of 19.64 years ( $SD = 1.69$ ). When students were asked to select the ethnicity with which they most strongly identify, “Caucasian/White” was the most common (44.6%) followed by “Hispanic/Latino” (39.3%). Analyses involving ethnicity were run with the original six categories and also were run with the two most commonly selected identities (Caucasian/White and Hispanic/Latino) because of the small number of participants in the remaining ethnic categories. Please see Table 1 for more information on ethnic identify of participants.

Table 1

#### *Ethnic Identity of Participants*

<b>Ethnicity Response Options</b>	<b>N</b>	<b>%</b>
Caucasian/White	75	44.6
Hispanic/Latino	66	39.3
Black	4	2.4
Asian American	5	3.0
American Indian/Alaskan Native	7	4.2
Multiracial	11	6.5
TOTAL	168	100

Table 2 describes the number of participants in each class year. Nearly half of the sample was freshmen (43.5%), and the number of participants declined as the year in college advanced.

Table 2

*Distribution of Participants by Year in College*

<b>Year in College</b>	<b>N</b>	<b>%</b>
Freshman	73	43.5
Sophomore	35	20.8
Junior	31	18.5
Senior	29	17.3
TOTAL	168	100

The mean age and year in college met expectations given the restricted age range in the eligibility requirements. Sixty-four percent of participants lived off-campus, while the remaining 36% lived in dormitories. Nearly all participants were “full-time” students (98.8%), as indicated by the number of credit hours reported ( $M = 15.73$ ,  $SD = 1.91$ ). About a third of participants (36.3%) reported no outside employment. The greatest proportion of students reported working part-time (20 hours a week or less; 38.1%), and a quarter of the sample (25.6%) reported employment of more than 20 hours per week. The majority of students classified their relationship status as “single” (42.9%), in a committed relationship but living separately (28.6%), or causally dating (16.7%) Please refer to Table 3 for more information on relationship status.

Table 3

*Relationship Status Indicated by Participants*

<b>Relationship Status</b>	<b>N</b>	<b>%</b>
Single	72	42.9
In a committed relationship but not married – living separately	48	28.6
Casually dating	28	16.7
In a committed relationship but not married – living together	17	10.1
Married	3	1.8
Separated	0	0
Divorced	0	0
TOTAL	168	100

The average Body Mass Index (BMI) for the sample was 23.42 ( $SD = 4.69$ ), which is considered in the “normal weight” range. The vast majority of this sample did not have children (98.8%). Based on the descriptive statistics listed above, it is appropriate to say that a “traditional college population” was recruited. In other words, the sample represented a group of students in emerging adulthood who recently had transitioned from high school to college.

When comparing those randomly assigned to the control group versus the experimental group, there were no significant differences between the two

groups on gender, age, ethnicity, year in college, number of credit hours, number of hours employed or number of hours spent participating in organizations (both on- and off-campus). There were, however, some significant differences between the control group and experimental group on baseline level of alcohol use. Those in the experimental group reported a larger number of drinks over the course of a typical week ( $M = 5.31$ ,  $SD = 6.36$ ) compared to students in the control group ( $M = 3.53$ ,  $SD = 4.07$ ),  $t(166) = -2.13$ ,  $p = 0.035$ ,  $d = 0.33$ . Students in the experimental group also spent more hours drinking during a typical week ( $M = 4.73$ ,  $SD = 4.77$ ) compared to those in the control group ( $M = 3.45$ ,  $SD = 3.43$ ),  $t(166) = -1.98$ ,  $p = 0.049$ ,  $d = 0.31$ . Significant differences did not exist between the groups on alcohol consumption during the heaviest week. Table 4 contains additional information on baseline levels of alcohol use.

Table 4

*Comparison of Alcohol Use between Experimental and Control Groups at**Baseline*

<b>Drinking Variable</b>	<b>Control Group M (SD)</b>	<b>Experimental Group M (SD)</b>	<b>t value (p)</b>	<b>Cohen's d</b>
Total drinks during typical week	3.53 (4.07)	5.31 (6.36)	-2.13 (0.035)*	0.33
Total drinks during heaviest week	8.17 (6.75)	10.45 (8.35)	-1.93 (0.056)	0.30
ADDD during typical week	1.95 (2.06)	2.19 (2.33)	-0.72 (0.472)	0.11
ADDD during heaviest week	3.79 (2.47)	4.46 (3.22)	-1.51 (0.133)	0.23
Total hours drinking during typical week	3.45 (3.43)	4.73 (4.77)	-1.98 (0.049)*	0.31
Total hours drinking during heaviest week	6.72 (4.98)	7.24 (5.66)	-0.63 (0.530)	0.10

*Note.* df = 166. Drinks = Standard Drinks. ADDD = Average Drinks per Drinking Day.

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

As a combined group, the mean number of standard drinks consumed during a typical week was 4.37 ( $SD = 5.33$ ) and the average went up to 9.24 drinks ( $SD = 7.61$ ) during the heaviest week. Participants spent, on average, 4.05 hours drinking ( $SD = 4.15$ ) during a typical week and 6.97 hours drinking ( $SD = 5.30$ ) during the heaviest week. The majority of the participants in the current

sample were considered heavy drinkers (61.3%), while the remaining participants were considered light/moderate drinkers (38.7%). Those classified as light/moderate drinkers consumed, on average, 1.22 drinks ( $SD = 1.64$ ) during a typical week and 2.95 drinks ( $SD = 1.85$ ) during the heaviest week. In comparison, heavy drinkers consumed 6.35 drinks ( $SD = 5.87$ ) during a typical week and 13.21 drinks ( $SD = 7.18$ ) during the heaviest week. Light/moderate drinkers spent 1.45 hours drinking ( $SD = 1.97$ ) during a typical week and 3.23 hours drinking ( $SD = 2.65$ ) during the heaviest week. Heavy drinkers spent 5.70 hours drinking ( $SD = 4.32$ ) during a typical week and 9.33 hours drinking ( $SD = 5.20$ ) during the heaviest week.

Ethnicity did not account for a significant portion of variance in alcohol use variables at baseline according to ANOVA. Age was not significantly correlated with measures of alcohol quantity but was positively correlated with alcohol use frequency,  $r(166) = 0.22$ ,  $p = 0.004$ . The effect of gender was not significant in accounting for variance in alcohol consumption during a typical week, but ANOVA revealed a significant gender effect on average drinks per drinking day during the heaviest week,  $F(1, 166) = 4.62$ ,  $p = 0.033$ . Males ( $M = 4.87$ ,  $SD = 3.39$ ) consumed more alcohol on drinking days than females ( $M = 3.82$ ,  $SD = 2.59$ ) when participants were asked about the heaviest week in the last month,  $t(166) = 2.15$ ,  $p = 0.033$ ,  $d = 0.35$ .

Degree of sensation seeking had a significant positive correlation with alcohol consumption in typical and heaviest weeks, and preference for immediate rewards (i.e., delayed discounting) was also associated with the number of hours

spent drinking during the heaviest week (see Table 5). In general, males ( $M = 15.69$ ,  $SD = 2.39$ ) scored higher than females ( $M = 14.35$ ,  $SD = 2.80$ ) on degree of sensation seeking,  $t(166) = 2.88$ ,  $p = 0.005$ . Males and females were not significantly different in terms of delayed discounting.

Table 5

*Correlation of Individual Difference Variables and Alcohol Use at Baseline*

<b>Alcohol Use Variable</b>	<b>Sensation Seeking (Total score from BSSS-4)</b>	<b>Discounting rate, k, from MCQ</b>
Number of drinks in typical week	$r = 0.17$ , $p = 0.030$ *	$r = 0.12$ , $p = 0.131$
Number of hours drinking in a typical week	$r = 0.17$ , $p = 0.029$ *	$r = 0.15$ , $p = 0.052$
Number of drinks in the heaviest week	$r = 0.17$ , $p = 0.027$ *	$r = 0.14$ , $p = 0.075$
Number of hours drinking during the heaviest week	$r = 0.07$ , $p = 0.405$	$r = 0.17$ , $p = 0.027$ *

*Note.*  $df = 166$  for sensation seeking correlations and  $df = 161$  for discounting rate correlations

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

When assessed regarding drug use, participants were instructed to only report use that was “recreational” (i.e., outside the bounds of a prescription). The most commonly used drug (other than alcohol) in the past 30 days was marijuana/cannabis (endorsed by 35.7% of students) followed by tobacco (22.6% of students). Table 6 contains additional information on drug use at baseline. There were no significant differences between the control group and experimental group on hours of drug use.

Table 6

*Drug Use Reported by Participants at Baseline*

Drug Endorsed	N	%	Hours of Use	
			Typical Week M (SD)	Heaviest Week M (SD)
Marijuana/Cannabis	60	35.7	14.27 (22.19)	19.97 (26.51)
Tobacco	38	22.6	5.86 (9.92)	11.45 (19.66)
Hallucinogens	9	5.4	4.89 (5.49)	8.00 (3.43)
Amphetamines	6	3.6	13.00 (24.82)	16.67 (23.25)
Powder Cocaine	5	3.0	1.60 (2.61)	5.90 (2.70)
Club Drugs	5	3.0	3.00 (2.83)	6.60 (2.41)
Other Opiates	3	1.8	2.67 (4.62)	0.33 (0.58)
Sedatives/Hypnotics	1	0.6	0	2.0 (0.0)
Methamphetamines	1	0.6	0	0
Crack Cocaine	0	0	0	0
Heroin	0	0	0	0
Methadone	0	0	0	0
Barbiturates	0	0	0	0
Inhalants	0	0	0	0

**Aim #1: Implementing Online CRA Goal Setting**

**Hypothesis 1.** It was hypothesized that “academic activities” and “social activities” would be the most commonly selected areas for goal setting. Results

showed that this hypothesis was partially supported with respect to academic activities. However, the domain of social activities was not one of the main areas in which students indicated the greatest desire to set goals. The most commonly selected goal area was physical exercise (40.5% of students) followed by academic activities (17.7%) and spiritual activities (11.4%). See *Figure 5* for the frequency of each goal domain. Interestingly, participants who selected “physical exercise” were in the “normal weight” range ( $M = 24.10$ ,  $SD = 4.52$ ), whereas those who selected “academic activities” had the highest BMI ( $M = 26.01$ ,  $SD = 6.86$ ; classified as “overweight”). Of all the goal areas presented, participants were least likely to set goals pertaining to substance-involved activities (1.3%).

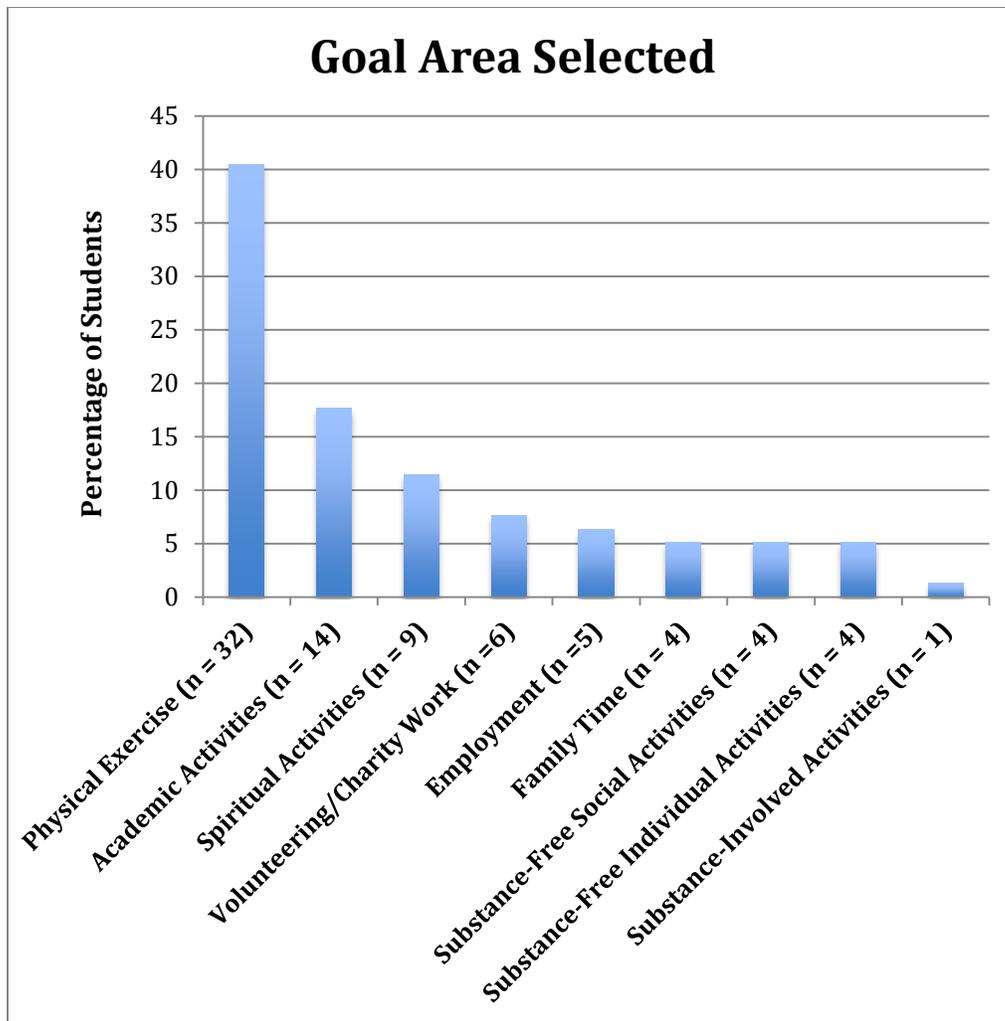


Figure 5. Goal domain selected during goal-setting module.

**Hypothesis 2.** It was hypothesized that completion of the goal setting exercise (i.e., being allocated to the experimental group) would result in significant changes in the way students spent their time in all activity domains except employment. Paired Samples *t*-Tests revealed that there were some significant changes in the way students allocated their time in various activities (see Table 7).

Table 7

*Comparison of Activity Participation over Time within Experimental Group*

<b>Activity Assessed</b>	<b>Baseline Hours M (SD)</b>	<b>Planned Hours M (SD)</b>	<b>Follow Up Hours M (SD)</b>	<b>Planned vs. Baseline t-value (p), d</b>	<b>Follow Up vs. Planned t-value (p), d</b>	<b>Follow Up vs. Baseline t-value (p), d</b>
Academic Activities	27.69 (14.63)	29.75 (13.74)	24.34 (13.08)	1.81 (0.075) d = 0.15	-3.61 (0.001)*** d = 0.40	-2.08 (0.040)* d = 0.24
Employment	14.52 (14.47)	13.63 (12.62)	11.81 (13.66)	-0.94 (0.349) d = 0.07	-1.85 (0.068) d = 0.14	-2.36 (0.021)* d = 0.19
Spiritual Activities	1.59 (3.59)	2.04 (3.43)	1.50 (3.31)	1.16 (0.248) d = 0.13	-2.20 (0.031)* d = 0.16	-0.28 (0.782) d = 0.03
Volunteer/Charity Work	1.00 (2.94)	1.27 (3.49)	0.75 (2.11)	0.60 (0.549) d = 0.08	-1.39 (0.167) d = 0.18	-0.75 (0.454) d = 0.10
Physical Exercise	5.42 (5.22)	7.31 (4.98)	4.55 (4.53)	2.70 (0.009)** d = 0.37	-4.71 (0.001)*** d = 0.58	-1.28 (0.205) d = 0.18
Family Time	13.86 (14.66)	13.15 (14.66)	13.09 (14.94)	-0.65 (0.519) d = 0.05	-0.03 (0.974) d < 0.01	-0.47 (0.640) d = 0.05
Substance-Free Social	27.5 (28.51)	24.06 (28.58)	17.85 (14.99)	-1.85 (0.069) d = 0.12	-1.96 (0.054) d = 0.27	-3.02 (0.003)** d = 0.42
Substance-Free Individual	18.36 (26.78)	18.57 (28.49)	12.08 (15.77)	0.12 (0.903) d = 0.01	-2.09 (0.040)* d = 0.28	-2.11 (0.038)* d = 0.29
Substance-Involved Activities	5.18 (8.01)	4.09 (6.98)	4.56 (8.71)	-2.25 (0.027)* d = 0.15	0.60 (0.549) d = 0.06	-0.68 (0.499) d = 0.07

Note. *df* = 78. *d* = Cohen's *d*. \**p* < 0.05. \*\**p* ≤ 0.01. \*\*\**p* ≤ 0.001.

When comparing how participants in the experimental group planned to spend the next week (after completing goal setting) to the hours spent at baseline, there were significant differences in the number of hours for physical exercise and substance-involved activities. Specifically, participants planned to spend more time in physical exercise and less time in substance-involved activities (see Table 7). At the one-month follow up, when participants once again reported their activity participation, there were significant differences in how students actually spent their time and how they originally planned to spend their time in response to goal setting. Students spent less time than originally planned in academics, spiritual activities, physical exercise, and substance-free individual activities (see Table 7). When activity participation at follow up was compared to activity participation at baseline, there was a decline in activity participation, with significant differences in academic activities, employment, substance-free social activities, and substance-free individual activities (see Table 7).

Given that the participants were asked to set goals to increase happiness in one domain, it was worth exploring the changes in the area selected for goal setting as this was the area expected to show the greatest amount of change. Among those who chose physical exercise as their goal, there was an average increase (nonsignificant) of about 1 hour a week from baseline ( $M = 3.44$ ;  $SD = 2.98$ ) to follow up ( $M = 4.53$ ;  $SD = 4.82$ ),  $t(31) = -1.18$ ,  $p = .249$ ,  $d = .27$ . Small sample size limited the ability to detect significant effects, even among the most commonly selected goal (physical exercise).

In summary, there were some significant changes in time spent in various activities, but a significant change was not seen in all domains. When comparing activity participation at baseline and follow up, time spent in employment was not the most stable activity, as originally hypothesized. Spiritual activities, family time, and time spent in substance-involved activities showed the least amount of change from baseline to follow up. Given that only the experimental group reported activity participation, it is unclear whether change in activity participation was the result of time, participation in goal-setting, or another unmeasured variable.

A secondary hypothesis was that degree of activity participation would be associated with happiness at follow up. This hypothesis was supported for several activities. More time spent in employment, spiritual activities, volunteering/charity work, physical exercise, and family time were significantly correlated with greater happiness (see Table 8). Participants with higher values on sensation seeking were less satisfied with their substance-free social activities,  $r(166) = -0.18, p = 0.018$ , as well as their substance-free individual activities,  $r(166) = -0.19, p = 0.013$ . Degree of delayed discounting was not significantly correlated with happiness scores.

Table 8

*Correlation of Happiness Ratings with Hours Spent in Activities at Follow Up*

<b>Happiness Domain</b>	<b>Hours Spent in the Activity</b>	<b>Significance</b>
Academic Activities	$r(77) = 0.09$	$p = 0.433$
Employment	$r(77) = 0.33$	$p = 0.003^{**}$
Spiritual Activities	$r(77) = 0.27$	$p = 0.017^*$
Volunteering/Charity Work	$r(77) = 0.26$	$p = 0.021^*$
Physical Exercise	$r(77) = 0.43$	$p < 0.001^{***}$
Family Time	$r(77) = 0.24$	$p = 0.035^*$
Substance-Free Social Activities	$r(77) = 0.15$	$p = 0.185$
Substance-Free Individual Activities	$r(77) = -0.16$	$p = 0.152$
Substance-Involved Activities	$r(77) = 0.04$	$p = 0.753$

*Note.*  $N = 79$  participants in the experimental group.

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

Given that goal setting was designed to increase happiness, the experimental group and control group were compared based on levels of happiness. There were no significant differences in happiness ratings between the control group and experimental group at baseline or follow up. Additionally, there were no significant differences between males and females on happiness

ratings at baseline, but males ( $M = 7.24$ ,  $SD = 2.77$ ) were significantly happier with physical exercise than females ( $M = 5.91$ ,  $SD = 2.99$ ) at follow up,  $t(166) = 2.62$ ,  $p = .010$ ,  $d = 0.46$ . When looking at the control group alone, there were significant increases in happiness from baseline to follow up in employment, spiritual activities, substance-free social activities, and average happiness ratings (see Table 9).

Table 9

*Comparison of Happiness Ratings from Baseline to Follow Up for Controls*

<b>Happiness Domain</b>	<b>Baseline M (SD)</b>	<b>Follow Up M (SD)</b>	<b>t-value (p)</b>	<b>Cohen's d</b>
Academic Activities	6.61 (2.34)	6.72 (2.19)	0.50 (.622)	0.05
Employment	5.96 (2.38)	6.54 (2.42)	2.75 (.007) **	0.24
Spiritual Activities	6.07 (2.39)	6.70 (2.28)	2.94 (.004) **	0.27
Volunteering/ Charity Work	5.29 (2.49)	5.78 (2.67)	1.97 (.052)	0.19
Physical Exercise	6.11 (2.90)	6.49 (2.99)	1.65 (.102)	0.13
Family Time	6.98 (2.59)	7.30 (2.19)	1.27 (.208)	0.13
Substance-Free Social Activities	7.42 (2.46)	7.98 (2.12)	2.33 (.022) *	0.24
Substance-Free Indiv. Activities	7.74 (2.14)	7.96 (2.11)	1.03 (.308)	0.10
Substance- Involved Act.	6.85 (2.54)	7.13 (2.30)	1.12 (.264)	0.12
Average Happiness	6.56 (1.50)	6.96 (1.56)	3.56 (.001) ***	0.26

*Note.*  $df = 88$ ; Happiness was rated on a scale from 1-10; 1 = "completely unhappy" & 10 = "completely happy"

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

To evaluate the implementation of online goal setting, participants were asked to report whether or not they successfully reached their goals. Of the 79 individuals in the experimental group, 55 (70%) reported they had successfully reached their goals. Of those who were not successful, 50% reported “lack of time” and 30% reported “stress” as the primary reason for not accomplishing their goals. A chi-square test indicated that there was not a significant relationship between gender and reaching goals,  $X^2 (1, N = 79) = 0.28, p = 0.595$ . A likelihood ratio indicated that the frequency of achieving goals also did not vary by ethnicity,  $X^2 (5, N = 79) = 0.09 p = 0.906$ . According to Independent Samples *t*-Tests, those who achieved their goals were not significantly different from those who did not meet their goals on measures of sensation seeking, delayed discounting, number of credit hours, or number of hours employed.

When the experimental group was divided into those who were successful at meeting their goals and those who were not, those who indicated that they reached their goals reported significant changes from baseline to follow up in happiness related to employment and physical exercise (Table 10). Additionally, participants who achieved their goals were significantly happier with academic activities, employment, volunteering/charity work, physical exercise, and family time when compared to those who did not achieve their goals (Table 11). Of note, these two groups did not differ from one another in happiness ratings at baseline.

Table 10

*Comparison of Happiness from Baseline to Follow Up for Goal Achievers*

<b>Happiness Domain</b>	<b>Baseline M (SD)</b>	<b>Follow Up M (SD)</b>	<b>t-value (p)</b>	<b>Cohen's d</b>
Academic Activities	7.18 (2.13)	7.65 (2.01)	1.48 (.144)	0.23
Employment	6.36 (2.70)	7.18 (2.65)	2.60 (.012)*	0.31
Spiritual Activities	5.91 (2.68)	6.31 (2.64)	0.85 (.397)	0.15
Volunteering/ Charity Work	5.15 (2.61)	5.53 (2.71)	0.96 (.340)	0.14
Physical Exercise	5.95 (2.67)	6.67 (2.67)	2.22 (.031)*	0.27
Family Time	7.16 (2.62)	7.76 (2.06)	1.66 (.102)	0.25
Substance-Free Social Activities	7.98 (2.21)	7.91 (2.31)	-0.22 (.828)	0.03
Substance-Free Indiv. Activities	7.89 (2.49)	7.87 (2.35)	-0.05 (.957)	0.01
Substance- Involved Act.	7.22 (2.75)	7.42 (2.40)	0.48 (.630)	0.08
Average Happiness	6.76 (1.63)	7.15 (1.47)	1.67 (.101)	0.25

*Note.*  $df = 54$ ; Happiness was rated on a scale from 1-10; 1 = "completely unhappy" & 10 = "completely happy"

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

Table 11

*Comparison of Non-Achievers and Achievers on Happiness at Follow Up*

<b>Happiness Domain</b>	<b>Non-Achievers M (SD)</b>	<b>Achievers M (SD)</b>	<b>t-value (p)</b>	<b>Cohen's d</b>
Academic Activities	6.17 (2.28)	7.65 (2.01)	2.90 (0.005)**	0.69
Employment	5.83 (2.58)	7.18 (2.65)	2.09 (0.040)*	0.52
Spiritual Activities	5.50 (2.62)	6.31 (2.64)	1.26 (0.213)	0.31
Volunteering/ Charity Work	4.17 (2.28)	5.53 (2.71)	2.15 (0.035)*	0.54
Physical Exercise	4.54 (3.18)	6.67 (2.67)	3.08 (0.003)**	0.73
Family Time	6.50 (2.40)	7.76 (2.06)	2.38 (0.020)*	0.56
Substance-Free Social Activities	7.33 (1.88)	7.91 (2.31)	1.07 (0.286)	0.28
Substance-Free Indiv. Activities	7.29 (2.01)	7.87 (2.35)	1.05 (0.295)	0.27
Substance- Involved Act.	7.00 (2.55)	7.42 (2.40)	0.70 (0.487)	0.17
Average Happiness	6.04 (1.44)	7.15 (1.47)	3.10 (0.003)**	0.76

*Note.*  $df = 77$ ;  $N = 24$  for “non-achievers” and  $N = 55$  for “achievers”. Happiness was rated on a scale from 1-10; 1 = “completely unhappy” & 10 = “completely happy”.

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

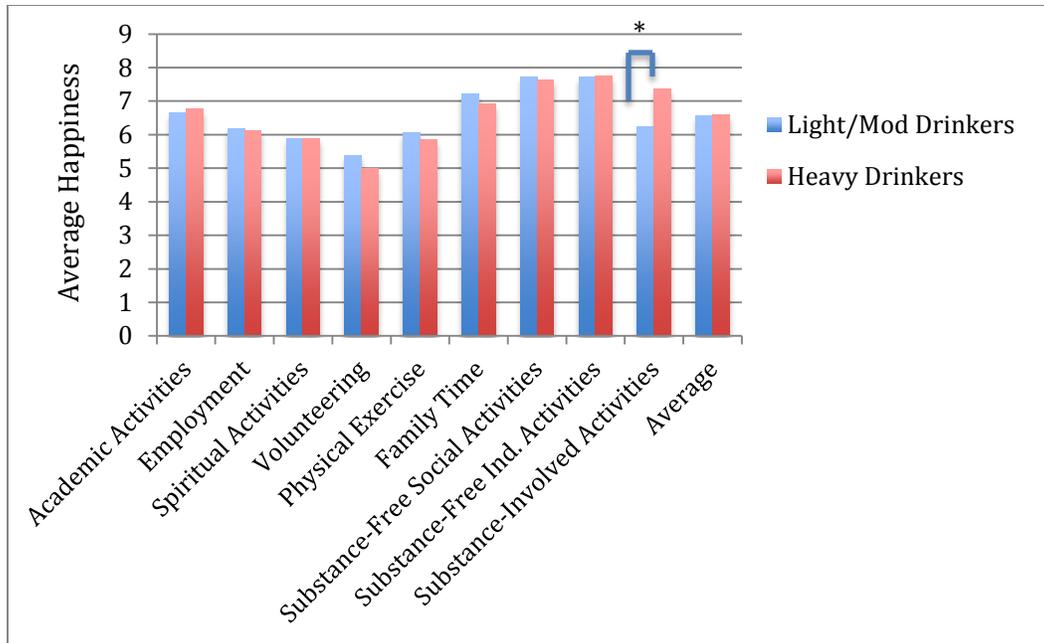
In addition to looking at changes in happiness in all domains, specific attention was paid to the top three areas in which participants set goals. Among participants who selected physical exercise (the most commonly selected goal), there was a significant increase in happiness from baseline ( $M = 4.50$ ,  $SD = 2.41$ ) to follow up ( $M = 5.38$ ,  $SD = 2.89$ ),  $t(31) = -2.32$ ,  $p = .027$ ,  $d = 0.33$ . Among participants who chose to set goals to improve academic activities, there was also an increase in happiness from baseline ( $M = 5.71$ ,  $SD = 2.05$ ) to follow up ( $M = 6.57$ ,  $SD = 2.82$ ), but it was not statistically significant,  $t(13) = -0.89$ ,  $p = 0.388$ ,  $d = 0.35$ . Similarly, there was an average increase of nearly two points in happiness in spiritual activities from baseline ( $M = 4.33$ ,  $SD = 1.73$ ) to follow up ( $M = 6.00$ ,  $SD = 2.12$ ) among those who chose to set goals in this area, but the results were not statistically significant,  $t(8) = -1.62$ ,  $p = 0.143$ ,  $d = 0.86$ . When the experimental group was divided by the specific goal area selected, the sample size became small and limited the power needed to detect significant differences.

**Summary of Results: Aim #1.** The first aim of the study was to implement CRA goal setting in an online format. Participants were most interested in setting goals in the domains of physical exercise, academic activities and spiritual activities, and participants were least likely to set goals to directly change their substance-involved activities. Students planned to spend more time in physical exercise and less time in substance-involved activities following goal setting, but overall, students reported a general decrease in activity participation across all domains. However, when looking at only

participants who selected physical exercise as the goal, there was an increase in time spent exercising from baseline to follow up (average of one hour a week but not statistically significant) and a significant increase in happiness. In general, those who completed only the happiness scale but no goal setting (i.e., control group) reported an increase in happiness with employment, spiritual activities, and substance-free social activities from baseline to follow up. Finally, the majority of participants who participated in goal setting reported achieving their goal at follow up (70%), and goal achievement was not affected by gender or ethnicity. Participants who achieved their goals were significantly happier (overall and in many specific domains) compared to those who did not achieve their goals.

#### **Aim #2: Identifying activities that may compete with substance use**

**Hypothesis 1.** It was hypothesized that heavy drinkers would report lower levels of happiness at baseline in all domains of the happiness scale, with the exception of substance-free social activities. Contrary to the original hypothesis, heavy drinkers and light/moderate drinkers did not report significant differences in happiness in most domains of the Happiness Scale-CSV (see *Figure 6*). Independent Samples *t*-Tests, comparing happiness ratings at baseline between light/moderate drinkers and heavy drinkers, only revealed significant differences in participants' happiness with substance-involved activities,  $t(166) = -2.79$ ,  $p = 0.006$ ,  $d = 0.43$ . Heavy drinkers reported greater happiness with substance-involved activities ( $M = 7.36$ ,  $SD = 2.321$ ) compared to light/moderate drinkers ( $M = 6.25$ ,  $SD = 2.812$ ).



*Figure 6.* Comparison of light/moderate drinkers to heavy drinkers on levels of happiness at baseline. Happiness was rated on a scale from 1-10; 1 = “completely unhappy” & 10 = “completely happy”

\*  $t(166) = -2.79, p = 0.006, d = 0.43$

Only three areas of the happiness scale (volunteering, physical exercise and substance-involved activities) were significantly correlated with alcohol consumption at baseline. As the number of standard drinks per typical week increased, happiness decreased in volunteering/charity work,  $r(166) = -0.21, p = 0.006$ , and in physical exercise  $r(166) = -0.20, p = 0.011$ . The number of drinks and hours spent drinking during the heaviest week were positively correlated with happiness in substance-involved activities,  $r(166) = 0.23, p < 0.001$  and  $r(166) = 0.24, p = 0.002$ , respectively. Using linear regression, happiness with volunteering/charity work was significantly associated with number of standard drinks in a typical week,  $\beta = -0.21, t(166) = -2.79, p = 0.006$ . Happiness with volunteering also accounted for a small and significant proportion of variance in

number of drinks during a typical week,  $R^2 = 0.05$ ,  $F(1,166) = 7.79$ ,  $p = 0.006$ .

Similarly, happiness with physical exercise was significantly associated with number of standard drinks in a typical week,  $\beta = -0.20$ ,  $t(166) = -2.58$ ,  $p = 0.011$ .

Happiness with physical exercise also accounted for a small and significant proportion of variance in number of drinks during a typical week,  $R^2 = 0.04$ ,  $F(1,166) = 6.64$ ,  $p = 0.011$ .

To further investigate which activities might effectively compete with substance use, the change in hours of activity participation (follow up minus baseline) was correlated with number of drinks during a typical week at follow up. An increase in the number of hours spent in academics was correlated with lower levels of alcohol consumption at follow up,  $r(77) = -0.26$ ,  $p = 0.022$ . Similarly, an increase in the number of hours spent in spiritual activities was correlated with lower levels of alcohol consumption at follow up,  $r(77) = -0.30$ ,  $p = 0.007$ . Additionally, bivariate correlations were run between the change in hours of activity participation and change in alcohol use from baseline to follow up. Change in hours of employment was positively correlated with change in total number of drinks during a typical week,  $r(77) = 0.26$ ,  $p = 0.023$ , total number of hours spent drinking in a typical week,  $r(77) = 0.32$ ,  $p = 0.004$ , and change in maximum number of drinks on a weekend night,  $r(77) = 0.30$ ,  $p = 0.008$ . In other words, a larger decrease in number of hours employed was associated with a larger decrease in alcohol use.

**Hypothesis 2.** It was hypothesized that participants who engaged in high levels of alcohol use (i.e., heavy drinkers) would show deficits in substance-free

reinforcement according to reinforcement inventories (i.e., PAL and ARSS-AUV) when compared to light/moderate drinkers. This hypothesis was not supported. Based on Independent Samples *t*-Tests, there were no significant differences between light/moderate drinkers and heavy drinkers in the degree of substance-free reinforcement (i.e., cross product of frequency and enjoyment of activities without alcohol) measured by the PAL or ARSS-AUV at baseline. Heavy drinkers ( $M = 614.59$ ,  $SD = 293.47$ ) were significantly higher than light/moderate drinkers ( $M = 381.23$ ,  $SD = 265.78$ ) on degree of alcohol-related reinforcement as calculated by the PAL,  $t(154) = -4.95$ ,  $p < 0.001$ ,  $d = 0.83$ . A similar finding was found using the ARSS-AUV. Heavy drinkers ( $M = 64.41$ ,  $SD = 69.02$ ) were significantly higher than light/moderate drinkers ( $M = 28.48$ ,  $SD = 36.17$ ) on degree of alcohol-related reinforcement as calculated from the ARSS-AUV,  $t(318) = -6.11$ ,  $p < 0.001$ ,  $d = 0.65$ .

Linear regression did not show a significant relationship between alcohol-free reinforcement (from either the PAL or the ARSS-AUV) and alcohol use variables at baseline. However, the degree of alcohol-related reinforcement, as measured by the PAL, was significantly associated with number of standard drinks in a typical week,  $\beta = 0.48$ ,  $t(152) = 6.70$ ,  $p < 0.001$ . Degree of alcohol-related reinforcement (PAL) also accounted for a significant proportion of variance in number of drinks during a typical week,  $R^2 = 0.23$ ,  $F(1,152) = 44.90$ ,  $p < 0.001$ . Similarly, the degree of alcohol-related reinforcement, as measured by the ARSS-AUV, was significantly associated with number of standard drinks in a typical week,  $\beta = 0.40$ ,  $t(316) = 7.63$ ,  $p < 0.001$ . Degree of alcohol-related

reinforcement (ARSS-AUV) also accounted for a small and significant proportion of variance in number of drinks during a typical week,  $R^2 = 0.16$ ,  $F(1, 316) = 58.25$ ,  $p < 0.001$ .

Although the difference in alcohol-free reinforcement was not significantly different between light/moderate drinkers and heavy drinkers, it was found that alcohol-free reinforcement (as measured by the ARSS-AUV) was positively correlated with happiness ratings in family time, substance-free social activities, substance-free individual activities, and average happiness overall (see Table 12).

Table 12.

*Correlation of Alcohol-Free Reinforcement and Happiness Ratings*

<b>Happiness Domain</b>	<b>Correlation with Alcohol-Free Reinforcement Pearson's <i>r</i></b>	<b>Significance (<i>p</i>)</b>
Academic Activities	0.13	0.090
Employment	0.09	0.255
Spiritual Activities	0.02	0.849
Volunteering/Charity Work	0.09	0.275
Physical Exercise	0.05	0.539
Family Time	0.20	0.009**
Substance-Free Social Activities	0.27	< 0.001***
Substance-Free Individual Activities	0.22	0.004**
Substance-Involved Activities	0.13	0.094
Happiness Overall (average)	0.21	0.006**

*Note.* *df* = 166. Alcohol-Free Reinforcement was measured with the ARSS-AUV at baseline.

\**p* < 0.05. \*\**p* ≤ 0.01. \*\*\**p* ≤ 0.001.

**Hypothesis 3.** It was hypothesized that decreased substance use (from baseline to follow up) would be associated with an increase in happiness at

follow up, particularly among heavy drinkers. Support was found for this hypothesis. As participants decreased the total number of standard drinks consumed during a typical week, their degree of happiness with substance-involved activities increased,  $r(166) = -0.16, p = 0.041$ . As expected, the relationship between changes in substance use and changes in happiness were more pronounced among heavy drinkers. Among heavy drinkers, a decrease in the total number of standard drinks in a typical week was associated with an increase in happiness with regard to substance-involved activities,  $r(101) = -0.24, p = 0.014$ . Similarly, the change in number of hours spent drinking during a typical week was also negatively correlated with a change in happiness with substance-involved activities,  $r(101) = -0.20, p = 0.04$ , meaning that drinking fewer hours was associated with greater increases in happiness. Additionally, a decrease in the maximum number of drinks on a given day (any day of the week) was correlated with an increase in happiness in the domain of employment,  $r(101) = -0.20, p = 0.047$ . This correlation with employment was even stronger when maximum number of drinks on weekend nights (Friday and Saturday) was analyzed,  $r(101) = -0.21, p = 0.033$ . The change in maximum number of drinks on a weekend night was also negatively correlated with change in overall happiness,  $r(101) = -0.20, p = 0.042$ . In other words, as heavy drinkers decreased the maximum number of drinks on a weekend night, they increased their overall happiness rating.

**Hypothesis 4.** It was hypothesized that goal-setting achievements would result in increased alcohol-free reinforcement (as measured by PAL and ARSS-

AUV) at follow-up. This hypothesis was not supported. According to Independent Samples *t*-Tests, there were no significant differences between the control group and the experimental group on level of alcohol-free reinforcement at baseline or follow up. Based on an Analysis of Variance (ANOVA), group assignment (experimental or control) did not account for a significant portion of variance in alcohol-free reinforcement at follow-up. Additionally, among the experimental group only, significant differences were not found in degree of alcohol-free reinforcement between those who reported achieving their goal and those who did not reach their goal.

Although the degree of alcohol-free reinforcement in the goal-setting group was not significantly higher than the control group, there were some significant differences in the magnitude of change in alcohol use from baseline to follow up. Both the control group and the experimental group reported a decline in alcohol consumption from baseline to follow up. For the control group (Table 13) there was a significant decrease in average drinks per drinking day (typical week and heaviest week), and a decrease in maximum number of drinks on a drinking day (typical and heaviest week).

Table 13

*Change in Alcohol Consumption for Control Group*

<b>Drinking Variable</b>	<b>Baseline M (SD)</b>	<b>Follow Up M (SD)</b>	<b>t-value (p)</b>	<b>Cohen's d</b>
Total number of drinks - typical week	3.53 (4.07)	3.25 (4.85)	0.68 (0.500)	0.06
ADDD – typical week	1.95 (2.06)	1.50 (1.79)	2.03 (0.045)*	0.23
Max. number of drinks in one day – typical week	2.28 (2.41)	1.70 (2.00)	2.45 (0.016)*	0.26
Total number of hours drinking – typical week	3.45 (3.43)	3.25 (3.81)	0.56 (0.579)	0.06
Total number of drinks – heaviest week	8.17 (6.75)	7.22 (8.37)	1.38 (0.170)	0.12
ADDD – heaviest week	3.79 (2.47)	2.84 (2.41)	3.35 (0.001)***	0.39
Max. number of drinks in one day – heaviest week	4.71 (3.07)	3.47 (3.05)	3.53 (0.001)***	0.41
Total number of hours drinking – heaviest week	6.72 (4.98)	6.15 (6.61)	1.12 (0.265)	0.10

Note: df = 88. ADDD = Average number of Drinks per Drinking Day

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

The experimental group showed a significant decrease in additional alcohol use variables for both the typical week and the heaviest week, including significant decreases in total number of drinks, average drinks per drinking day, maximum number of drinks on a single occasion, and total number of hours spent drinking (see Table 14). When looking only at participants who set goals to improve happiness in the domain of physical exercise, there was a significant decrease (from baseline to follow up) in maximum number of drinks in one day during a typical week (see Table 15).

Table 14

*Change in Alcohol Consumption for Experimental Group*

<b>Drinking Variable</b>	<b>Baseline M (SD)</b>	<b>Follow Up M (SD)</b>	<b>t-value (p)</b>	<b>Cohen's d</b>
Total number of drinks - typical week	5.31 (6.36)	3.24 (5.16)	3.01 (0.003)**	0.36
ADDD – typical week	2.19 (2.33)	1.43 (1.70)	3.00 (0.004)**	0.37
Max number of drinks in one day – typical week	2.82 (3.12)	1.70 (2.14)	3.41 (0.001)***	0.42
Total number of hours drinking – typical week	4.73 (4.77)	3.01 (4.05)	3.21 (0.002)**	0.39
Total number of drinks – heaviest week	10.45 (8.35)	7.03 (8.19)	3.72 ( $< 0.001$ )***	0.41
ADDD – heaviest week	4.46 (3.22)	3.25 (2.90)	2.83 (0.006)**	0.39
Max number of drinks in one day – heaviest week	5.75 (4.36)	3.80 (3.52)	3.58 (0.001)***	0.49
Total number of hours drinking – heaviest week	7.24 (5.66)	5.35 (5.84)	2.72 (0.008)**	0.33

*Note:*  $df = 78$ . ADDD = Average number of Drinks per Drinking Day.

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

Table 15

*Change in Alcohol Consumption for Physical Exercise Group*

<b>Drinking Variable</b>	<b>Baseline M (SD)</b>	<b>Follow Up M (SD)</b>	<b>t-value (p)</b>	<b>Cohen's d</b>
Total number of drinks - typical week	5.58 (5.50)	4.25 (6.65)	1.38 (0.177)	0.22
ADDD – typical week	2.13 (2.01)	1.68 (1.90)	1.65 (0.110)	0.23
Max number of drinks in one day – typical week	2.89 (2.80)	2.09 (2.56)	2.12 (0.042)*	0.30
Total number of hours drinking – typical week	4.50 (3.59)	3.63 (4.71)	1.18 (0.248)	0.21
Total number of drinks – heaviest week	10.84 (7.57)	8.81 (9.85)	1.65 (0.109)	0.23
ADDD – heaviest week	4.70 (2.91)	4.02 (3.44)	1.07 (0.292)	0.21
Max number of drinks in one day – heaviest week	6.00 (3.81)	4.84 (4.36)	1.64 (0.112)	0.28
Total number of hours drinking – heaviest week	6.92 (3.79)	6.02 (6.82)	0.80 (0.431)	0.16

*Note:*  $df = 31$ . ADDD = Average number of Drinks per Drinking Day.

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

When compared to the control group, the experimental group (i.e., those who completed the goal-setting module) showed a greater decrease in total number of drinks for both a typical week and the heaviest week and also showed a greater decrease in number of hours spent drinking during a typical week according to Independent Samples *t*-Tests (see Table 16).

Table 16

*Change in Alcohol Use Between Control and Experimental Groups*

<b>Change in Drinking Variable</b>	<b>Control Group M (SD)</b>	<b>Experimental Group M (SD)</b>	<b><i>t</i> – value (<i>p</i>)</b>	<b>Cohen’s <i>d</i></b>
Total # of drinks in typical week	-.28 (3.91)	-2.07 (6.11)	2.29 (.024)*	<i>d</i> = 0.35
Total # of drinks in heaviest week	-.95 (6.47)	-3.43 (8.20)	2.18 (.030)*	<i>d</i> = 0.34
Total # hours drinking in typical week	-.20 (3.43)	-1.72 (4.77)	2.34 (.020)*	<i>d</i> = 0.37
Total # hours drinking in heaviest week	-.57 (4.82)	-1.89 (6.17)	1.55 (.12)	<i>d</i> = 0.24

*Note.* *df* = 166. Change = Follow Up – Baseline.

\**p* < 0.05. \*\**p* ≤ 0.01. \*\*\**p* ≤ 0.001.

Given that the experimental group was drinking significantly more than the control group at baseline, a one-way ANCOVA was conducted to determine if there was a statistically significant difference between the experimental group and control group on number of standard drinks during a typical week at follow up after controlling for the number of drinks during a typical week at baseline.

There was not a significant main effect of group assignment on number of drinks in a typical week at follow up after controlling for drinks at baseline,  $F(1,164) = 0.63$ ,  $p = 0.428$ . There was, however, a significant interaction effect between group assignment and number of drinks at baseline,  $F(1,164) = 8.16$ ,  $p = 0.005$ . Similarly, there was a significant interaction effect between group assignment and number of drinks during the heaviest week at baseline,  $F(1,164) = 4.91$ ,  $p = 0.028$ . An ANCOVA exploring the effect of group assignment on number of drinks on a typical weekend day (controlling for baseline use) found a nearly significant effect for group assignment,  $F(1,164) = 3.77$ ,  $p = 0.054$ , and a significant interaction effect between group assignment and baseline reports of weekend consumption,  $F(1,164) = 6.33$ ,  $p = 0.013$ . *Figure 7* illustrates the difference in degree of change in alcohol use over time when comparing the control group to the experimental group.

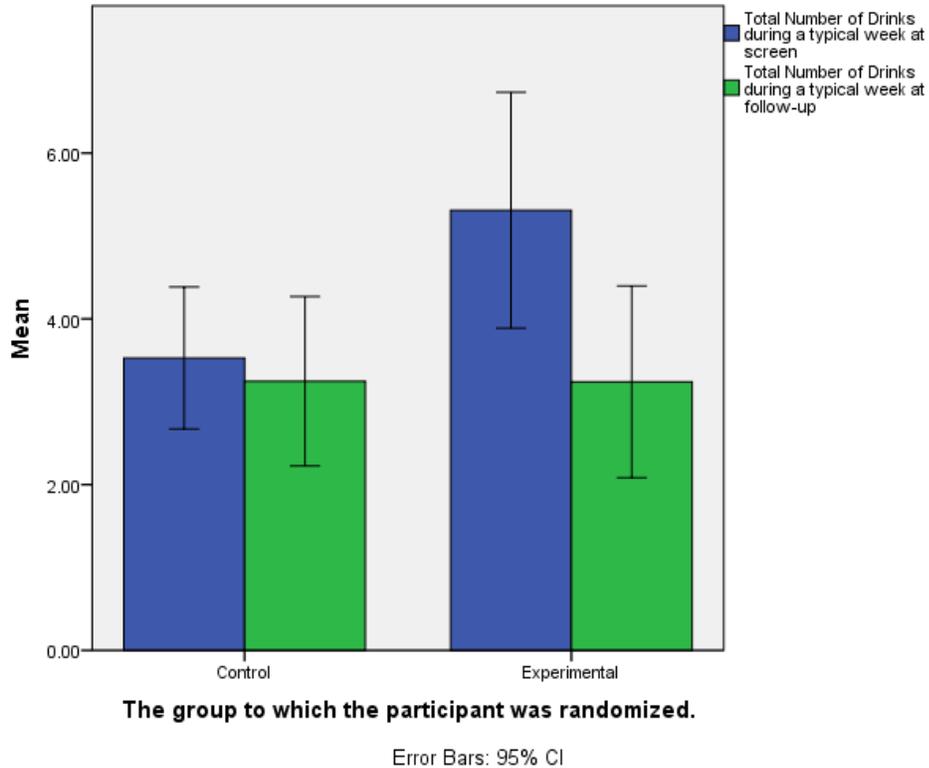


Figure 7. Comparison of the control group and experimental group in the change in total number of drinks in a typical week from baseline to follow up

**Summary of Results: Aim #2.** The second aim of the study was to identify which activities (i.e., sources of alcohol-free reinforcement) had the potential to compete with alcohol use. Although heavy drinkers were not less happy than light/moderate drinkers with the domains measured, the degree of happiness in certain areas correlated with degree of alcohol use. Happiness with volunteering/charity work and physical exercise were both negatively correlated with alcohol consumption, while happiness with substance-involved activities was positively correlated with consumption. Over time, an increase in time spent in either academic activities or spiritual activities was associated with decreased alcohol use at follow up. Additionally, a larger decrease in hours spent in

employment was associated with a larger decrease in alcohol consumption from baseline to follow up. When alcohol use was explored among participants who set goals in the domain of physical exercise, there was a decrease in alcohol consumption from baseline to follow up.

Heavy drinkers did not show a deficit in alcohol-free reinforcement. Using the combined sample of drinkers, however, higher levels of alcohol-free reinforcement were correlated with higher levels of happiness in family time, substance-free social activities, substance-free individual activities, and overall happiness. Among heavy drinkers, a decrease in alcohol use was correlated with an increase in happiness with substance-involved activities, employment and overall happiness. Those who set goals to increase their happiness showed a greater amount of change (i.e., decrease) in their alcohol consumption over time compared to those who did not set goals.

### **Aim #3: Exploration of the Pleasant Activities List (PAL)**

**Hypothesis 1.** It was hypothesized that the full, 139-item version of the PAL would have a strong positive correlation with the shorter, 57-item version of the PAL. This hypothesis was supported. As shown in Table 17, frequency and enjoyment scores (both with and without alcohol) from the full PAL were highly correlated ( $p < 0.001$ ) with the corresponding frequency and enjoyment scores from the brief version of the PAL. Additionally, enjoyment ratings with alcohol were positively correlated with enjoyment ratings without alcohol, indicating that activities that students found enjoyable with alcohol were also highly enjoyable without alcohol.

Table 17

*Correlation of Full PAL with Brief PAL on Frequency and Enjoyment Scores*

Score	1	2	3	4	5	6	7	8
1. Freq. w/o Alc - PAL	--							
2. Enjoy. w/o Alc - PAL	$r = 0.68$ $p < 0.001^{***}$	--						
3. Freq. w/ Alc - PAL	$r = 0.16$ $p = 0.044^*$	$r = 0.06$ $p = 0.473$	--					
4. Enjoy.w/ Alc - PAL	$r = 0.02$ $p = 0.825$	$r = 0.31$ $p < 0.001^{***}$	$r = 0.59$ $p < 0.001^{***}$	--				
5. Freq. w/o Alc - B. PAL	$r = 0.94$ $p < 0.001^{***}$	$r = 0.67$ $p < 0.001^{***}$	$r = 0.19$ $p = 0.016^*$	$r = 0.04$ $p = 0.656$	--			
6. Enjoy.w/ o Alc - B. PAL	$r = 0.62$ $p < 0.001^{***}$	$r = 0.91$ $p < 0.001^{***}$	$r = 0.09$ $p = 0.291$	$r = 0.30$ $p < 0.001^{***}$	$r = 0.72$ $p < 0.001^{***}$	--		
7. Freq. w/ Alc - B. PAL	$r = 0.12$ $p = 0.128$	$r = 0.04$ $p = 0.625$	$r = 0.95$ $p < 0.001^{***}$	$r = 0.56$ $p < 0.001^{***}$	$r = 0.21$ $p = 0.009^{**}$	$r = 0.13$ $p = 0.107$	--	
8. Enjoy.w/ Alc - B. PAL	$r = 0.01$ $p = 0.897$	$r = 0.26$ $p = 0.001^{***}$	$r = 0.65$ $p < 0.001^{***}$	$r = 0.96$ $p < 0.001^{***}$	$r = 0.07$ $p = 0.372$	$r = 0.32$ $p < 0.001^{***}$	$r = 0.69$ $p < 0.001^{***}$	--

Note.  $df = 154$ . B. PAL = Brief PAL.  $*p < 0.05$ .  $**p \leq 0.01$ .  $***p \leq 0.001$ .

The degree of alcohol-related and alcohol-free reinforcement between the full PAL and the brief version was also highly correlated ( $p < 0.001$ ; see Table 18).

Table 18

*Correlation of Full PAL with Brief PAL on Reinforcement Variables*

Variable	1	2	3	4
1. AR – Full PAL	--			
2. AFR – Full PAL	$r = 0.10$ $p = 0.231$	--		
3. AR – Brief PAL	$r = 0.96$ $p < 0.001$ ***	$r = 0.09$ $p = 0.254$	--	
4. AFR – Brief PAL	$r = 0.15$ $p = 0.059$	$r = 0.94$ $p < 0.001$ ***	$r = 0.20$ $p = 0.014$ *	--

*Note.*  $df = 154$ . Pearson's  $r$

AR = Alcohol-Related Reinforcement (sum of cross products of frequency and enjoyment with alcohol).

AFR = Alcohol-Free Reinforcement (sum of cross products of frequency and enjoyment without alcohol).

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

The degree of alcohol-related reinforcement and alcohol-free reinforcement was positively correlated using the brief PAL,  $r(154) = 0.20$ ,  $p = 0.014$ . This relationship was not found using the full version of the PAL. Finally, the reinforcement ratios produced by the full PAL and the brief PAL were highly correlated (Table 19).

Table 19

*Correlation of Full PAL with Brief PAL on Reinforcement Ratios*

Variable	1	2	3	4
1. Reinforcement Ratio using full PAL	--			
2. Total Reinforcement Ratio using full PAL	$r = 0.98$ $p < 0.001^{***}$	--		
3. Reinforcement Ratio using brief PAL	$r = 0.97$ $p < 0.001^{***}$	$r = 0.96$ $p < 0.001^{***}$	--	
4. Total Reinforcement Ratio using brief PAL	$r = 0.95$ $p < 0.001^{***}$	$r = 0.98$ $p < 0.001^{***}$	$r = 0.98$ $p < 0.001^{***}$	--

*Note.*  $df = 154$ . Pearson's  $r$

Reinforcement Ratio = Alcohol-related reinforcement / alcohol-free reinforcement.

Total Reinforcement Ratio = Alcohol-related reinforcement / (alcohol-related reinforcement + alcohol-free reinforcement).

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

**Hypothesis 2.** It was hypothesized that scores from the PAL would correlate with the Adolescent Reinforcement Survey Schedule-Alcohol Use Version (ARSS-AUV). This hypothesis was supported. As Table 20 indicates, the degree of alcohol-related and alcohol-free reinforcement based on the full PAL was highly correlated with the degree of reinforcement based on the ARSS-AUV. The alcohol-related and alcohol-free reinforcement values from the brief version of the PAL were also significantly correlated with the ARSS-AUV (see Table 21).

Table 20

*Correlation of Full PAL with ARSS-AUV on Reinforcement Variables*

Score	1	2	3	4
1. AR – Full PAL	--			
2. AFR – Full PAL	$r = 0.10$ $p = 0.231$	--		
3. AR – ARSS	$r = 0.65$ $p < 0.001^{***}$	$r = 0.01$ $p = 0.921$	--	
4. AFR – ARSS	$r = 0.15$ $p = 0.061$	$r = 0.32$ $p < 0.001^{***}$	$r = 0.17$ $p = 0.003^{**}$	--

*Note.*  $df = 154$ . Pearson's  $r$

AR = Alcohol-Related Reinforcement (sum of cross products of frequency and enjoyment with alcohol).

AFR = Alcohol-Free Reinforcement (sum of cross products of frequency and enjoyment without alcohol).

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

Table 21

*Correlation of Brief PAL with ARSS-AUV on Reinforcement Variables*

Score	1	2	3	4
1. AR – Brief PAL	--			
2. AFR – Brief PAL	$r = 0.20$ $p = 0.014^*$	--		
3. AR – ARSS	$r = 0.65$ $p < 0.001^{***}$	$r = 0.05$ $p = 0.536$	--	
4. AFR – ARSS	$r = 0.24$ $p = 0.003^{**}$	$r = 0.39$ $p < 0.001^{***}$	$r = 0.17$ $p = 0.003^{**}$	--

*Note.*  $df = 154$ . Pearson's  $r$

AR = Alcohol-Related Reinforcement (sum of cross products of frequency and enjoyment with alcohol).

AFR = Alcohol-Free Reinforcement (sum of cross products of frequency and enjoyment without alcohol).

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

These results indicate that the degree of alcohol-related and alcohol-free reinforcement derived from the PAL is similar to the degree of alcohol-related and alcohol-free reinforcement derived from the more commonly used ARSS.

**Hypothesis #3.** It was hypothesized that scores from both the full version and the brief version of the PAL would correlate with degree of alcohol use among college students, in that lower substance-free reinforcement would be positively associated with higher substance use. Table 22 shows that the reinforcement ratios and the degree of alcohol-related reinforcement, calculated using the full version of the PAL at baseline, were positively correlated with alcohol use at baseline. As the degree of alcohol-related reinforcement increased, the degree of alcohol use also increased. Contrary to the original hypothesis, the degree of alcohol-free reinforcement, on its own, was not significantly correlated with alcohol use.

Table 22

*Correlation of PAL with Alcohol Use at Baseline*

PAL Variable	# Drinks During Typical Week	# Hours Drinking During Typical Week	# Drinks During Heaviest Week	# Hours Drinking During Heaviest Week
Reinforcement Ratio	$r = 0.49$ $p < 0.001^{***}$	$r = 0.47$ $p < 0.001^{***}$	$r = 0.46$ $p < 0.001^{***}$	$r = 0.33$ $p < 0.001^{***}$
Total Reinforcement Ratio	$r = 0.47$ $p < 0.001^{***}$	$r = 0.47$ $p < 0.001^{***}$	$r = 0.46$ $p < 0.001^{***}$	$r = 0.34$ $p < 0.001^{***}$
Alcohol-Related Reinforcement (AR)	$r = 0.48$ $p < 0.001^{***}$	$r = 0.52$ $p < 0.001^{***}$	$r = 0.45$ $p < 0.001^{***}$	$r = 0.36$ $p < 0.001^{***}$
Alcohol-Free Reinforcement (AFR)	$r = -0.06$ $p = 0.449$	$r = -0.04$ $p = 0.646$	$r = -0.08$ $p = 0.354$	$r = -0.02$ $p = 0.764$

*Note.*  $df = 152$ . Pearson's  $r$

AR = Alcohol-Related Reinforcement (sum of cross products of frequency and enjoyment with alcohol)

AFR = Alcohol-Free Reinforcement (sum of cross products of frequency and enjoyment without alcohol)

Reinforcement Ratio =  $AR / AFR$

Total Reinforcement Ratio =  $AR / (AR + AFR)$

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

Similar findings were found when using the abbreviated version of the PAL (see Table 23). The reinforcement ratios and degree of alcohol-related reinforcement were positively correlated with alcohol use, but the degree of alcohol-free reinforcement was not significantly correlated with number of drinks or number of hours spent drinking.

Table 23

*Correlation of Brief, 57-item PAL with Alcohol Use at Baseline*

PAL Variables	# Drinks During Typical Week	# Hours Drinking During Typical Week	# Drinks During Heaviest Week	# Hours Drinking During Heaviest Week
Reinforcement Ratio	$r = 0.52$ $p < 0.001^{***}$	$r = 0.51$ $p < 0.001^{***}$	$r = 0.49$ $p < 0.001^{***}$	$r = 0.37$ $p < 0.001^{***}$
Total Reinforcement Ratio	$r = 0.49$ $p < 0.001^{***}$	$r = 0.50$ $p < 0.001^{***}$	$r = 0.48$ $p < 0.001^{**}$	$r = 0.36$ $p < 0.001^{***}$
Alcohol- Related Reinforcement (AR)	$r = 0.52$ $p < 0.001^{***}$	$r = 0.54$ $p < 0.001^{***}$	$r = 0.52$ $p < 0.001^{**}$	$r = 0.38$ $p < 0.001^{***}$
Alcohol-Free Reinforcement (AFR)	$r = -0.02$ $p = 0.805$	$r = -0.01$ $p = 0.874$	$r = -0.01$ $p = 0.933$	$r = -0.01$ $p = 0.884$

Note.  $df = 152$ . Pearson's  $r$

AR = Alcohol-Related Reinforcement (sum of cross products of frequency and enjoyment with alcohol)

AFR = Alcohol-Free Reinforcement (sum of cross products of frequency and enjoyment without alcohol)

Reinforcement Ratio =  $AR / AFR$

Total Reinforcement Ratio =  $AR / (AR + AFR)$

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

Both the full version of the PAL and the abbreviated version of the PAL indicated that heavy drinkers had significantly higher levels of alcohol-related reinforcement compared to light drinkers (see Table 24). There were no significant differences between light/moderate drinkers and heavy drinkers in the degree of alcohol-free reinforcement.

Table 24

*Comparison of Drinkers on Reinforcement Values Given by PAL at Baseline*

<b>Reinforcement Variable</b>	<b>Light/Moderate Drinkers M (SD)</b>	<b>Heavy Drinkers M (SD)</b>	<b>t- value (p)</b>
Reinforcement Ratio – Full PAL	0.34 (0.22)	0.54 (0.23)	-5.28 (< 0.001)***
Total Reinforcement Ratio – Full PAL	0.23 (0.11)	0.33 (0.10)	-5.59 (< 0.001)***
Alcohol-Related Reinforcement (AR) – Full PAL	381.23 (265.78)	614.59 (293.47)	-4.97 (< 0.001)***
Alcohol-Free Reinforcement (AFR) – Full PAL	1246.56 (551.43)	1235.46 (548.51)	0.12 (0.904)
Reinforcement Ratio – Brief PAL	0.34 (0.24)	0.59 (0.26)	-5.96 (< 0.001)***
Total Reinforcement Ratio – Brief PAL	0.23 (0.12)	0.35 (0.11)	-6.31 (< 0.001)***
Alcohol-Related Reinforcement (AR) – Brief PAL	195.72 (144.18)	364.11 (181.52)	-6.00 (< 0.001)***
Alcohol-Free Reinforcement (AFR) – Brief PAL	620.77 (238.72)	641.24 (229.57)	-0.53 (0.598)

*Note.*  $df = 154$ . Pearson's  $r$ .

AR = Alcohol-Related Reinforcement (sum of cross products of frequency and enjoyment with alcohol).

AFR = Alcohol-Free Reinforcement (sum of cross products of frequency and enjoyment without alcohol).

Reinforcement Ratio = AR / AFR.

Total Reinforcement Ratio = AR / (AR + AFR).

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

Linear regression was used to determine whether the reinforcement ratio from the full PAL, the brief PAL, or the ARSS-AUV was more strongly associated with alcohol use. Using linear regression, the reinforcement ratio (AR / AFR) as measured by the PAL was significantly associated with number of standard drinks in a typical week,  $\beta = 0.49$ ,  $t(152) = 6.95$ ,  $p < 0.001$ . Scores on the reinforcement ratio also accounted for a significant proportion of variance in number of drinks during a typical week,  $R^2 = 0.24$ ,  $F(1, 152) = 48.35$ ,  $p < 0.001$ . The reinforcement ratio, as measured by the brief PAL, was also significantly associated with number of standard drinks in a typical week,  $\beta = 0.52$ ,  $t(152) = 7.48$ ,  $p < 0.001$ . Degree of substance-related reinforcement also accounted for a significant proportion of variance in number of drinks during a typical week,  $R^2 = 0.27$ ,  $F(1, 152) = 55.91$ ,  $p < 0.001$ . Finally, the reinforcement ratio, as measured by the ARSS-AUV, was significantly associated with number of standard drinks in a typical week,  $\beta = 0.36$ ,  $t(316) = 6.82$ ,  $p < 0.001$ . The reinforcement ratio from the ARSS-AUV also accounted for a significant proportion of variance in number of drinks during a typical week,  $R^2 = 0.13$ ,  $F(1, 316) = 46.48$ ,  $p < 0.001$ . Although the reinforcement ratio from all three measures was significantly associated with alcohol use, the ratio produced by the brief PAL had the strongest relationship with alcohol use and accounted for the greatest degree of variance in quantity of alcohol consumed during a typical week.

**Item-level exploration.** Given that the PAL contains 139 items across a range of activities, it was worth exploring the frequency of engagement and the

degree of enjoyment derived from each activity both in the presence of alcohol and when alcohol was not involved. Tables 25 and 26 highlight the top 10 most frequent activities in which students participated with and without alcohol.

Similarly, Tables 27 and 28 highlight the top 10 activities students enjoyed with and without alcohol.

Table 25

*Top 10 Most Frequent Activities With Alcohol*

<b>Item from the PAL</b>	<b><i>M (SD)</i></b>
47. Hugging Someone	2.97 (1.60)
48. Flirting	2.81 (1.52)
50. Kissing	2.73 (1.55)
29. Visiting friends or acquaintances	2.55 (1.34)
59. Sleeping late	2.54 (1.58)
3. Listening to music	2.53 (1.51)
53. Watching attractive women or men	2.46 (1.50)
74. Going to parties or receptions	2.46 (1.44)
40. Meeting someone new of the opposite sex	2.36 (1.40)
115. Sending SMS or MMS	2.36 (1.50)

*Note:*  $N = 156$ . Frequency was rated on a 5-point Likert scale (1 = Not at all; 2 = A bit; 3 = Moderate; 4 = Much; 5 = Very Much).

Table 26

*Top 10 Most Frequent Activities Without Alcohol*

<b>Item from the PAL</b>	<b><i>M (SD)</i></b>
54. Taking a shower or bath	4.47 (0.94)
3. Listening to music	4.23 (1.21)
47. Hugging someone	3.90 (1.19)
29. Visiting friends or acquaintances	3.88 (1.17)
113. Internet (surfing, downloading)	3.83 (1.28)
115. Sending SMS or MMS	3.82 (1.42)
1. Watching TV	3.78 (1.30)
30. Having a meal with friends	3.76 (1.23)
2. Listening to the radio	3.74 (1.41)
103. Watching movies, videos, DVDs	3.63 (1.18)

*Note:*  $N = 156$ . Frequency was rated on a 5-point Likert scale (1 = Not at all; 2 = A bit; 3 = Moderate; 4 = Much; 5 = Very Much).

Table 27

*Top 10 Most Enjoyable Activities With Alcohol*

<b>Item from the PAL</b>	<b><i>M (SD)</i></b>
47. Hugging someone	3.56 (1.60)
29. Visiting friends or acquaintances	3.52 (1.60)
50. Kissing	3.51 (1.67)
48. Flirting	3.40 (1.57)
30. Having a meal with friends	3.34 (1.62)
74. Going to parties or receptions	3.34 (1.62)
3. Listening to music	3.30 (1.65)
46. Make love	3.15 (1.71)
127. Going to mass events (house or rave parties)	2.94 (1.70)
59. Sleeping late	2.93 (1.73)

*Note:*  $N = 156$ . Enjoyment was rated on a 5-point Likert scale (1 = Not at all; 2 = A bit; 3 = Moderate; 4 = Much; 5 = Very Much).

Table 28

*Top 10 Most Enjoyable Activities Without Alcohol*

<b>Item from the PAL</b>	<b><i>M (SD)</i></b>
3. Listening to music	4.44 (0.99)
30. Having a meal with friends	4.38 (1.01)
29. Visiting friends or acquaintances	4.35 (1.03)
54. Taking a shower or bath	4.31 (0.99)
1. Watching TV	4.20 (1.00)
28. Visiting my parents, family	4.17 (1.18)
47. Hugging someone	4.14 (1.09)
103. Watching movies, videos, DVDs	4.12 (1.11)
50. Kissing	4.09 (1.34)
69. Going to a restaurant/eat out	4.07 (1.20)

*Note:*  $N = 156$ . Enjoyment was rated on a 5-point Likert scale (1 = Not at all; 2 = A bit; 3 = Moderate; 4 = Much; 5 = Very Much).

Table 29 provides information on the reinforcement derived both with and without alcohol for each of the 139 items on the PAL. Rank ordering gives information on which activities were the most reinforcing with and without alcohol. Table 29 also provides the reinforcement ratio and total reinforcement ratio for each activity.

Table 29

*Reinforcement Properties of Each of the 139 Items from the PAL*

<b>Item on Pleasant Activities List (PAL)</b>	<b>Rank Order of Rein. Derived from activity with Alcohol</b>	<b>Rank Order of Rein. Derived from Activity without Alcohol</b>	<b>Rein. Derived from Activity with Alcohol <i>M (SD)</i></b>	<b>Rein. Derived from Activity without Alcohol <i>M (SD)</i></b>	<b>Rein. Ratio: (AR/AFR) <i>M (SD)</i></b>	<b>Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i></b>
47. Hugging someone	1	5	12.52 (9.37)	17.01 (7.50)	0.78 (0.56)	0.38 (0.19)
50. Kissing	2	9	11.54 (9.05)	15.83 (8.47)	0.88 (0.86)	0.40 (0.19)
48. Flirting	3	20	11.49 (8.97)	13.43 (7.89)	0.94 (0.61)	0.43 (0.19)
29. Visiting friends or acquaintances	4	3	10.50 (7.84)	17.65 (7.26)	0.65 (0.49)	0.35 (0.18)
3. Listening to music (audiotape, CD, mp3, etc.)	5	2	10.17 (8.69)	19.77 (7.43)	0.58 (0.52)	0.31 (0.19)
74. Going to parties or receptions	6	47	9.81 (8.17)	10.30 (7.73)	1.77 (3.36)	0.48 (0.22)
59. Sleeping late	7	24	9.39 (8.99)	12.71 (8.22)	0.99 (1.12)	0.39 (0.22)
53. Watching attractive women or men	8	36	8.97 (8.76)	11.66 (8.20)	0.90 (0.66)	0.41 (0.20)
30. Having a meal with friends	9	4	8.83 (7.30)	17.02 (7.14)	0.63 (0.71)	0.32 (0.19)
127. Going to mass events (house and rave parties)	10	87	8.61 (8.45)	7.47 (7.61)	2.36 (4.14)	0.52 (0.21)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
46. Make love	11	23	8.52 (7.89)	13.08 (8.96)	0.92 (1.20)	0.40 (0.19)
40. Meeting someone new of the opposite sex	12	41	8.24 (8.02)	11.26 (6.94)	0.95 (1.03)	0.39 (0.22)
41. Meeting someone new of the same sex	13	43	7.95 (7.23)	11.15 (6.53)	0.80 (0.63)	0.38 (0.20)
36. Telling something I have experienced	14	32	7.92 (8.08)	11.97 (7.11)	0.83 (1.10)	0.36 (0.21)
115. Sending a SMS or MMS	15	14	7.80 (8.43)	14.22 (8.18)	0.64 (0.58)	0.33 (0.20)
103. Watching movies, videos, DVDs	16	10	7.77 (7.19)	15.78 (7.21)	0.57 (0.53)	0.30 (0.19)
31. Giving a party	17	90	7.29 (7.97)	7.15 (7.41)	1.87 (3.31)	0.50 (0.20)
49. Dating	18	18	7.27 (8.19)	13.60 (9.02)	0.72 (0.91)	0.34 (0.20)
54. Taking a shower or bath	19	1	7.01 (7.57)	19.88 (6.54)	0.42 (0.59)	0.23 (0.19)
52. Telling someone what I think of him/her	20	52	6.88 (7.51)	10.01 (7.19)	0.99 (1.26)	0.38 (0.23)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
37. Talking about my daily pursuits (job or school, politics, hobbies, public affairs, etc.)	21	26	6.67 (6.96)	12.44 (7.14)	0.64 (0.62)	0.32 (0.19)
35. Chatting with a stranger	22	67	6.51 (7.26)	8.71 (7.05)	1.27 (2.42)	0.41 (0.24)
55. Drinking a soda (lemonade, fruit juice, etc.)	23	34	6.38 (6.81)	11.72 (8.51)	0.95 (1.46)	0.36 (0.23)
2. Listening to the radio	24	8	6.35 (7.76)	16.06 (8.67)	0.53 (0.62)	0.27 (0.21)
33. Having houseguests	25	45	6.32 (6.91)	10.58 (7.47)	0.77 (0.78)	0.36 (0.20)
11. Singing or playing a musical instrument	26	33	6.30 (7.24)	11.92 (9.07)	0.78 (0.74)	0.36 (0.21)
113. Internet surfing, downloading	27	12	6.29 (7.03)	14.62 (7.88)	0.49 (0.44)	0.27 (0.19)
69. Going to a restaurant/ eat out	28	13	6.04 (6.86)	14.31 (7.27)	0.51 (0.54)	0.27 (0.20)
39. Phone friends or acquaintances	29	30	6.00 (6.76)	12.12 (7.80)	0.71 (1.04)	0.31 (0.21)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
93. Going to a sports event	30	57	5.90 (7.46)	9.40 (8.15)	0.86 (1.04)	0.38 (0.20)
7. Playing cards	31	66	5.88 (6.14)	8.84 (7.88)	1.61 (3.48)	0.42 (0.24)
60. Taking a nap	32	17	5.74 (7.05)	13.69 (8.53)	0.61 (1.04)	0.29 (0.21)
63. Using cologne, perfume, or after shave	33	16	5.59 (6.91)	14.01 (8.73)	0.67 (2.01)	0.29 (0.21)
104. Watching sports events on TV	34	53	5.43 (7.18)	9.93 (9.11)	0.76 (0.83)	0.37 (0.19)
89. Talking about sports	35	48	5.38 (6.87)	10.24 (8.93)	0.70 (0.49)	0.36 (0.18)
68. Making snacks	36	35	5.29 (6.45)	11.68 (7.87)	0.59 (0.53)	0.31 (0.20)
70. Going to a bar or café	37	65	5.25 (6.68)	8.90 (7.60)	1.15 (2.55)	0.37 (0.22)
5. Playing board games (monopoly, scrabble, etc.)	38	60	5.24 (6.18)	9.28 (7.38)	0.86 (1.16)	0.37 (0.21)
71. Going to a concert, play, opera or ballet	39	64	5.21 (6.48)	8.94 (7.79)	0.89 (1.10)	0.38 (0.22)
73. Taking a vacation	40	59	5.17 (6.44)	9.37 (8.02)	0.77 (0.60)	0.38 (0.19)
1. Watching TV	41	6	4.96 (5.73)	16.66 (7.73)	0.34 (0.37)	0.21 (0.16)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
42. Counseling someone	42	56	4.56 (5.87)	9.49 (7.71)	0.73 (0.98)	0.34 (0.20)
85. Traveling with a group	43	54	4.54 (6.12)	9.69 (7.71)	0.66 (0.58)	0.33 (0.21)
56. Smoking a pipe, cigar or cigarette	44	108	4.37 (6.32)	5.10 (7.49)	1.42 (1.86)	0.49 (0.17)
92. Doing unorganized sports (ping pong, soccer, skiing, skating, bowling, etc.)	45	49	4.07 (5.82)	10.12 (8.52)	0.87 (2.33)	0.32 (0.22)
45. Giving massages or backrubs	46	84	4.04 (5.33)	7.62 (6.89)	0.83 (1.11)	0.37 (0.20)
88. Taking a walk	47	38	4.01 (5.57)	11.50 (7.76)	0.48 (0.47)	0.27 (0.19)
58. Just sitting quietly	48	37	3.90 (4.84)	11.61 (7.51)	0.51 (0.95)	0.26 (0.19)
132. Writing or telling stories	49	88	3.88 (5.55)	7.32 (7.50)	0.89 (1.44)	0.38 (0.20)
28. Visiting my parents, family	50	7	3.85 (4.24)	16.07 (7.93)	0.37 (0.60)	0.21 (0.18)
90. Staying with family	51	19	3.83 (4.57)	13.53 (8.11)	0.42 (0.45)	0.24 (0.18)
105. Playing pool or billiards	52	100	3.81 (5.67)	5.97 (7.59)	1.06 (1.72)	0.43 (0.17)

Table 29 Continued

<b>Item on Pleasant Activities List (PAL)</b>	<b>Rank Order of Rein. Derived from activity with Alcohol</b>	<b>Rank Order of Rein. Derived from Activity without Alcohol</b>	<b>Rein. Derived from Activity with Alcohol <i>M (SD)</i></b>	<b>Rein. Derived from Activity without Alcohol <i>M (SD)</i></b>	<b>Rein. Ratio: (AR/AFR) <i>M (SD)</i></b>	<b>Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i></b>
80. Buying something for myself	53	15	3.67 (5.15)	14.01 (7.37)	0.31 (0.33)	0.20 (0.16)
43. Asking for help or advice	54	76	3.62 (4.55)	8.18 (6.62)	0.74 (0.93)	0.33 (0.22)
119. Game computer (e.g., Nintendo, X-box, Playstation)	55	86	3.51 (5.35)	7.55 (8.08)	0.73 (0.50)	0.37 (0.19)
61. Sitting in an outdoor café/on a terrace	56	74	3.36 (4.56)	8.33 (7.26)	0.64 (0.50)	0.33 (0.20)
79. Going to a swimming pool, sauna bath, etc.	57	70	3.31 (4.37)	8.51 (7.58)	0.66 (0.60)	0.33 (0.20)
17. Photography and filming	58	89	3.31 (5.00)	7.26 (7.37)	0.83 (1.67)	0.35 (0.21)
66. Cooking, trying out new recipes	59	39	3.28 (4.78)	11.46 (8.09)	0.51 (0.67)	0.26 (0.21)
72. Going to a fair, carnival, circus, amusement park, zoo or rodeo	60	73	3.22 (4.65)	8.41 (7.65)	0.65 (0.62)	0.33 (0.20)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
20. Training and/or taking care of my pet	61	28	3.18 (4.79)	12.35 (9.38)	0.45 (0.42)	0.26 (0.19)
137. Hiking, camping, picnicking, mountaineering, exploring, etc.	62	61	3.17 (5.14)	9.20 (8.35)	0.61 (0.54)	0.32 (0.20)
18. Going fishing	63	101	3.15 (5.16)	5.67 (6.79)	0.87 (0.80)	0.41 (0.18)
32. Having coffee, tea, etc. with friends and acquaintances	64	21	2.96 (4.34)	13.42 (7.84)	0.34 (0.39)	0.20 (0.18)
83. Buying something for someone else	65	40	2.96 (3.77)	11.39 (7.21)	0.40 (0.44)	0.23 (0.18)
67. Baking bread, pie or cookies	66	58	2.95 (4.02)	9.38 (8.42)	0.66 (1.07)	0.31 (0.21)
84. Traveling (car, train, bus, etc.)	67	27	2.94 (4.10)	12.42 (7.08)	0.33 (0.43)	0.20 (0.17)
86. Dancing, ballet, gymnastics, aerobics, etc.	68	91	2.93 (4.98)	7.01 (8.57)	0.89 (1.62)	0.39 (0.20)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
64. Going to the movies	69	44	2.91 (4.04)	10.88 (7.23)	0.47 (0.60)	0.25 (0.20)
114. Chatting on the internet (MSN)	70	92	2.88 (4.40)	6.99 (7.74)	0.75 (1.01)	0.36 (0.19)
57. Laying or sitting in the sun or on a sun bed	71	81	2.72 (3.83)	7.84 (7.92)	0.63 (0.43)	0.34 (0.19)
51. Drinking coffee or tea	72	11	2.65 (4.21)	15.51 (8.98)	0.35 (0.75)	0.18 (0.19)
122. Ball sports (soccer, basketball, volleyball, handball, rugby, American football, baseball, softball, etc.)	73	51	2.61 (3.76)	10.06 (9.18)	0.55 (0.45)	0.30 (0.20)
22. Re-arranging or redecorating my room or house	74	55	2.59 (3.96)	9.62 (7.96)	0.47 (0.47)	0.26 (0.19)
99. Doing things with your neighbors	75	117	2.57 (4.42)	4.60 (6.46)	0.85 (0.43)	0.43 (0.16)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
121. Boating (canoeing, rafting, sailing, catamaran)	76	107	2.56 (4.13)	5.16 (6.88)	0.90 (1.32)	0.41 (0.18)
95. Visiting caves, waterfalls, scenic wonders	77	77	2.48 (3.99)	8.00 (8.14)	0.64 (0.48)	0.33 (0.20)
96. Excursions and trips (including looking at maps, travel folders and tour books)	78	94	2.46 (4.12)	6.60 (7.43)	0.70 (0.57)	0.36 (0.19)
111. Travel to a foreign country	79	104	2.43 (2.77)	5.58 (6.73)	0.78 (0.46)	0.40 (0.17)
65. Let someone take care of your looks	80	106	2.41 (3.16)	5.24 (6.60)	0.97 (1.47)	0.40 (0.19)
78. Shopping	81	29	2.27 (3.14)	12.20 (7.30)	0.31 (0.42)	0.18 (0.17)
128. Water sports [water skiing, jet skiing, (kite) surfing, scuba diving, etc.]	82	116	2.27 (3.54)	4.66 (6.44)	0.90 (0.91)	0.41 (0.18)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
126. Four wheel drive, quad, cross country motorcycling, SUV, etc.	83	97	2.18 (2.95)	6.50 (7.71)	0.75 (0.79)	0.37 (0.19)
23. Doing a chore in or around the house	84	68	2.17 (2.61)	8.67 (6.67)	0.48 (1.32)	0.23 (0.17)
8. Solving a puzzle	85	80	2.15 (3.49)	7.87 (8.21)	0.61 (0.65)	0.31 (0.20)
38. Attending an official ceremony	86	98	2.09 (3.31)	6.37 (7.02)	0.69 (0.78)	0.33 (0.20)
44. Visiting people who are sick or in trouble	87	96	2.06 (3.63)	6.58 (6.71)	0.61 (0.60)	0.31 (0.20)
91. Doing organized sports (in a club, competition)	88	75	2.04 (3.35)	8.21 (8.90)	0.60 (0.44)	0.32 (0.20)
94. Performing astrology, reading your horoscope	89	111	2.04 (3.12)	4.87 (6.73)	0.78 (0.47)	0.40 (0.17)
112. (Indoor) skiing/snowboard oarding	90	125	1.99 (3.07)	4.03 (6.32)	0.85 (0.39)	0.43 (0.15)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
4. Fund raising, organizing events and committee work as a hobby	91	72	1.95 (3.68)	8.42 (7.98)	0.55 (0.82)	0.27 (0.21)
129. Skating (skateboard)	92	105	1.90 (2.91)	5.26 (7.14)	0.76 (0.47)	0.39 (0.18)
110. Learning to speak a foreign language	93	93	1.88 (2.70)	6.74 (7.44)	0.64 (0.61)	0.32 (0.20)
87. Riding a bicycle, going for a bicycle ride	94	99	1.87 (2.71)	6.25 (7.52)	0.65 (0.42)	0.35 (0.19)
26. Performing a task at work with others	95	46	1.85 (2.54)	10.47 (7.64)	0.41 (0.60)	0.22 (0.19)
102. Working on computer technology and communication	96	83	1.85 (2.76)	7.63 (8.11)	0.56 (0.47)	0.31 (0.19)
62. Going to a barber or a beautician	97	78	1.81 (2.78)	7.94 (7.68)	0.68 (2.03)	0.28 (0.21)
81. Going to lectures or hearing speakers	98	50	1.80 (2.63)	10.08 (7.00)	0.40 (0.81)	0.21 (0.19)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
75. Going to the market	99	62	1.79 (2.97)	9.18 (6.91)	0.39 (0.86)	0.21 (0.17)
117. Racing in a car, track racing	100	119	1.79 (2.56)	4.54 (6.60)	0.80 (0.39)	0.41 (0.17)
27. Performing a task at work alone	101	31	1.78 (2.70)	12.00 (7.98)	0.31 (0.40)	0.18 (0.17)
139. Horseback riding	102	109	1.78 (2.58)	5.01 (6.86)	0.75 (0.45)	0.38 (0.18)
131. Playing golf	103	128	1.78 (2.73)	3.81 (6.08)	0.87 (0.39)	0.43 (0.15)
13. Drawing or painting	104	95	1.76 (2.17)	6.59 (7.75)	0.66 (0.50)	0.34 (0.20)
34. Writing a letter or an e-mail	105	71	1.74 (2.24)	8.43 (6.63)	0.42 (0.78)	0.23 (0.17)
9. Reading	106	25	1.74 (2.47)	12.69 (8.30)	0.26 (0.33)	0.17 (0.15)
6. Charity work or working in the voluntary sector	107	63	1.74 (3.24)	8.97 (8.22)	0.52 (1.06)	0.25 (0.20)
134. Fighting sports	108	120	1.73 (2.70)	4.46 (6.96)	0.85 (0.48)	0.42 (0.17)
14. Doing craft work like pottery, leather, weaving, etc.	109	103	1.69 (2.35)	5.58 (7.28)	0.73 (0.49)	0.37 (0.19)
16. Keeping a diary	110	126	1.69 (2.30)	4.01 (5.95)	0.83 (0.59)	0.41 (0.17)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+ AFR) <i>M (SD)</i>
135. Jogging	111	69	1.68 (2.65)	8.51 (7.29)	0.45 (0.50)	0.25 (0.19)
12. Meditating or doing yoga	112	79	1.67 (2.35)	7.90 (8.32)	0.72 (1.73)	0.30 (0.21)
138. Improving my health (having my teeth fixed, getting new glasses, changing my diet, etc.)	113	42	1.67 (2.43)	11.21 (8.10)	0.32 (0.36)	0.19 (0.17)
120. Performing on a stage (band, dance, comedian, play, etc.)	114	121	1.66 (1.85)	4.12 (6.58)	0.93 (0.63)	0.43 (0.18)
107. Motor vehicle technique (e.g., repairing or building cars, tuning)	115	127	1.66 (2.61)	3.97 (6.29)	0.83 (0.38)	0.42 (0.16)
125. Keeping a terrarium with (exotic) animals	116	137	1.66 (2.61)	3.22 (5.48)	0.87 (0.33)	0.44 (0.14)
101. Fitness, weightlifting, etc.	117	22	1.65 (3.01)	13.25 (8.83)	0.27 (0.35)	0.17 (0.17)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
133. Ice skating, roller blade	118	118	1.65 (1.97)	4.60 (6.43)	0.81 (0.78)	0.39 (0.18)
82. Going to a museum or exhibit	119	102	1.58 (1.73)	5.63 (6.91)	0.69 (0.51)	0.36 (0.19)
19. Gardening, taking care of plants	120	115	1.57 (2.38)	4.72 (6.31)	0.78 (0.66)	0.38 (0.19)
76. Going to the library	121	85	1.55 (2.47)	7.59 (7.24)	0.50 (0.57)	0.27 (0.20)
98. Reading or studying history	122	112	1.54 (2.42)	4.86 (5.89)	0.67 (0.49)	0.35 (0.18)
10. Reading newspapers or magazines	123	82	1.54 (2.28)	7.83 (7.66)	0.46 (0.41)	0.26 (0.18)
97. Science hobbies like astronomy and nature study	124	113	1.54 (2.17)	4.85 (6.97)	0.74 (0.44)	0.38 (0.18)
118. Bungee jumping, sky diving	125	133	1.54 (1.85)	3.52 (5.45)	0.83 (0.40)	0.42 (0.15)
136. Trading or selling	126	136	1.53 (1.82)	3.24 (4.95)	0.85 (0.35)	0.43 (0.15)
124. Keeping an aquarium	127	123	1.52 (2.21)	4.08 (6.46)	0.81 (0.44)	0.41 (0.16)
116. Riding a motorcycle	128	114	1.51 (1.73)	4.84 (6.86)	0.75 (0.41)	0.39 (0.18)
109. Flying, gliding	129	134	1.49 (1.64)	3.42 (5.39)	0.84 (0.35)	0.43 (0.15)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+ AFR) <i>M (SD)</i>
123. Playing tennis	130	131	1.47 (2.09)	3.59 (5.78)	0.82 (0.47)	0.41 (0.16)
24. Doing heavy outdoor work (wood chopping, etc.)	131	110	1.45 (2.12)	4.99 (6.90)	0.76 (0.65)	0.37 (0.19)
100. Doing things with your child(ren) or grandchild(ren)	132	135	1.42 (1.38)	3.35 (5.52)	0.83 (0.32)	0.43 (0.14)
15. Knitting, crocheting, embroidery, or fancy needle work	133	124	1.41 (2.34)	4.04 (6.60)	0.80 (0.40)	0.41 (0.17)
21. Working on a collection (stamps, coins, etc.)	134	132	1.41 (1.76)	3.59 (6.16)	0.83 (0.35)	0.42 (0.15)
108. Water polo	135	138	1.40 (1.59)	3.11 (5.59)	0.88 (0.36)	0.44 (0.14)
130. Playing (ice) hockey	136	139	1.37 (1.42)	3.01 (5.18)	0.86 (0.34)	0.44 (0.14)
106. Woodworking activities	137	130	1.36 (1.67)	3.61 (5.87)	0.82 (0.41)	0.42 (0.16)
77. Going to auctions, garage sales, etc.	138	129	1.35 (1.48)	3.77 (5.67)	0.77 (0.40)	0.40 (0.17)

Table 29 Continued

Item on Pleasant Activities List (PAL)	Rank Order of Rein. Derived from activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
25. Making/Repairing clothes, sewing	139	122	1.27 (1.15)	4.12 (6.46)	0.80 (0.45)	0.40 (0.17)

*Note.*  $N = 156$  (57 light/moderate drinkers and 99 heavy drinkers)

Reinforcement (Rein.) = Enjoyment x Frequency

Reinforcement Ratio = Alcohol-Related Reinforcement / Alcohol-Free Reinforcement

Total Reinforcement Ratio = Alcohol-Related Reinforcement / Total Reinforcement

Social activities (particularly those that may involve a potential romantic partner, e.g., hugging, kissing, going to parties) were reported as the most reinforcing activities when alcohol was involved (i.e., cross product of frequency and enjoyment with alcohol). The most reinforcing sober activities included showering, listening to music and visiting friends (although listening to music and visiting friends were also highly reinforcing with alcohol). Activities with the highest total reinforcement ratio (i.e., those in which the reinforcement with alcohol accounted for a higher percentage of the total reinforcement received from the item) included going to parties/mass events, flirting, smoking cigar/cigarettes, hanging out with neighbors, playing cards, and playing pool/billiards. Items with some of the lowest total reinforcement ratio values

included activities to improve health, fitness/weight lifting, buying something for self/shopping, having coffee with friends, traveling, and watching TV.

Males and females did not significantly differ from one another on degree of alcohol-free and alcohol-related reinforcement (as measured by the PAL and the ARSS-AUV), but there were some significant gender differences on two specific subscales of the PAL, sensation-seeking activities and sports-related activities (see Table 30). Males reported more frequent engagement in sensation-seeking activities when alcohol was involved when compared to females. Males also engaged in sports-related activities (with and without alcohol) more frequently than did females. Finally, males reported more enjoyment than females with sports-related activities without alcohol.

Table 30

*Comparison of Males and Females on Two PAL Subscales*

	<b>Males (M, SD)</b>	<b>Females (M, SD)</b>	<b>t-value (p)</b>	<b>Cohen's d</b>
Sensation-Seeking Activities: Freq. w/ Alc.	1.36 (0.45)	1.20 (0.33)	2.02 (0.049) *	0.41
Sensation-Seeking Activities: Freq. w/o Alc.	1.77 (1.04)	1.63 (0.96)	0.75 (0.454)	0.14
Sensation-Seeking Activities: Enjoy. w/ Alc.	1.56 (0.59)	1.52 (0.71)	0.27 (0.788)	0.06
Sensation-Seeking Activities: Enjoy. w/o Alc.	2.38 (1.22)	2.02 (0.95)	1.66 (0.102)	0.33
Sports-Related Activities: Freq. w/ Alc.	1.83 (0.87)	1.49 (0.64)	2.29 (0.026) *	0.45
Sports-Related Activities: Freq. w/o Alc.	3.06 (1.07)	2.25 (1.09)	4.04 (<0.001) ***	0.75
Sports-Related Activities: Enjoy. w/ Alc.	2.32 (1.04)	1.99 (1.00)	1.80 (0.073)	0.32
Sports-Related Activities: Enjoy. w/o Alc.	3.53 (1.04)	2.77 (1.11)	3.78 (<0.001) ***	0.71

Note:  $df = 152$ .  $N = 40$  males & 114 females.

\* $p < 0.05$ . \*\* $p \leq 0.01$ . \*\*\* $p \leq 0.001$ .

Results from Adolescent Reinforcement Survey Schedule – Alcohol Use Version (ARSS-AUV) were similar to the results seen with the PAL. Table 31 outlines the reinforcement value with and without alcohol for each of the 45 activities as well as the reinforcement ratios. Items with the highest alcohol-related reinforcement included talking with friends, going to parties, and interacting with/flirting with potential romantic partners. Items with the highest alcohol-free reinforcement included nonverbal and verbal forms of communication with friends, communication with family members, and talking with dates. Items for which alcohol-related reinforcement accounted for the highest proportion of total reinforcement included going to parties with friends, meeting new people of the same age, flirting, kissing and being noticed by romantic partners. Items with the lowest total reinforcement value (i.e., those activities for which alcohol-related reinforcement was the smallest proportion of the total reinforcement) included items pertaining to exercise, work, academic activities, and interaction with family members or siblings.

Table 31

*Reinforcement Properties of Each of the 45 Items from the ARSS*

<b>Item on ARSS - AUV</b>	<b>Rank Order of Rein. Derived from Activity with Alcohol</b>	<b>Rank Order of Rein. Derived from Activity without Alcohol</b>	<b>Rein. Derived from Activity with Alcohol <i>M (SD)</i></b>	<b>Rein. Derived from Activity without Alcohol <i>M (SD)</i></b>	<b>Rein. Ratio: (AR/AFR) <i>M (SD)</i></b>	<b>Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i></b>
12. Talk with same sex friends	1	2	2.40 (3.37)	9.43 (4.75)	0.27 (0.39)	0.17 (0.20)
16. Go to parties with friends	2	42	2.33 (2.77)	2.33 (3.10)	0.57 (0.78)	0.36 (0.35)
5. Flirt with dates or potential romantic partners	3	10	2.24 (3.41)	6.97 (5.83)	0.38 (0.83)	0.19 (0.26)
9. Kiss dates or potential romantic partners	4	12	2.21 (3.30)	6.44 (6.12)	0.38 (0.93)	0.19 (0.27)
23. Receive email, text messages, or letters from friends	5	1	2.18 (3.46)	9.83 (4.99)	0.21 (0.31)	0.14 (0.19)
22. Interact with people of own age and sex	6	6	2.13 (2.88)	7.89 (4.85)	0.33 (0.59)	0.18 (0.22)
18. Get compliments from friends	7	17	2.12 (3.44)	6.14 (4.42)	0.35 (0.53)	0.18 (0.23)

Table 31 Continued

Item on ARSS - AUV	Rank Order of Rein. Derived from Activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
6. Get compliments from dates or potential romantic partners	8	11	2.09 (3.23)	6.91 (5.50)	0.38 (0.92)	0.18 (0.25)
2. Talk with dates or potential romantic partners	9	5	2.08 (3.21)	7.93 (6.03)	0.26 (0.48)	0.16 (0.23)
32. Caressing with a date/romantic partner	10	19	1.93 (3.03)	5.61 (5.21)	0.30 (0.60)	0.17 (0.25)
3. Be noticed by dates or potential romantic partners	11	18	1.90 (3.11)	5.99 (5.54)	0.36 (0.76)	0.19 (0.27)
24. Write email, text messages, or letters to friends	12	3	1.88 (3.44)	9.35 (5.10)	0.20 (0.42)	0.12 (0.18)
13. Go places with friends	13	14	1.84 (2.60)	6.36 (4.28)	0.35 (0.57)	0.18 (0.23)

Table 31 Continued

Item on ARSS - AUV	Rank Order of Rein. Derived from Activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+AFR) <i>M (SD)</i>
8. Interact with dates or potential romantic partners	14	8	1.83 (2.64)	7.06 (5.68)	0.31 (0.63)	0.16 (0.22)
34. Sexual intercourse with a date/romantic partner	15	29	1.82 (3.14)	4.31 (4.48)	0.34 (0.87)	0.17 (0.26)
20. Meet new people my age	16	28	1.79 (2.89)	4.33 (4.39)	0.41 (0.65)	0.22 (0.28)
43. Stay home and relax	17	7	1.76 (2.70)	7.46 (4.58)	0.32 (0.64)	0.17 (0.22)
21. Go hang out where friends meet	18	22	1.67 (2.66)	5.21 (4.53)	0.34 (0.54)	0.18 (0.23)
11. Go out to eat with friends	19	21	1.53 (2.60)	5.38 (3.86)	0.29 (0.51)	0.16 (0.23)
17. Talk with friends about day's activities	20	9	1.44 (2.82)	7.00 (4.81)	0.19 (0.35)	0.12 (0.19)
33. Oral sex with a date/romantic partner	21	37	1.39 (2.86)	3.28 (3.99)	0.27 (0.55)	0.14 (0.24)

Table 31 Continued

Item on ARSS - AUV	Rank Order of Rein. Derived from Activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+ AFR) <i>M (SD)</i>
1. Go places with dates or potential romantic partners	22	25	1.33 (2.35)	4.68 (4.43)	0.29 (0.78)	0.14 (0.24)
35. Weekends/ vacations with romantic partner	23	39	1.03 (2.21)	2.87 (4.17)	0.19 (0.40)	0.11 (0.22)
4. Go out to eat with dates or potential romantic partners	24	30	0.98 (2.28)	4.19 (4.17)	0.19 (0.48)	0.12 (0.23)
19. Ride around in car with friends	25	27	0.97 (2.35)	4.41 (4.05)	0.22 (0.56)	0.11 (0.23)
7. Go on dates	26	32	0.85 (1.87)	3.74 (3.69)	0.18 (0.47)	0.11 (0.23)
15. Talk on phone with friends	27	23	0.83 (1.84)	4.81 (4.74)	0.17 (0.43)	0.10 (0.20)
26. Talk with siblings or family members	28	4	0.80 (1.97)	8.24 (5.23)	0.12 (0.37)	0.07 (0.15)

Table 31 Continued

Item on ARSS -AUV	Rank Order of Rein. Derived from Activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+ AFR) <i>M (SD)</i>
25. Go places with siblings or family members	29	24	0.71 (2.22)	4.71 (4.03)	0.14 (0.40)	0.07 (0.17)
30. Spend weekends/vacations with siblings/family	30	33	0.61 (1.45)	3.74 (4.15)	0.14 (0.35)	0.08 (0.19)
27. Go out to eat with siblings or family members	31	31	0.59 (1.79)	3.81 (3.44)	0.13 (0.47)	0.07 (0.18)
14. Go for walk with friends	32	36	0.57 (1.83)	3.42 (4.37)	0.08 (0.27)	0.06 (0.19)
29. Talk with siblings or family about day's activities	33	16	0.48 (1.42)	6.23 (4.84)	0.10 (0.37)	0.05 (0.13)
28. Tell secrets to siblings or family members	34	41	0.37 (1.53)	2.78 (3.99)	0.13 (0.66)	0.05 (0.16)
37. Studying	35	26	0.36 (1.55)	4.51 (4.34)	0.06 (0.25)	0.05 (0.19)
31. Discuss school with siblings/family	36	20	0.35 (1.41)	5.44 (4.66)	0.07 (0.38)	0.03 (0.12)

Table 31 Continued

Item on ARSS -AUV	Rank Order of Rein. Derived from Activity with Alcohol	Rank Order of Rein. Derived from Activity without Alcohol	Rein. Derived from Activity with Alcohol <i>M (SD)</i>	Rein. Derived from Activity without Alcohol <i>M (SD)</i>	Rein. Ratio: (AR/AFR) <i>M (SD)</i>	Total Rein. Ratio: AR/(AR+ AFR) <i>M (SD)</i>
10. Exercise or participate in sports	37	13	0.33 (1.60)	6.44 (5.00)	0.04 (0.19)	0.02 (0.10)
44. Go to a movie	38	40	0.33 (1.69)	2.84 (3.24)	0.06 (0.25)	0.04 (0.14)
38. Doing chores at home	39	38	0.28 (1.39)	3.10 (3.76)	0.07 (0.41)	0.04 (0.17)
36. Going to school	40	15	0.27 (1.44)	6.35 (4.35)	0.05 (0.31)	0.03 (0.11)
39. Read a book, magazine, or newspaper	41	35	0.21 (0.96)	3.59 (4.10)	0.08 (0.57)	0.03 (0.13)
45. Play a musical instrument	42	43	0.19 (1.13)	1.57 (3.72)	0.04 (0.19)	0.03 (0.12)
41. Ride a bicycle	43	44	0.16 (0.96)	1.42 (3.31)	0.03 (0.22)	0.02 (0.11)
40. Go to plays	44	45	0.15 (0.95)	0.87 (2.81)	0.05 (0.37)	0.02 (0.09)
42. Go to work	45	34	0.13 (0.80)	3.65 (3.73)	0.03 (0.20)	0.02 (0.10)

*Note.*  $N = 318$  (124 light/moderate drinkers and 194 heavy drinkers).

Reinforcement (Rein.) = Enjoyment x Frequency.

Reinforcement Ratio = Alcohol-Related Reinforcement / Alcohol-Free Reinforcement.

Total Reinforcement Ratio = Alcohol-Related Reinforcement / Total Reinforcement.

**Summary of Results: Aim #3.** Given the importance of having valid measures to quantify the reinforcing properties of alternative activities, the third and final aim of the study was to explore the Pleasant Activities List (PAL) in a sample of U.S. college students. The current study found that a 57-item PAL was highly correlated with the full, 139-item version with respect to frequency scores, enjoyment scores, and reinforcement ratios. Additionally, the degree of alcohol-related and alcohol-free reinforcement derived from the PAL was positively correlated with the degree of alcohol-related and alcohol-free reinforcement derived from the ARSS-AUV, a reinforcement survey more commonly used with U.S. college students. The degree of alcohol-related reinforcement and ratio of alcohol-related reinforcement to alcohol-free reinforcement was highly correlated with degree of alcohol use.

When looking at specific items of the PAL, it was found that items pertaining to social interaction and physical touch were reported with the highest frequency when alcohol was involved. When alcohol was not involved, the most frequent items were some of the same activities that were reported with alcohol, but also included additional solitary activities. The most enjoyable activities with alcohol included social interactions (especially those with potential romantic partners), and the most enjoyable activities without alcohol included a mix of social and individual activities.

## Chapter 4:

### Discussion

#### Overview

The current study found that achieving self-identified goals through CRA goal setting was associated with significant increases in happiness in many domains of life among college drinkers. Additionally, goal setting was associated with a decrease in alcohol consumption, and participants in the goal-setting group reported a greater amount of change when compared to the control group. The key to a reinforcement-based approach is finding alternative sources of reinforcement that have the ability to effectively compete with substance use, and this study found that setting goals to improve happiness with physical exercise (the most commonly selected goal) was associated with an increase in happiness and a decrease in alcohol use over time. This study also identified additional activities that are negatively associated with alcohol use among college drinkers, and the PAL provided information about the types of activities that show the highest degree of alcohol-free reinforcement. These findings provided important future directions in research pertaining to the behavioral modifications that may help college students reduce their drinking.

#### Goal Setting

**Goals selected.** Based on the results of this study, college student drinkers were most interested in setting goals to increase happiness with physical exercise, academic activities, and spiritual activities. Very few students set goals to improve happiness in substance-involved activities, which is in line

with previous findings that college students rarely seek treatment for their substance use (Knight et al., 2002). The majority of students (70%) reported successfully achieving their goal, and reaching goals was not affected by gender, ethnicity, degree of sensation seeking, or delayed discounting. The majority of participants who did not achieve their goals cited lack of time and stress as the primary obstacles.

**Increasing happiness.** A key outcome variable in response to goal setting was level of happiness, and there were some significant changes over time. Among those who set goals related to physical exercise, there was a significant increase in happiness in this specific domain from baseline to follow up. Additionally, participants who achieved their goals were significantly happier in the domain of academics, employment, volunteering, physical exercise, and time spent with family when compared to participants who did not reach their goals at follow up.

Interestingly, students in the control group also showed some improvements in happiness specific to employment, spiritual activities, and substance-free social activities. Although these students did not receive the goal-setting module, it could be that simply completing alcohol assessments and the happiness scale had an effect on happiness over time by giving students an opportunity to reflect on the current state of their lives, and perhaps make changes that were not measured in this study.

**Increasing activity participation.** According to CRA, accomplishing goals (and improving level of happiness) often requires a change in the way

individuals spend their time (Meyers & Smith, 1995; Miller, Meyers, & Hiller-Sturmhofel, 1999). In response to goal setting, students in the experimental group planned to spend more time in physical exercise and less time in substance-involved activities. When activity participation by the experimental group was viewed as a whole, there was an overall decrease in activity participation. This decrease was significant for academic activities, employment, substance-free social activities, and substance-free individual activities. However, when looking only at individuals who set goals in the domain of physical exercise, there was an increase of about one hour a week in exercise from baseline to follow up, which may be clinically meaningful but was not statistically significant. One potential explanation for the general decrease in activity participation when looking at the group as a whole is that the follow up assessment asked about participation in the last week. It is possible that students increased activity participation shortly after completing the goal setting intervention, but lost momentum and did not maintain changes over time. Other research (e.g., Lash, Smith, & Rinehart, 2016) has found that changes in complex behaviors, like dieting and weight loss, are often difficult to sustain.

Finally, participants who completed the goal-setting module were not significantly higher in alcohol-free reinforcement when compared to the control group. However, the experimental group did show a greater decrease (as compared to controls) in the amount of alcohol consumed (typical week and heaviest week) and number of hours spent drinking (typical week) from baseline to follow up.

## **Identifying Alternative Activities**

At baseline, students who reported higher levels of happiness with volunteering/charity work or physical exercise also reported less alcohol use. Additionally, an increase in time spent in academic activities or spiritual activities from baseline to follow up (among experimental group) was correlated with lower levels of alcohol consumption at follow up. In the opposite direction, a decrease in time spent in employment was correlated with a decrease in alcohol consumption over time.

Given the small number of participants in each goal category, it was difficult to examine changes in alcohol consumption between specific goal domains. When looking at individuals who set goals in the area of physical exercise, the most commonly selected goal, there was a decrease in the maximum number of drinks on a drinking occasion during a typical week from baseline to follow up. This finding suggests that interventions that increase physical exercise may lead to a decrease in alcohol consumption among college students. Similarly, other researchers have found that increasing physical exercise among college students is associated with a decrease in substance use (Murphy, Pagano & Marlatt, 1986; Correia, Benson, & Carey, 2005).

## **Light/Moderate versus Heavy Drinkers**

**Happiness comparisons.** Although it was hypothesized that heavy drinkers would be less happy with their lives compared to light/moderate drinkers, this was not supported in the current study when alcohol use was viewed as a categorical variable (heavy drinkers vs. light/moderate drinkers).

Heavy drinkers (i.e., those who consumed an average of 13.21 drinks in the *heaviest* week) did not report a deficit in happiness scores and actually reported significantly higher ratings of happiness in substance-related activities compared to light/moderate drinkers (i.e., those who consumed an average of 2.95 drinks in the *heaviest* week). The average level of consumption reported by the heavy drinkers suggests that even the “heavy drinkers” were not drinking heavily as part of a consistent routine. Understanding the pattern of drinking (e.g., episodic versus daily) is important, especially when trying to find alternatives sources of reinforcement to fill the time previously devoted to substances. When alcohol use was quantified as a continuous variable (number of standard drinks in a typical week), students who drank more merely reported less happiness with volunteering/charity work and less happiness with their physical exercise.

Additionally, this study found that changes in alcohol use from baseline to follow up were associated with changes in happiness. Among heavy drinkers, greater decreases in the maximum number of drinks on a given day was associated with greater improvements in happiness related to employment and average ratings of overall happiness. Although causation cannot be inferred from correlational findings, it could be valuable to inform college students that decreasing the number of drinks on a drinking occasion is associated with increased happiness, especially from the perspective of harm reduction. The current study found that happiness with family time, substance-free individual and social activities, and overall happiness were positively correlated with the degree of alcohol-free reinforcement. This finding is in line with Correia, Carey,

and Borsari (2002) who found a significant, positive association between substance-free reinforcement and positive affect and interactions with students and professors.

**Alcohol-free reinforcement.** The hypothesis that heavy drinkers would show a deficit in substance-free reinforcement was not supported in the current study. Other studies with college student drinkers have also failed to find a significant relationship between alcohol consumption and degree of substance-free reinforcement (Hallgren, Greenfield, & Ladd, 2016; Correia, Carey, & Borsari, 2002), although some have found a deficit in substance-free reinforcement among heavy drinkers (Correia, Carey, Simons, & Borsari, 2003). Using the ARSS-SUV, Skidmore and Murphy (2010) found that heavy drinking college students were actually higher in substance-free peer and sexual reinforcement when compared to light drinkers, and their research suggests that college student drinkers may be receiving more benefits from drinking as compared to other groups. One such benefit may be higher levels of social interaction and engagement, given that alcohol consumption among college students is positively correlated with perceived social support (Zeleski, Levey-Thors, & Schiaffino, 1998). Some college drinkers also may not be showing deficits in alcohol-free reinforcement because they are early in the development of alcohol-related disorders. This hypothesis is difficult to test in the current study without diagnostic measures or information on drinking-related consequences. Correia, Carey, and Borsari (2002) found that substance-related reinforcement (including alcohol and illicit drugs) was positively associated with drinking-related

consequences among undergraduate college students. Again, the pattern of alcohol use among college students may be influencing the degree of consequences experienced, as binge drinking in particular has been shown to correlate with negative consequences (White & Hingson, 2014).

### **Exploration of the PAL**

The PAL helped point out activities that might compete with alcohol use by quantifying the degree of alcohol-related reinforcement for a variety of relevant activities. This study found that a shorter, 57-item version of the PAL was highly correlated with the 139-item version. Using the brief PAL would likely lead to decreased participant burden and increased utility of the measure. Additionally, this study found that the PAL is strongly correlated with the ARSS-AUV, a reinforcement survey instrument that is commonly used in the U.S.

The PAL seems to have some advantages over the ARSS-AUV, one of which is the finding that the reinforcement ratio calculated using the PAL accounts for a greater proportion of the variance in alcohol use than does the ARSS-AUV. The PAL includes activities that are “active,” meaning that participants have more control over the frequency of an item (e.g., meditating, buying something for someone else, or sitting in an outdoor cafe). Many of the items on the ARSS are overlapping and are more “passive” in that the initiation of the activity is not within the participant’s control (e.g., receiving compliments). And although the PAL covers a wider range of relevant activities for college students (especially technology-based activities), there are some activities that it does not assess, like spiritual activities (e.g., attending a religious service,

reading religious literature or prayer). It also mentions “surfing the web” but it does not specifically mention “social media,” a popular activity among college students (Pempek, Yermolayeva, & Calvert, 2010).

Based on results from the reinforcement inventories, it was interesting to find that many of the activities that students found highly reinforcing with alcohol were also highly reinforcing without alcohol (e.g., visiting friends and listening to music). Some social situations, however, were clearly enhanced by adding alcohol (e.g., flirting, going to mass events/parties). Alcohol-related reinforcement took up a greater proportion of total reinforcement in many social activities, while the reverse was seen for many individual-based activities. This lends support to the theory that enhanced socialization is related to increased alcohol use. In previous research, higher levels of perceived social support have been associated with higher levels of drinking among college students (Zeleski, Levey-Thors, & Schiaffino, 1998). Additionally, many college students expect that alcohol will improve their ability to participate in social situations (Lewis & O’Neill, 2000). Yet one would not want to simply encourage individualistic activities, because social interaction is a developmental hallmark of this age group (Arnett, 2000). Results from the ARSS also suggest that time spent with family/siblings is comprised mainly of alcohol-free reinforcement. However, in an individualistic culture it is developmentally appropriate for college-aged individuals to separate from home during young adulthood (Arnett, 2000), and many students leave home in order to attend college.

## Individual Difference Variables

In the current study, males consumed more alcohol than females during heavy drinking weeks, but males and females reported similar levels of consumption during typical weeks. This fits with previous literature demonstrating that males tend to report higher levels of consumption than females (Capraro, 2000). Males and females were not significantly different in their ratings of happiness at baseline, but males were happier with their level of physical exercise at follow-up. Males reported higher levels of sensation seeking but not increased preference for immediate rewards when compared to females. Males and females did not differ in total degree of alcohol-free and alcohol-related reinforcement, but males reported greater frequency of sensation-seeking activities (with alcohol), greater frequency of sports-related activities (with and without alcohol), and greater enjoyment of sports-related activities (without alcohol) when compared to females.

Level of sensation seeking was positively correlated with quantity of alcohol use in a typical week and during the heaviest week, while delayed discounting was positively correlated with number of hours spent drinking during the heaviest week. This is in line with previous research, which found a positive association between alcohol use and sensation seeking (Borsari, Murphy, & Barnett, 2007) as well as delayed discounting (Madden & Bickel, 2010). Interestingly, individuals with higher levels of sensation seeking were less satisfied with their substance-free social activities and their substance-free individual activities. One might speculate that the individuals high in sensation

seeking found activities without alcohol to be less stimulating. LaBrie, Kenney, Napper, and Miller (2014) found that college students high in sensation seeking tend to hold strong beliefs that alcohol is a fundamental part of the college experience.

### **Limitations**

The finding that goal setting (when goal categories were combined) did not result in increased activity participation or increased alcohol-free reinforcement as compared to the control group may be partially explained by the fact that the greatest amount of change was expected in the one specific area selected for goal setting, not necessarily in all domains. But the small sample size in each goal category (number of participants who selected volunteering, family time, etc.) prevented the exploration of potential causal connections between specific goal activities and alcohol use in low frequency goal domains.

Also, students were asked to set goals to increase happiness, which does not necessarily translate into changes in the amount of time spent on an activity (one critical variable for quantifying reinforcement). A student could have improved his or her happiness with academics, for example, by studying more efficiently or even by practicing more acceptance, which had the potential to increase happiness but not necessarily result in a change in the amount of time devoted. As found in the current study, the association between number of hours spent in an activity and the degree of happiness with that activity varies depending on the activity.

Given that this study was specifically designed to explore changes in happiness, reinforcement, and alcohol use, one of the primary limitations with the current study was the degree of attrition over time. Of the 357 students who signed up for the study, 47% provided data at all time points (i.e., screener, baseline and follow up). Statistical analyses were based on these 168 completers, except in the item-level analyses of the PAL and ARSS-AUV (where only baseline data was needed). Importantly, there were no significant differences between completers and noncompleters on levels of happiness, reinforcement, or alcohol use at baseline.

Although the goal-setting module itself was very brief, the additional measures included in each assessment may have made participation too burdensome. The baseline session, for example, was estimated to take two hours. Although the goal setting procedures did not ask students to set goals specific to their alcohol use, a reflection on their alcohol use through the alcohol assessments may have deterred students from wanting to complete the study. While the online modality presumably increased accessibility and anonymity, it also potentially lacked the degree of engagement that is expected during a face-to-face assessment. Although college students have no problem spending lengthy periods of time online with certain sites (like social media, Pempek, Yermolayeva, & Calvert, 2010), online surveys and interventions would likely increase retention by decreasing the time commitment required and increasing strategies for maintaining engagement.

An additional statistical limitation in the current study was the use of change scores to investigate the degree of relationship between change in happiness and change in alcohol use over time. Change scores are inherently less reliable than the original scores themselves. Multiple statistical tests can also increase the probability of committing a Type I error. Some researchers attempt to counteract alpha inflation by adjusting the  $p$ -value (e.g., a Bonferroni correction), whereas others present compelling arguments against it (Moran, 2003).

Like many studies in psychology, these results are limited by measures that rely on self-report. Although this study could not verify students' reports of consumption, the validity of self-report regarding alcohol use among college students has been previously verified using biochemical tests (Simons, Wills, Emery, & Marks, 2015). Given the more private nature of online participation, as compared to face-to-face assessment, it was assumed that students would feel more comfortable giving accurate, honest reports. Another limitation is the fact that this study did not include a measure of drinking-related consequences. Although heavy drinkers were not statistically less happy with their lives than were light/moderate drinkers, it is unclear the degree to which these students were experiencing negative drinking-related consequences. A reasonable hypothesis is that students who were experiencing greater negative consequences would have shown a deficit in happiness scores as compared to those who were experiencing fewer negative consequences.

Finally, this study specifically recruited students between the ages of 18-25 who consumed alcohol in the last 30 days, and therefore the results may not generalize to older or nondrinking college students. The limited eligibility requirements were constructed by design so that this study could investigate potential reductions in alcohol use among “traditional college students” (with respect to age). Also, over half of the sample analyzed in this study was female (73%), which is not uncommon in studies of undergraduate students (e.g., Correia, Benson, & Carey, 2005; Hallgren, Greenfield, & Ladd, 2016; Murphy, Barnett, & Colby, 2006). The breakdown of the sample is worth noting given gender differences in the reinforcement received from alcohol and other competing activities. Lastly, this sample had the ability to recruit a sizeable number of Hispanic/Latino students (39.3%), but this sample did not include enough participants in other minority groups, specifically Black, Asian American or American Indian/Alaskan Native, in order to fully explore ethnicity effects.

### **Future Studies**

Universities are interested in increasing the availability of substance-free activities, but the effect on subsequent substance use requires further study. For example, the University of New Mexico’s Campus Office of Substance Abuse and Prevention (COSAP) provides a brochure to students called “Fun in the 505” (<http://cosap.unm.edu/>), which is designed to highlight substance-free activities that are available to UNM students. The brochure provides specific ideas for local activities that are available when a student is feeling adventurous, creative, hungry, stressed (in addition to other categories). At the end of each activity

section, the brochure provides some facts about the effects of alcohol (e.g., on metabolism) and normative information about alcohol use among UNM students. Although this free brochure is available online and around campus, it is unclear how well this brochure is known and utilized by students. Also, it is assumed that this tool increases sources of substance-free reinforcement, but the effect of this brochure on substance use still needs to be tested.

Given that college students in this study demonstrated a strong desire to increase their happiness with physical exercise, this particular goal domain is worth exploring in future research. On both the PAL and ARSS-AUV, items related to physical fitness were rated low in alcohol-related reinforcement but not alcohol-free reinforcement. These activities were usually enjoyed without the presence of alcohol. Intervention studies in which college students were asked to increase their physical exercise have shown a resultant decrease in alcohol consumption (Murphy, Pagano & Marlatt, 1986; Correia, Benson, & Carey, 2005). It is worth noting, however, that engagement in physical exercise has had some mixed results, with several cross-sectional studies showing that greater amounts of physical activity were associated with higher levels of alcohol consumption (Dunn & Wang, 2003; Moore & Werch, 2008). Physical activity that requires group participation (like team sports) likely increases the opportunity for social reinforcement, and increasing social reinforcement (even alcohol-free social reinforcement) can lead to increased alcohol use (Skidmore & Murphy, 2010; Finlay et al., 2012). With this in mind, future studies should aim to increase

the types of physical exercise that are least likely to lead to an increased risk for alcohol abuse.

There are likely important moderators, or differences between groups of college students, that influence the relationship between physical exercise and alcohol use. In 2011, Buscemi and colleagues designed a study to investigate the moderating effects of gender, Greek status (e.g., fraternity or sorority), and ethnicity (Caucasian or African American) on physical exercise and alcohol use using a sample of college freshmen. The authors found that physical exercise was positively correlated with alcohol consumption among men but not women (i.e., a moderating effect of gender). There was a similar finding with Greek membership, in that those involved with Greek organizations showed the same positive relationship between exercise and alcohol use. Moderating effects were not found based on ethnicity. Overall, the study by Buscemi and colleagues concluded that physical exercise may be a complement to drinking rather than a substitute, especially in men and those involved with Greek organizations. The cross-sectional nature of the Buscemi et al. study did not allow for interpretations of potential causal links (or intervention effects) between the amount of physical exercise and alcohol use. Their work does suggest that any intervention effects may vary based on individual differences like gender and involvement with Greek organizations.

In addition to the moderating effects of individual difference variables, understanding the motivation behind exercise would likely increase our understanding of the mixed relationship between exercise and substance use.

Using a cross-sectional design, Rockafellow and Saules (2006) found that those who engage in regular exercise for extrinsic reasons (e.g., to achieve an outcome, like in team sports) reported higher levels of substance use compared to those who were intrinsically motivated to exercise (e.g., enjoyed the activity itself). An interesting longitudinal study might compare students on their motives for exercise, forms of physical activity, and subsequent alcohol use. One might hypothesize that increasing exercise to enhance physical attractiveness ultimately may increase risk for drinking among college students, as these students may then be more inclined to pursue social/dating activities; activities high in alcohol-related reinforcement. If, however, students are exercising to improve their health (i.e., intrinsic reason), one might hypothesize that these students would be less likely to engage in high-risk forms of drinking (e.g., binge drinking). This hypothesis is supported by the current study, which found that behaviors designed to improve health were not highly reinforcing with alcohol. Future research should further investigate the effect of exercise motives on substance use.

### **Conclusions**

Not surprisingly, college students in the current study did not show much interest in self-selecting substance-related activities as an area for goal setting. Instead they expressed greater interest in improving their happiness in other domains of their lives. Physical exercise, in particular, was an area of interest for college students, and results from reinforcement survey instruments indicated that reinforcement derived from fitness behaviors was mostly alcohol-free.

In addition to asking students to reflect on their current happiness in multiple domains of life and set specific goals, results from the current study suggest that college students might benefit from more assistance in learning how to translate a specific goal on paper into actual behavior change. This appears warranted because students in the current sample planned to change the way they spent their time following goal setting but these changes were not seen at follow up. Additionally, the majority of students cited lack of time as the primary barrier to accomplishing their goals. The schedule for a typical college student has a great deal of variability from one day to the next, and it is during the transition from high school to college that students learn to manage an independent lifestyle with various activities (Arnett, 2015). Research shows that college students have a great deal of unstructured time, with one study estimating as much as 42 hours a week (Bureau of Labor Statistics, 2010). This is nearly double the amount of time spent in academic activities, as reported in the current study. This unstructured, “free” time puts students at risk for alcohol abuse and further establishes the need for a reinforcement-based approach to the problem of college drinking (Miller, 2013). A reinforcement-based approach can help identify activities in the natural environment that can compete with the positive rewards of drinking with fewer negative consequences.

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