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**ASSESSING THE REAL-WORLD EFFECTIVENESS OF BOTVIN LIFESKILLS
TRAINING IN PUBLIC SCHOOLS**

A Dissertation in

School Psychology

by

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ABSTRACT

Adolescent substance abuse can lead to detrimental long-term outcomes; thus, many schools have implemented programs to reduce both the incidence and prevalence of these issues. The *Botvin LifeSkills Training* (LST) program has demonstrated promising results in randomized controlled trials, but program results outside randomized trials have been mixed. This study examined the effectiveness of LST in modifying risk and protective factors and resultant alcohol, tobacco, and other drug use among 6th-grade students in schools in the mid-Atlantic region.

Propensity score matching procedures were used to form equivalent exposure and non-exposure groups, and hierarchical linear models were used to examine main program effects and tests of moderation. Overall, hierarchical models demonstrated limited utility of LST when comparing results of 13 treatment schools ($N_{students} = 1,052$) to 10 control schools ($N_{students} = 494$).

Significant moderation effects were observed such that boys gained stronger treatment effects than girls on risk factors related to friends' maladaptive behaviors, early drug use, lifetime cigarette use, and lifetime alcohol use. Unexpectedly, girls who received LST were more willing to use alcohol. Overall implications for practice and future study are also discussed.

Keywords: Life Skills, substance use prevention, LST, intervention effectiveness, adolescent, school-based prevention, universal prevention, skills training

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Chapter 1

Introduction

Adolescent substance misuse and abuse is not a new problem. In fact, the spike in substance abuse in adolescence between the ages of 13 and 18 is considered one of the most prominent public health problems in the Western world due to the myriad of problems it may lead to both in the short- and long-term (Kleinjan & Engels, 2011; Luciana & Ewing, 2016; Merikangas & McClair, 2012). Early first-time use of alcohol and marijuana has been associated with a higher incidence of substance use disorders in adulthood, which often has serious social consequences and is linked to several leading causes of adult mortality in the United States such as cancer, heart disease, and diabetes (Center for Disease Control, 2016b; Center for Disease Control, 2016c; Grant & Dawson, 1997; Kleinjan & Engels, 2011; Johnston et al., 2016; Luciana & Ewing, 2016; National Center for Health Statistics, 2016). Tobacco use is the leading preventable cause of death in the world, and most tobacco use begins in adolescence (Center for Disease Control, 2016b; Das, Salam, Arshad, Finkelstein, & Bhutta, 2016). Sustained substance abuse also reduces overall quality of life, including but not limited to long-standing financial problems, devastated careers, strained and broken relationships, and possible long-term consequences for the children of users (Kleinjan & Engels, 2011).

Aside from these direct effects on health, adolescent substance abuse has been linked to a variety of negative secondary psychosocial consequences. Moderate use of alcohol and marijuana during adolescence has been found to alter neural structure and functioning irreversibly, even if the adolescent or young adult stops using the substance completely (LeNoue & Riggs, 2016; Luciana & Ewing, 2016). This is especially problematic as attitudes toward marijuana use are becoming more permissive among teens and adults, putting individuals at

greater risk of using marijuana and suffering these long-term consequences (LeNoue & Riggs, 2016). Recent research has shown an increase in cannabis use disorders in states that have legalized medical marijuana (Hasain, et al., 2017). Frequent heavy adolescent alcohol use has been associated with changes in executive function, attention and memory deficits, and an increased propensity to commit dispute-related violence, while increased marijuana use has been linked to an increased risk of psychosis (Green, Doherty, Zebrak, & Ensminger, 2011; Kleinjan & Engels, 2011; Luciana & Ewing, 2016). Impacts on academic achievement such as poor grades, school dropout, negative attitudes toward school, and negative effects on future academic achievement have been established as well (Haller, Handley, Chassin, & Bountress, 2010).

In addition, substance abuse is a huge financial burden for society. According to a report generated by the Pennsylvania Department of Drug and Alcohol Prevention (DDAP; 2014), the estimated national cost of drug abuse, not including the high cost of alcohol abuse, was \$193 billion, and approximately one-third of these costs involved drug-related crime. Within the state of Pennsylvania, \$5.3 billion is spent to address substance use related issues, which amounts to approximately \$429.59 per taxpayer or 15.9% of the state budget.

Epidemiology of Substance Abuse in Adolescence

Due to the serious, life-course altering consequences of adolescent tobacco, substance, and alcohol use, the National Institute of Health and other organizations have engaged in multiple efforts to track adolescent substance use longitudinally. In 2016, Monitoring the Future (MTF; Johnston, O'Malley, Miech, Bachman, Schulenberg, 2017), one of the most scientifically valid epidemiological sources of information regarding drug use since 1975, surveyed a nationally representative sample of about 45,500 8th-, 10th-, and 12th-grade students. Their findings include both encouraging and alarming news. Some positive findings include the

continued decline of cigarette smoking, down from 21-37% during the 1996-1997 peaks, to now only 3-11% depending on age. Alcohol use has also reached the lowest levels in the history of the survey, while the use of any particular drug did not significantly increase between 2015 and 2016. However, rates of recent marijuana use now exceed rates of cigarette use, and attitudes toward marijuana use have become more permissive compared to 1991 as now only 31.1% of seniors believe that marijuana use is harmful, as opposed to 78.6% in 1991. Adolescent drinking, while decreasing, is still high with approximately 1 in 3 high school seniors reporting alcohol use within the past month (Johnston et al., 2017). Therefore, further work must be done to continue to address substance use in adolescence.

School-Based Prevention

The cost benefits of substance use prevention and treatment have been demonstrated, as a DDAP (2014) report found a \$7 return for every dollar spent on drug and alcohol prevention programming. This statistic demonstrates an average effect, as not all prevention efforts are equally effective at reducing the risk of initiating and sustaining substance use. Between instructional and extracurricular activities, all children spend a large amount of time in school, making school an ideal avenue for delivering drug and alcohol prevention programming (LeNoue & Riggs, 2016; Onrust, Otten, Lammers, & Smit, 2016). Though the majority of teens using marijuana obtain it outside of school, a recent study showed that almost 10% of students who use marijuana ($N = 3,102$ students) obtained marijuana in school or on school property (King, Merianos, & Vidourek, 2016). This finding does not include other substances commonly used in adolescence, which may be distributed on school grounds, as well. Still, schools provide essential assets to aid prevention efforts, too, as the most effective school-based programs utilize

both teacher and non-teacher facilitators (e.g., community health providers and counselors) (LeNoue & Riggs, 2016).

In an analysis of 46 review articles about adolescent substance abuse prevention, Das et al. (2016) found many specific aspects of universal school-based prevention programs which were effective in reduction of tobacco smoking initiation, frequency of alcohol use, and frequency of marijuana use. Pure prevention, or targeting students prior to their initial use of drugs, is ideal, especially when these approaches utilize social influence, or norms-focused, and social competence, or skills-training, approaches (Das et al., 2016). Although popular, the D.A.R.E. program that historically solely utilizes drug resistance education has been found to be ineffective and some studies have even found that it leads to an increase in alcohol and tobacco use (Lilienfeld & Arkowitz, 2014). Instead, the most effective school-based programs include a combination of self-control training, problem solving skills training, and cognitive behavioral therapy techniques (Onrust et al., 2016). School-based brief alcohol interventions, which are low-dosage cognitive behavioral, motivational, or psychoeducational therapy interventions that are less than five hours long, are also associated with significant reduction of use (Das et al., 2016; Hennessy & Tanner-Smith, 2015).

Botvin LifeSkills Training: An Evidence-Based Solution

Botvin LifeSkills Training (LST) program is a widely used school-based substance use prevention program that includes several of the features of effective programs identified in previous research. LST offers sequenced, 3-year, universal programming specifically designed for elementary school students (Grades 3-6), middle or junior high school students (Grades 6-9), and high school students (Grades 9-10), with additional resources for more intensive intervention and a parent program (Botvin, n.d.). The format of LST programming is generally similar across

grade bands. Focusing on the middle or junior high school program (LST-MS), the most widely researched version of the program, the curriculum is split into three levels. Level 1, the core program, is designed to be implemented in 6th grade (or the first year of junior high) and consists of 15 lessons that are meant to take 30-45 minutes each. Levels 2 and 3, administered in the next two years of school, are considered booster levels with ten and five class sessions, respectively (Botvin, n.d.). The LST-MS materials include a teacher's manual, 30 student guides, both a CD and DVD, and access to the paired website, costing \$645 for Levels 1-3 (Botvin, n.d.; Botvin & Griffin, 2014). Lesson plans include unit timing, goals and objectives, key vocabulary, necessary materials, and detailed instructions for how to proceed through the plan that are almost scripted (e.g., using statements such as "Ask students to..." or "Tell students that..."; Botvin, n.d.). The elementary school program can be delivered to students in grades 3-6, depending on the year the school starts implementing the program. This version of the curriculum has developmentally appropriate lessons more evenly split across three years, with eight 30-45-minute sessions per year. This version of the curriculum costs \$655 for a similar package as described for LST-MS (Botvin, n.d.).

Though the LST program is often taught in school classrooms, it has also been taught in after-school programs, summer camps, and through community organizations (Botvin, n.d.). While LST is most often taught by teachers and school counselors, because of its easy-to-use design, LST can also be taught by community educators, prevention specialists and other program providers. In order to implement the program as designed, facilitators are encouraged to teach core and booster lessons once a week until they are completed, using a combination of both traditional lectures and more interactive methods as guided by the lesson plans (Botvin, n.d.; Botvin & Griffin, 2014). Formal training in administering the LST curriculum is not

required per se, but it is highly recommended because the training sessions equip teachers to best implement the content with fidelity based on their individual site needs (Botvin, n.d.). Trainer of Trainers and Technical Assistance trainings are also available. All training is offered through the National Health Promotion Associates via both in-person and web-based training platforms.

Using many techniques borrowed from cognitive-behavioral therapy, this program aims to help adolescents learn healthy alternatives to risky behaviors, such as drug and alcohol use, through a variety of activities that teach resistance and coping skills, promote self-esteem and self-efficacy, and inform students of the consequences of substance use and abuse. The Evidence-based Prevention and Intervention Support Center (EPISCenter) developed a visual representation for the LST middle school curriculum theory of change, replicated and enhanced with elements from Botvin's theory of action (See Figure 1; EPISCenter, 2015). It details how specific program components, proximal outcomes, and distal outcomes are linked. The goal of LST is to reduce adolescent risky behavior, especially use and abuse of tobacco, alcohol, marijuana, other substances, and engagement in other risk-taking behaviors (Botvin & Griffin, 2014). These goals can be subdivided into three main components: (a) a personal competence component, (b) a social competence component, and (c) a drug resistance component (Botvin & Griffin, 2014; Botvin, n.d.).

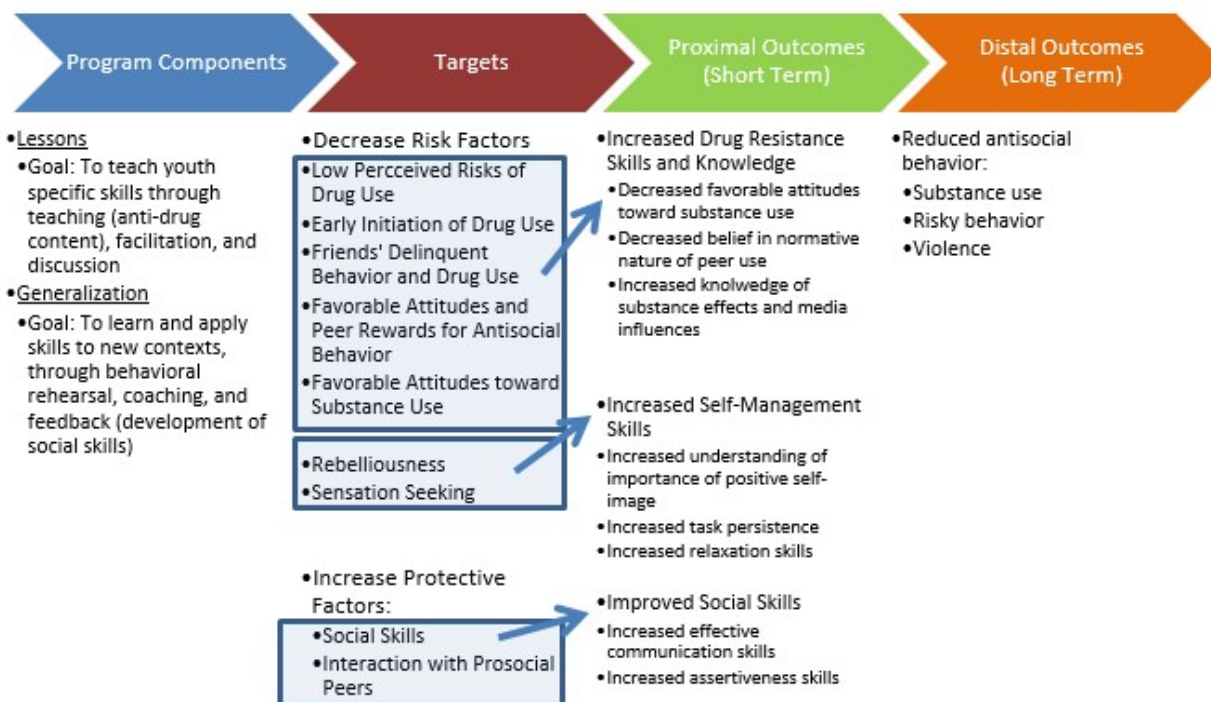


Figure 1. Logic model for LifeSkills Training, Middle School Program (LST MS). Based on work done by the Evidence-based Prevention and Intervention Support Center (EPISCenter) at The Pennsylvania State University (2013).

LST aims to increase self-management skills as a means of reducing antisocial behaviors, including substance use. As described by Botvin and Griffin (2014), through the personal competence components of LST, students learn critical thinking through media analysis, problem-solving and decision-making skills, self-regulation skills, self-monitoring, and goal-setting skills. Multiple studies have demonstrated how such skills might influence substance use. Epstein and colleagues (1999) found that both poor decision-making skills and low psychological well-being predicted smoking in adolescents, thus supporting the utility of training in decision-making skills and coping skills. Students with higher decision-making skills and self-efficacy have also been found to report higher psychological well-being, which acts as a protective factor against alcohol use (Epstein, Griffin, & Botvin, 2002). Further, Trudeau and colleagues (2003) found that decision-making acted as a significant predictor of increased

negative expectancies of the consequences of drugs, thus negatively affecting drug use initiation. However, decision-making did not directly affect the initiation of substance use.

As noted in the theory of change model, LST also aims to increase drug resistance skills and knowledge to reduce substance abuse. The drug resistance component aims to increase students' ability to resist perceived social pressures to initiate substance use by increasing general knowledge about effects of substance use and correct any misperceptions about current norms in substance use. Knowledge topics throughout program units address common misconceptions, realities, and various physiological effects related to substance use (myths and realities related to different substances and physiological effects of substance use (Botvin & Griffin, 2014). Trudeau, Lillehoj, Spoth, and Redmond (2003) examined how negative expectancies about social and personal consequences of alcohol, cigarette, and marijuana use and intention to refuse and resist drugs when offered might influence substance use initiation. Their work found that the direct effect of negative expectancies on substance use initiation was significant, but the effect of refusal intention on substance use initiation was not significant. This finding is consistent with prior research which has found that drug use norms as modeled by parents and friends are significant predictors of smoking initiation; thus, restructuring adolescent perceptions of the acceptability and frequency of substance use in their social networks is a potentially powerful approach to prevention (Botvin & Griffin, 2014; Epstein, Botvin, & Diaz, 1999).

Beyond drug resistance and self-management skills, LST program participants are also expected to learn social skills, such as assertiveness and communication skills. The social competence component is primarily a communication program for students, teaching students how to communicate clearly and confidently, initiate and sustain pleasant conversation, listen

actively, utilize assertiveness (verbal and nonverbal), and react appropriately when faced with challenges (Botvin, n.d.). The effects of assertiveness on substance use initiation have also been studied (Trudeau et al., 2003). Similar to the effects of decision-making, assertiveness was also a significant predictor of negative expectancies, which decreased drug use initiation, but again, a direct path between assertiveness and substance use initiation was not found to be significant. Communication skills training programs that teach skills such as giving praise, giving and receiving criticism, conversing effectively, and resolving conflict have also been found to be effective in reducing alcohol-related behaviors when used in conjunction with coping skills training (Rohsenow et al., 2001).

Evidence of LST efficacy. Multiple prevention program registries have evaluated the LST program and found it to meet the highest standards for prevention quality (Botvin, n.d.). For example, LST has been rated as a Top Tier program by the Coalition for Evidence-Based Policy (n.d.), a Proven program by the Promising Practices Network (2011), and Model Plus by Blueprints for Violence Prevention (n.d.), among many other positive reviews (Botvin, n.d.). The Office of Juvenile Justice and Delinquency Prevention Model Programs Guide states that LST is proven to be effective by more than one study, including studies by the primary program developers and independent researchers (Office of Justice Programs, n.d.).

The LST developers have conducted multiple studies that demonstrate its efficacy. One of the earliest studies of intervention efficacy was conducted by Botvin, Baker, Dusenbury, Botvin, and Diaz (1995). A randomized trial was conducted in 56 public schools, starting with a large cohort of 7th-grade students ($N = 5,954$) of which 4,466 students reported follow-up data upon completing the ninth grade. Of these students, 3,597 predominantly white 12th-grade students participated in the longitudinal follow-up, which demonstrated significant reductions in

self-reported drug use in the groups that received the most complete version of the LST program when compared to controls ($d_{30\text{-day cigarette}} = -0.12$; $d_{\text{drunk}} = -0.12$; $d_{30\text{-day marijuana}} = -0.09$). Other studies have since supported the effects of LST with minority populations (Botvin & Kantor, 2000). Further, the elementary school program was also found to reduce annual tobacco use ($d = -0.11$) and increase drug-related knowledge in 3rd- to 6th-grade students (Botvin, Griffin, Paul, & Macaulay, 2003). Additional evidence from a study by Griffin, Botvin, Nichols, and Doyle (2003) showed that the program had significant longitudinal effects on substance use in high risk teens ($d = -0.18$).

Recently, Spoth, Trudeau, Redmond, and Shin (2014) replicated and extended analyses from a randomized control trial originally conducted in 1997 with 7th-grade students and their families from 36 rural Iowa schools. This trial tested three conditions: LST only, the *Strengthening Families Program: For Parents and Youth 10-14* (SFP 10-14) combined with LST, and a control condition. Study participants were assessed twice in seventh grade, once a year in each subsequent grade, and were also surveyed in early adulthood (ages 19-22) about their substance use initiations and patterns of use. Investigators found that LST was effective in reducing average young adult levels of drunkenness, alcohol-related problems, cigarette use, and illicit substance use when compared to controls. This reduction was particularly strong for high-risk participants (i.e., those who had initiated use of at least two of the following substances: alcohol, cigarettes, and marijuana).

Crowley, Jones, Coffman, and Greenberg (2014) experimentally examined the cost-effectiveness of LST and other prevention programs and their effects on reducing opioid abuse. Using a population of sixth-grade students ($N_{\text{intervention}} = 5,026$; $N_{\text{control}} = 5,292$) from 28 rural public school districts in Iowa and Pennsylvania, participants were randomly assigned to

experimental or control conditions across eight years (2002-2010). At the community-level, prevention programs were selected by local prevention teams, but all youth in the intervention communities were also administered a school-based prevention program ($N_{LST} = 1,166$ students). Overall, it was found that LST significantly reduced nonmedical opioid abuse initiation compared to the control group, and the LST program alone was the most cost-effective for the degree of outcomes achieved.

Overall, the effect sizes from LST efficacy trials show generally small effects, ranging from $d = -0.09$ to $d = -0.18$ (Botvin et al., 1995; Botvin & Kantor, 2000; Botvin, et al., 2003; Griffin, et al., 2003). These effect sizes are within the expected range for comprehensive school reform studies and universal programming. A percentile distribution of 145 achievement effect sizes from school reform meta-analyses conducted by Bloom, Hill, Black, and Lipsey (2006) demonstrated an average effect size of $d = 0.16$. Furthermore, work by Onrust and her colleagues (2016) showed that collectively, universal programs for child or adolescent substance use show favorable effect sizes ranging from $d = -0.06$ to $d = -0.22$; thus, similar effect sizes are expected from studies of LST.

Contradictory results. Although many studies have highlighted the efficacy of LST, other researchers have raised concerns that need to be addressed through further study. Though the rigorous randomized trials have shown positive effects of LST under ideal conditions, the potential effectiveness of LST implemented under real-world conditions are less clear. Vicary et al. (2006) studied the effectiveness of two forms of delivering LST in small, economically-disadvantaged rural school districts; one form was the standard format while the other was integrated across the school curriculum. Teachers who were going to implement standard LST were trained by trainers from the program publisher, and implementation fidelity was tracked

using teacher self-rating forms. Data from 234 students in the LST condition of this study demonstrated significant effects on reducing substance use in girls in the seventh and eighth grades, but no significant effects were found on these behaviors in boys. Unfortunately, the significant effects on substance use observed in girls in earlier years did not persist through the end of ninth grade. The program was effective in producing a lasting impression on girls' communication and coping, but again, these effects were not found for boys. See Table 1 for an overview of these findings, finding supporting LST efficacy, and proposed study outcomes.

Other studies have criticized the data analysis and reporting practices of the program developers. One study noted that evaluation studies use of one-tailed significance testing, changes in outcome variables across multiple publications using the same study data, and the use post-test data as the baseline for long-term follow-up removed any potential increase in drug use during the intervention period (Gorman, Conde, & Huber, 2007). These practices limit the practical significance of the study findings. The use of subgroup analyses of only high-risk program participants or high-fidelity implementation groups has also been criticized, as full-sample analyses would show that the LST programming produces no effect on marijuana use (Gorman, 2011).

Focus of Present Study

The evidence from multiple randomized trials studying the *Botvin LifeSkills Training* (LST) program support the positive effects of the program in reducing the risk factors and increasing the protective factors related to adolescent substance use and abuse (Botvin et al., 1995; Botvin & Kantor, 2000). Furthermore, randomized trials have also shown that LST is a very cost-effective investment for communities to use in an effort reduce unhealthy substance use (Crowley et al., 2014). However, results from less controlled, real-world trials are weaker.

One three-year study did not find LST to provide long-term effects on reducing substance use, indicating some challenges when implementing LST outside rigorous research studies (Vicary et al., 2006). Other reports have criticized the data analytic procedures employed by many of the experimentally rigorous studies of program efficacy, especially those conducted by the program publishers (Gorman, 2011; Gorman, Conde, & Huber, 2007). See Table 1 for a review of key studies and the outcomes addressed by the proposed study. This study addresses some of these concerns through a true effectiveness trial of LST outcomes when delivered in typical school settings by school personnel, using a moderately large sample size. Therefore, the purpose of this study is to conduct additional research of LST effects under real-world conditions to clarify its utility for school-aged students.

Table 1

Outcomes Addressed by Key Studies and Current Study of LifeSkills Training

Outcome	Botvin et al. (1995)	Griffin et al. (2003)	Botvin et al. (2003)	Spoth et al. (2014) ^a	Vicary et al. (2006)	Current Study ^c
Alcohol		x	ns	x	ns	
Lifetime	-	-	-	-	-	x
30-day Use	x	-	-	-	-	x
Binging	x	-	-	x	ns	x
Cigarettes		x	x	x	ns	
Lifetime	-	-	-	-	-	x
30-day Use	x	-	-	-	-	x
Daily Use	x	-	-	-	-	-
Marijuana		ns		x	ns	
Lifetime	-	-	-	-	-	x
30-day use	x	-	-	-	-	x
Daily use	-	-	-	-	-	-
Other Narcotic Drugs				x		
Lifetime	-	-	-	-	-	x
30-day use	-	-	-	-	-	x
Daily use	-	-	-	-	-	-
Inhalants						
Lifetime	-	-	-	-	-	x
30-day use	-	-	-	-	-	x
Daily use	-	-	-	-	-	-
Risk Factors						
Rebelliousness	-	-	ns	-	-	x
Favorable Attitudes	-	-	-	-	x	x
Norms	-	-	x	-	x ^b	x
Perceived Risks	-	-	-	-	-	x
Early Use	-	-	-	-	-	x
Sensation Seeking	-	-	-	-	-	x
Protective Factors						
Decision Making		-	x	-	x	-
Communication		-	x	-	x	-
Refusal Skill		-	ns	-	ns	-
Media Resistance		-	ns	-	x	-
Assertiveness		-	-	-	x	-
Coping		-	-	-	x	-
Knowledge		-	x	-	x	-

Note: x = significant effect; ns = not significant; - = not studied

^aEffects on marijuana and narcotics were reported under the larger category of “other illicit drugs.” ^bSignificant effect observed in unexpected direction. “x” in the “Current Study” column indicates that study of these outcomes was conducted in this research study.

Research Questions

Two research questions were examined to address the main goals of this study. First, does the LST program produce the proximal and distal effects on student outcomes as theorized? Randomized trials have demonstrated program effectiveness, but further real-world study is necessary to determine any mismatches between promised impact and more realistic effects. Nevertheless, based on the wealth of support available for the program, the following hypotheses guided this research:

H1: In schools using the LST program, 6th-grade students will show decreased rates of alcohol, tobacco, and other drug (ATOD) use when compared to matched 6th-grade students from schools that were not using a universal substance use prevention program.

H2: In schools using the LST program, 6th-grade students will demonstrate decreased risk factor scale scores when compared to matched 6th-grade students from schools that were not using a universal substance use prevention program.

Second, does gender moderate the proximal and distal effects of LST on student outcomes? Results from Vicary et al. (2006) support increased effectiveness of LST in reducing binge drinking, general alcohol use, and marijuana use in adolescent females only. Further, findings from this study showed that LST was also more effective in reducing adolescent female's normative beliefs and attitudes toward antisocial behavior and drug use as compared to adolescent males. Therefore, it was predicted that:

H3: Gender will moderate the program outcomes related to ATOD such that adolescent females will show lower rates of ATOD use than adolescent males.

H4: Gender will moderate the program outcomes related to risk factors such that adolescent females will have lower risk factor scale scores than adolescent males.

Chapter 2

Literature Review

Substances Used in Adolescence

Monitoring the Future (MTF) provides highly detailed study of current trends in adolescent substance use (Johnston et al., 2017; Miech, Johnston, O'Malley, Bachman, Schulenberg, & Patrick, 2017). Although MTF collects data that encompasses a variety of legal and illicit substances, the following substances are reviewed in further detail: alcohol, cigarette use, marijuana, and prescription pain relievers. Current statistics may be found in Table 2.

Alcohol. Youth populations often use alcohol in social settings, and although overall rates of alcohol use have decreased, use within a 30-day period (i.e., an indicator of regular use) in 12th-grade students is still 33%. One behavior of special concern regarding alcohol is binge drinking, or drinking five or more drinks in a row on one occasion in the past two weeks, as it is a serious public health concern. Binge drinking has continued to decline in recent years; in 2016, 16% of 12th-grade students reported binge drinking as compared to the peak rate in 1979 of 41% (Miech et al., 2017). Authors of the MTF report suggest that this decline could be attributed to initial policy changes that impacted the minimum drinking age and continued public service advertising about the dangers of alcohol use (Johnston et al., 2017).

Cigarettes. Cigarette use tends to remain stable within a cohort of people, making “pure” prevention, or preventing the first-time use of the drug, essential. Twelfth-graders’ use of cigarettes within a 30-day period reached its highest point in 1976 at 39% and has since declined by 71%. Perceived risk of using cigarettes has increased over the history of the study, and importantly student perceptions regarding how available cigarettes are to them have declined in 8th- and 10th-grade students, with only 46-63% of students corresponding to their grade saying

cigarettes are fairly easy to get as compared to the highest rates of 78-91% (Johnston, et al., 2017).

Marijuana. Use of marijuana by 12th-grade students reached its highest level in 1979 at 51%. Since then, the annual trend in use has oscillated between periods of decline and increase. Medical marijuana was legalized in many states, starting with California in 1996, while recreational legalization started in 2012. In 2017, 29 states and Washington, D.C. have legalized marijuana for medical use while eight have also legalized recreational use (ProCon.org, 2017). Though marijuana was not legalized for recreational use in 2011, adolescent use of the drug increased that year. Since the increase, the rate has remained stable in 12th grade students with one-in-seventeen students smoking marijuana daily. As marijuana becomes legalized in more states, students of all ages are continuing to report sharply less perceived risk of using marijuana, though this has not yet markedly impacted actual marijuana use. Students still disapprove of regular marijuana use at high rates and most younger students (i.e., 8th- and 10th-grade students) have limited access to marijuana; yet, 12th-grade students report high rates of marijuana availability (Johnston et al., 2017). The 2015 National Survey on Drug Use and Health (NSDUH; SAMHSA, 2016) estimates that approximately 8.3% of people over the age of 12, or over 22 million people, use marijuana regularly (i.e., past month). Furthermore, approximately 7 million of those 22 million people are aged 18-25. Therefore, although rates of adolescent marijuana use have stabilized in recent years, rates remain high and this continues into young adulthood. This continued use may be impacted by the reduction in perceived risk of using marijuana.

Prescription pain relievers. The MTF survey reports data about prescription opioids, or strong pain relievers prescribed by physicians or dentists, as “Other Narcotic Drugs, Including

OxyContin and Vicodin.” For a large portion of the history of the study, use of these drugs was likely underreported before explicit examples of OxyContin, Percocet, and Vicodin were added to the survey in 2002. However, since the addition of these examples, after an initial spike in reported use, the annual prevalence, or use in the past year, has declined since 2009.

Specifically, annual prevalence of OxyContin is 3.4% in 12th-grade students, while that of Vicodin is 2.9% (Johnston et al., 2017; Miech et al., 2017). Although a large majority of students are not using prescription opioids at all, let alone regularly, the opioid epidemic in the adult population is well-documented; thus, it is important to continue monitoring adolescent use of the substances as well (CDC, 2016a).

Inhalants. This substance category broadly includes any gases or fumes that can be inhaled for a high. Often found in typical household products and therefore highly available, use of these substances is most popular among younger students. Overall, inhalant use has declined considerably since a brief increase was observed between 2003 and 2005, with current rates of lifetime use ranging between 5.0-7.7%. MTF does not include specific questions regarding the availability of inhalants due to the universal availability of products containing inhalable gases or fumes (Johnston et al., 2017).

Table 2

Monitoring the Future 2016 Summary Data for Substances of Study Focus in Percentages (Johnston et al., 2017)

Substance and grade level	30-day use	Lifetime use	Perceived risk of regular use ^a	Availability
Alcohol				
8 th Grade	7.3	22.8	53.4	52.7
10 th Grade	19.9	43.4	54.5	71.1
12 th Grade	39.2	61.2	48.4	85.4
Cigarettes				
8 th Grade	2.6	9.8	61.2	45.6
10 th Grade	4.9	17.5	71.5	62.9
12 th Grade	10.5	28.3	76.5	-
Marijuana				
8 th Grade	5.4	12.8	57.5	34.6
10 th Grade	14.0	29.7	44.0	64.0
12 th Grade	22.5	35.6	31.1	81.0
Other Narcotic Drugs^b				
8 th Grade	-	-	-	8.9
10 th Grade	-	-	-	16.8
12 th Grade	7.8	1.8	72.4	39.3
Inhalants				
8 th Grade	1.8	7.7	52.1	-
10 th Grade	1.0	6.6	59.7	-
12 th Grade	0.8	5.0	-	-

Notes: ^aPerceived Risk of each substance reported based on following statements: Alcohol: “Have five or more drinks once or twice each weekend.”; Cigarettes: “Smoke one or more packs of cigarettes a day.”; Marijuana: “Smoke marijuana regularly.”; Inhalants: “Take inhalants regularly.” ^bOther Narcotic Drugs is reported in Monitoring the Future as “Other Narcotic Drugs, Including OxyContin and Vicodin” and will be referred to interchangeably as “Prescription Pain Relievers.”

Risk Factors for Substance Abuse in Adolescence

Individual and peer factors. A variety of individual factors may place an adolescent at greater risk of substance misuse and abuse. A genetic component that explains a large amount of variation in use and dependence has been observed through twin studies, while sex differences in neural functioning related to substance abuse have also been identified (Hammerslag & Gulley,

2016; Kleinjan & Engels, 2011; Merikangas & McClair, 2012). Differences in how the environment impacts corticolimbic development make males more likely to develop substance abuse issues than females due to increased impulsivity and sensation seeking, though females who begin experimenting with drugs due to internalizing problems or stress may become addicted more rapidly than males (Hammerslag & Gulley, 2016; Kuhn, 2015).

Age of first experimentation with substances also greatly impacts an adolescent's risk of developing long-term substance use problems. Adolescents who started drinking prior to age 14 were four times more likely to become dependent on alcohol than those who started drinking at age 20 or older (Grant & Dawson, 1997; Kleinjan & Engels, 2011). Similar findings have been reported for marijuana and 'hard' drug dependence and abuse; in fact, early use of such drugs has been linked to far more deleterious effects in educational achievement and development of substance abuse disorders in adulthood than adolescent alcohol use (Haller, Handley, Chassin, & Bountress, 2010; Kilpatrick et al., 2000).

Other personal factors, such as an individual's knowledge and related cognitions about substances, drugs, and alcohol, personality, behavior, and other pre-existing conditions may also put him/her at risk for use and abuse. Positive attitudes toward particular drugs and their potential effects (socially or physiologically) are linked to the onset and continued use of illicit substances (Kleinjan & Engels, 2011). Adolescents who have low self-efficacy, poor behavioral control, and hopelessness are also at an increased risk of substance abuse (Kleinjan & Engels, 2011). Early displays of aggressive behavior and antisocial behavior have also been linked to increased substance use in adolescence (Harrop & Catalano, 2016). Finally, pre-existing psychiatric diagnoses of ADHD, conduct disorder, bipolar disorder, eating disorders, and schizophrenia are often comorbid with substance use disorders (Kleinjan & Engels, 2011).

An adolescent's social and relational contexts may be among some of the most powerful influences on potential substance abuse, especially during late adolescence (Kleinjan & Engels, 2011). Peer groups' importance and the drive for social acceptance reach their peak during adolescence and thus play a role in the development of substance abuse problems (Kleinjan & Engels, 2011). Adolescents may initiate using particular substances based on what their peer group is doing (i.e., 'socialization'), or if they are already using substances, they may form a 'deviant' peer group of other adolescents using the same substance (i.e., 'selection'), further reinforcing the behavior (Haller et al., 2010; Kleinjan & Engels, 2011; Kuhn, 2015).

Romantic relationships also impact substance use and abuse. Having a romantic partner who uses alcohol or drugs increases the risk of initiating and sustaining substance abuse in adolescent women (Kuhn, 2015). Relational impacts on substance abuse have also moved online. Victims of cyber dating abuse, or relational abuse of one's dating partner through technology and social media, engaged in heavy binge drinking more frequently than youth who were not victimized (Ouytsel, Ponnet, Walrave, & Temple, 2016).

Family factors. Trauma often precedes substance abuse; in fact, adolescents ages 12-17 who have been (a) exposed to, (b) subjected to physical or sexual violence, or (c) had posttraumatic stress disorder are at an increased risk for developing substance abuse or dependence (Banducci, Hoffman, Lejuez, & Koenen, 2014; Kilpatrick et al., 2000; Simmons & Suárez, 2016). Adolescents who have experienced trauma may be relying on substances to alleviate hyperarousal symptoms or to avoid distressing flashbacks (Simmons & Suárez, 2016).

A family history of alcohol and drug use problems also increases an individual's risk of developing such problems (Kilpatrick et al., 2000; Kleinjan & Engels, 2011). Aside from the genetic predispositions for substance abuse that children can inherit from parents, parents may

also create a home or family environment that promotes adolescent drug abuse. For example, parents may create a permissive environment either through modeling substance abuse themselves or by having drugs or alcohol in the home (Kleinjan & Engels, 2011). Challenges in family management and high levels of familial conflict may also place an adolescent at risk of substance use (Harrop & Catalano, 2016).

School factors. School-based factors also place adolescents at increased risk of using substances. For instance, academic failure in school that occurs as early as elementary school has been found to be a risk factor for adolescent substance abuse (Harrop & Catalano, 2016). Furthermore, students who are less committed or connected with the school community are also at an increased risk of initiating and sustaining substance use (Harrop & Catalano, 2016).

Community factors. Larger societal and media factors also play a role in the development of substance abuse in adolescents. Neighborhoods and areas which have a high poverty rate, a high crime rate, and are generally disorganized have higher rates of adolescent substance abuse (Harrop & Catalano, 2016; Kleinjan & Engels, 2011). Communities in which greater access to substances occurs through more established vendors often have increased rates of adolescent substance abuse (Harrop & Catalano, 2016). Highly transient community populations lead to reduced opportunity to build strong ties to the community, placing adolescents at risk of initiating and sustaining substance use (Harrop & Catalano, 2016). Furthermore, media depictions of drug and alcohol use promote more positive attitudes toward substance use, so much so that a causal relationship has been established between media depictions of smoking and onset of smoking in adolescents (Harrop & Catalano, 2016; Kleinjan & Engels, 2011).

Protective Factors Against Substance Abuse in Adolescence

Individual and peer factors. Many individual factors have been found to be protective against substance abuse issues. First, high self-esteem or self-concept has been negatively associated with alcohol use (Handren, Donaldson, & Crano, 2016). Second, 9th-grade students who self-reported high levels of grit, or perseverance and passion for long-term goals, demonstrated significantly lower odds of recent alcohol and marijuana use (Guerrero, Dudovitz, Chung, Dosanjh, & Wong, 2016). Religiosity and belief in the moral order have been identified as protective factors against substance use; these traits are integral parts of many effective substance use treatment programs (Harrop & Catalano, 2016). Furthermore, positive role-models such as non-using peers in friendship groups also protect against substance use (Handren et al., 2016). Finally, social, coping, and resistance skills also reduce the risk of adolescents developing problematic substance abuse patterns because such skills help with limit-setting and remaining firm despite environmental temptations (Harrop & Catalano, 2016; Kleinjan & Engels, 2011).

Family factors. High parental involvement and connectedness reduces the risk of engaging in substance abuse (Handren et al., 2016; Harrop & Catalano, 2016). High parental involvement should not be confused with ‘helicopter parenting,’ as this style does not allow children to develop independence and may lead to reduced resilience or increase rebelliousness. Instead, parents may increase involvement through helping with homework and instating reasonable rules (Handren et al., 2016). Parents may also create opportunities for prosocial involvement and recognize efforts in activities such as helping with chores, family meals, and game nights (Harrop & Catalano, 2016).

School-based factors. Schools that provide opportunities for prosocial involvement are instrumental in protecting adolescents from using substances. Examples of such opportunities include after-school clubs, athletics, and other school-based activities (Harrop & Catalano, 2016). Beyond offering these experiences, schools should recognize students for their exemplary performance and participation in such activities through events such as awards assemblies, pep rallies, and sponsorship of school-based theater/arts performances (Harrop & Catalano, 2016).

Community factors. When parental involvement is not feasible, having at least one positive adult connection, both in the general population and urban contexts, led adolescents to be significantly less likely to report ever using alcohol (Culyba et al., 2016). Opportunities to increase prosocial involvement through after school clubs and youth organizations have demonstrated protective effects on adolescent substance use (Harrop & Catalano, 2016). On a societal level, if the negative consequences of substance use, such as police involvement in cases of public intoxication or substance-induced violence, are more visible, attitudes favoring alcohol and substance use decrease (Kleinjan & Engels, 2011).

Theoretical Frameworks for the Etiology and Prevention of Adolescent Substance Abuse

Etiology. Three theories are critical to prevention researchers' conceptualization of why adolescent substance abuse problems develop: social learning theory, problem behavior theory, and a developmental perspective (Botvin & Griffin, 2014; Onrust et al., 2016). Social learning theory asserts that learning occurs through observation, imitation, and modeling, while problem behavior theory extends social learning to include the modeling of substance use and other risky behaviors by high status role models and other peers and its effects on adolescent substance use behavior (Botvin & Griffin, 2014). As outlined by Handren and colleagues (2016), problem behavior theory also identifies three systems that can be acted upon to reduce or increase risk of

substance abuse, including the perceived environment system (e.g., parental system), personality system (e.g., self-esteem and attitudes regarding substance use), and behavior system (e.g., using or abstaining from substance use). Using these perspectives, prevention efforts should provide examples of appropriate behaviors and increase environmental support by providing more opportunities for prosocial involvement and relationship-building, while reducing exposure to high status role models or peers who are modeling substance use. These could help ameliorate the effects of ‘deviant’ peer groups and family influences while increasing self-efficacy and resistance skills.

The developmental perspective of substance abuse purports that as the developmental goals change across different age stages (i.e., childhood, plus early, middle, and late adolescence), the motivations to initiate and sustain substance use change accordingly (Onrust et al., 2016). Thus, prevention efforts utilizing this perspective should utilize components that are most suitable for the audience’s developmental stage and associated individual and environmental risk factors. For example, social norm components that correct misperceptions of peers’ acceptance of and actual substance use have been found to be most effective when working with early adolescents, who are otherwise already aware of potential social pressures to use substances (Onrust et al., 2016). Such components are less effective in late adolescence, a period during which adolescents are more concerned with developing their personal identities (Onrust et al., 2016).

Tobacco prevention in schools. First, targeting students prior to even initiating cigarette smoking, otherwise known as a pure prevention approach, has been found to be most effective (Das et al., 2016). More than many other substances, addiction to nicotine can develop rapidly following initial use, increasing the urgency to intervene prior to initial use of tobacco (Kleinjan

& Engels, 2011). However, the content of such programs is also critical, as knowledge-based programs, or interventions that only inform adolescents of the negative effects of substance use, are generally ineffective (Kleinjan & Engels, 2011).

Alcohol and marijuana prevention in schools. Primary prevention programs that target alcohol and marijuana use are most effective when targeting 10-15-year-olds with a combination of antidrug information and training in refusal skills, self-management skills, and social skills training (Das et al., 2016). In addition, interventions that include personalized feedback, goal setting and are generally brief also reduce the frequency of alcohol consumption (Das et al., 2016). Other universal school-based prevention programs that utilize behavior skills training, encourage prosocial behaviors, and social influence approaches (i.e., approaches that debunk beliefs about widespread substance use among peers) have also been found to be effective (Das et al., 2016; LeNoue & Riggs, 2016).

Family- and community-based prevention. School-based prevention is not the only means of preventing adolescent substance abuse. In fact, many family-based programs have been shown to be effective in reducing adolescent risk (Harrop & Catalano, 2016). These programs focus on parenting skills, including setting clear behavioral expectations, fostering greater parental involvement, de-escalation techniques, and family management strategies (Harrop & Catalano, 2016). However, such programs are far more difficult to implement and monitor for fidelity than school-based programs. This is not surprising as it is far more feasible to evaluate a program serving 30 students in one classroom, as opposed to visiting each of those 30 children and their families at home. Similarly, some community-based efforts including prevention coalitions and media campaigns illustrating the potential effects of drunk driving have also proven to be effective (Das, et al., 2016; Harrop & Catalano, 2016). Yet, societal

approaches to handling substance abuse are still more reactive and focused on treating existing cases of adolescent substance use, unlike the ideal school-based approaches described for other substances (Harrop & Catalano, 2016).

Popular Approaches to School-Based Prevention

Universal programs are quite popular considering the phenomenon known as prevention paradox. That is, a large number of people who are at low risk for developing a problem may actually produce more problem cases than a small number of people who are at high risk for developing the problem (Harrop & Catalano, 2016). Furthermore, such programs can allow schools to intervene with substance use before it even begins (or before it worsens), a critical step for maximizing prevention efforts (Harrop & Catalano, 2016). In general, school-based programs including self-control training, problem solving skills training, and cognitive behavioral therapy techniques were found to be effective (Onrust et al., 2016). Strategies and approaches within the school setting for specific substances have also been identified. Although many other programs exist that may be implemented universally, including Project ALERT, Project STAR, and Lions-Quest Skills (SFA), detailed review of D.A.R.E. and Project Northland illuminates important similarities and differences in popular substance use prevention approaches.

D.A.R.E. The Drug Abuse Resistance Education (D.A.R.E.) program is well-known and widely used in the education community, but due to many curriculum changes over the past 30 years, D.A.R.E. has many different faces (D.A.R.E. America, 2016). Original D.A.R.E. lessons, given by uniformed and highly trained police officers, included lectures, workbook activities, question/answer sessions, and role plays with significant attention placed on learning how to “just say no” to the peer pressures of using drugs (Singh et al., 2011). Although drug resistance

education is often included in evidence-based drug-prevention programs, it often does not stand alone as it does in D.A.R.E. Unfortunately, numerous studies and meta-analyses found the program to be ineffective and some studies even found the program to increase alcohol and tobacco use (Ennett, Tobler, Ringwalt, & Flewelling, 1994; Lilienfeld & Arkowitz, 2014; West & O'Neal, 2004). This led to a reduction in federal funding to train D.A.R.E. officers, so in 2003, major changes were made to the curriculum, training models, and instructional methods (Singh et al., 2011). The new iteration of the D.A.R.E. curriculum included more interactive components to enhance decision-making skills. However, studies of this new iteration showed mixed results (Singh et al., 2011). In 2009, D.A.R.E. adopted the *keepin' it REAL* program (Refuse, Explain, Avoid, Leave; kiR) in partnership with Penn State University (D.A.R.E. America, 2016). Lessons continue to be given by uniformed police officers who receive over 80 hours of specialized training in the kiR/D.A.R.E. curriculum and instructional/classroom management skills. In partnership with teachers and schools, officers deliver ten lessons (45-60 minutes per lesson) over ten weeks to students in the classroom setting. kiR/D.A.R.E. lessons include interactive class discussions and group activities with many opportunities for students to practice strategies (e.g., role plays, cooperative activities; D.A.R.E. America, 2016). Though kiR has been recognized as an evidence-based program, evidence of efficacy and/or effectiveness of this program integrated with the D.A.R.E. framework has not yet been reported. New D.A.R.E. sites are provided the program materials free of charge, after which sites incur a cost of \$1.29 per student workbook (D.A.R.E. America, 2016).

An examination of the D.A.R.E. program's structure provides insight into why the program has been found to be ineffective across iterations. The most effective substance abuse prevention programs span multiple years to help reinforce skills; D.A.R.E. typically lasts only a

few months (Lilienfeld & Arkowitz, 2014). Furthermore, the program does not have a social-skill-building component and has utilized scare tactics to deter students from using substances. The D.A.R.E. program also does not utilize social norm education effectively; the best programs try to change students' normative perceptions so that they realize that drug use is not as common as they may think, while D.A.R.E. does the complete opposite (Lilienfeld & Arkowitz, 2014). Because studies have not evaluated the most recent changes to the D.A.R.E. curriculum, D.A.R.E. is not an evidence-based choice for school-based substance abuse prevention, despite the program's continued popularity.

Project Northland. Project Northland is a multilevel and multi-year intervention program designed to delay the age of onset for alcohol use, reduce alcohol use among youth who have already tried alcohol, limit use of other drugs, and reduce alcohol-related problems (Perry, n.d.). The program itself utilizes a variety of school and community-based components, including grade-specific tasks and exercises, parent involvement/education programming, behavioral curricula, peer participation, and community task force activities (Perry, et al., 1996; Perry, n.d.). While the program is subdivided into grade-specific activities, like LST, it may also be implemented by schools and/or community programs. Each lesson includes learner outcomes, a lesson summary, necessary materials checklist, background information, and scripted questions for facilitators to use while teaching (Perry, n.d.). The cost of the curriculum per classroom is \$625; this cost includes the full curriculum collection and a user's guide.

The Project Northland curriculum includes programs for grades 6-8 and is designed to be implemented on a weekly basis. The universal 6th-grade curriculum, called *Slick Tracy*, includes multiple key components, spread across at least six weeks. Peer leaders are elected by the students, who are trained to encourage appropriate student participation and lead small-group

activities with their peers. Another key component is the “Home Team Program,” which includes four classroom sessions that aim to start family-based discourse about alcohol-related issues and four weekly homework activity booklets. The *Slick Tracy* Poster Fair is the culminating activity which allows students the opportunity to present alcohol-related research projects to their school and community (Perry, n.d.). The eight-session 7th-grade curriculum, called *Amazing Alternatives*, focuses on reducing the social acceptability of alcohol use, alcohol resistance training, and encourages alcohol-free alternatives. The structure of this curriculum is similar to *Slick Tracy*, but it also includes weekly audio recordings that feature the story of four 7th-grade students and their ongoing challenges, while eliminating the poster fair. The 8th-grade curriculum, called *Powerlines*, aims to empower eighth graders to be productive emerging adults in their communities. Through eight classroom sessions, students learn about the range of professional and political powers that influence youth alcohol choices. This level includes shared peer leadership, an audio drama, community projects, and take-home materials.

The components of Project Northland have a strong basis in evidence-based practices. Project Northland utilizes a combination of alcohol education and norm reduction (Botvin & Griffin, 2014; Epstein, Botvin, & Diaz, 1999; Trudeau et al., 2003). Unlike LST, Project Northland also adds family- and community-based components. These components aim to increase parental involvement, which is a well-established protective factor against substance use (Harrop & Catalano, 2016).

The effects from rigorous studies are promising. Students participating in the program showed a 30% reduction in weekly drinking, 20% reduction in monthly drinking, and a reduced onset of alcohol use than control districts (Perry et al., 1996; Perry, n.d.). Further, an urban adaptation of the *Slick Tracy* curriculum was also found to lower normative expectations (i.e.,

that everyone uses drugs) and increased awareness of the consequences of alcohol use (Komro, et al., 2006). Several other programs target substance use. See Table 3 for a review of LST, Project Northland, D.A.R.E., and other programs. LST targets substance abuse more broadly than Project Northland's focus on alcohol using a combination of approaches that go beyond the scope of traditional D.A.R.E.

Table 3

Overview of Program Components and Outcomes for Universal School-based Programs Targeting Substance Use Among Sixth-Grade Students

Program	Delivery site (audience)	Targeted substances	Program components	Theorized outcomes	NREPP rating (SAMHSA, 2017)	Cost benefits (Blueprints, 2017)
LifeSkills Training (Botvin, n.d.)	School-based (K-12 students)	All Licit and Illicit Substances and Polydrug Use	Drug resistance, social training, self-management	Reduced substance use, risky behavior, and violence	Effective	\$1,607
D.A.R.E./kiR (D.A.R.E. America, 2016)	School-based (5-12 students)	Alcohol, Tobacco, Cannabis	Drug resistance, relationship skills, problem-solving, normative knowledge	Reduced substance use, increased knowledge, attitudes, and beliefs about substance use	Mixed; Promising and Ineffective outcomes (kiR); Unavailable for D.A.R.E.	-
Project Northland (Perry, n.d.)	School-based (6-12 students, parents, and community)	Alcohol	Normative knowledge	Delay age-of-onset for alcohol, reduce alcohol use, limit alcohol-related problems	Inconclusive	\$696
Project ALERT (Ellickson, 2017)	School-based (7-8 students)	Alcohol, Tobacco, Cannabis, Inhalants	Drug resistance, normative knowledge	Reduced substance use, increased knowledge, attitudes and beliefs about substance use	Promising (most outcomes)	N/A ^b
Project STAR ^a (Child Trends, 2010)	Community-based (6-7 students, parents, and community)	Alcohol, Tobacco, Marijuana	Skills training, parent education, media campaigning, health policy promotion	Reduce substance use	Unavailable	-
Lions-Quest Skills (SFA; Little, 2015)	School-based (K-12 students)	Alcohol, Tobacco, Illicit Drugs	Positive behavior support, character education, service learning, discouragement of drug use	Reduce substance use and violence	Promising for Disruptive behavior	-

^aProject STAR is not commercially available. ^bProject ALERT is a free program.

Chapter 3

Method

Participants

Participants were drawn from a large pool of participants participating in a statewide adolescent substance use surveillance program. Schools implementing the LST program with 6th-grade students were selected for inclusion in this study because in 6th grade, the LST program is administered alone without other commonly linked interventions. Although prior studies have evaluated a program that combined LST with the *Strengthening Families Program: For Parents and Youth 10-14* (SFP 10-14), school communities implementing both programs concurrently were not included in this study due to the likely confounds (Spoth et al., 2014). This contingency eliminated twelve schools from study participation.

The final treatment sample included 13 schools, nested in four districts. With regards to locale, 77% ($n = 10$) were considered suburban schools, and the remaining 23% ($n = 3$) were considered rural schools. The average 6th-grade enrollment of each school was approximately 81 students ($SD = 26.3$) with a range of 40 to 122 students.

With regard to student demographics, approximately 88.9% were Caucasian. Gender distributions were roughly balanced across schools with 52.1% females and 47.9% males in the treatment schools. Socioeconomic status was variable among schools included in the sample. On average, approximately 15.7% of students ($SD = .18$) across schools qualified for free or reduced-price lunch; however, this number ranged from 2% to 52% across the selected sample of schools. Description of the full participant sample, including control students, is continued in the study results section as a result of the propensity score matching procedure.

Measures

The Pennsylvania Youth Survey (PAYS). The PAYS has been administered to students in 6th, 8th, 10th, and 12th grades in the fall every two years since 2001 (Pennsylvania Commission on Crime and Delinquency; PCCD, 2016). Based on the *Communities That Care Youth Survey* (CTCYS; Glaser, Horn, Arthur, Hawkins, & Catalano, 2005), findings from the PAYS are meant to give educational stakeholders a deeper understanding of current school climate and community patterns of substance use and engagement in risky behavior, along with illustrating the risk and protective factors present in the community.

For this study, the 2011 version of this survey, originally administered to over 150,000 public school students, was used (PCCD, 2011). This survey, included a total of 113 questions, many of which had multiple parts. Questions include demographic questions and those that address topics such as substance abuse (tobacco, alcohol, prescriptions, illicit, and other substances) and other risky behaviors. Answer choices varied between questions, but all utilized categorical ratings that were either more Likert-style items that allowed raters to record varying levels of agreement with different statements or represented different numerical ranges to capture students' frequency of engaging in a variety of risky behaviors or presence of other risk and protective factors.

The PAYS measures ATOD use through a set of 36 questions. These questions are used to determine prevalence of substance use both within the last 30 days (a measure of current use) and over the lifespan (a measure of experimentation). For the purposes of this study, past 30-day use of cigarettes, marijuana, inhalants, and prescription pain relievers was examined. Given the public health concerns associated with binge drinking, this was also examined. Similarly, lifetime use of cigarettes was included due to the documented importance of pure prevention for

cigarettes specifically (Das et al., 2016). Though other substances are also important to examine, these five were selected due to their overall popularity in the LST evaluation literature, adolescent substance use literature and current concerns about the dangers of prescription opioid use (Botvin & Kantor, 2003; CDC, 2016a; Spoth et al., 2014). Furthermore, Gorman (2011) raised concerns regarding the previously reported effects on marijuana use, so this study examined these concerns.

Given the selection of 6th-grade students for this study, it was anticipated that the data would show low rates of substance use, given national statistics that show low base rates of ATOD use in this age group. Previous work has examined LST effects in low incidence populations and still found significant program effects (Botvin et al., 2003). Thus, base rates of substance use within the study sample were examined and compared to national statistics and those used in Botvin et al. (2003) to determine plausibility of the analyses. Based on an analysis of base rates, lifetime use of all study drugs (i.e., cigarettes, alcohol, marijuana, inhalants, and prescription drugs) and endorsed willingness to use alcohol, marijuana, and inhalants were also included to increase likelihood of detecting program effects. Each willingness item was a Likert-style item through which students endorsed how willing they would be to use each drug as *I would never use it, I probably would not use it, Not sure if I would use it, I would like to try or use it, or I would use it any chance I got*. Numerical anchors ranged from 0 through 4, respectively.

Specific items on PAYS have been combined into many risk and protective factor scales (PCCD, 2011). The scales, based on structure of the CTCYS represent risk and protective factors in the Community, School, Family, and Individual/Peer domains (Glaser et al., 2005; PCCD, 2011). Confirmatory factor analyses (CFA) of CTCYS subscales supported good model

fit for each domain and the related subscales. CFA analyses did not include the following subscales: Religiosity, Friends' Delinquent Behavior, Family Attachment (i.e., tested attachment to mother and father separately), and Community Opportunities for Prosocial Involvement.

Within the Community domain are the following subscales: (a) Community Opportunities for Prosocial Involvement, six items; (b) Community Rewards for Prosocial Involvement, three items; (c) Low Neighborhood Attachment, three items; (d) Community Disorganization, five items; (e) Transitions and Mobility, four items; (f) Laws and Norms Favorable to Drug Use, three items; (g) Perceived Availability of Drugs, four items; and (h) Perceived Availability of Handguns, one item. The family domain includes the following subscales: (a) Family Attachment, four items; (b) Family Opportunities for Prosocial Involvement, three items; (c) Family Rewards for Prosocial Involvement, two items; (d) Poor Family Management, eight items; (e) Family Conflict, three items; (f) Family History of Antisocial Behavior, ten items; (g) Parental Attitudes Favorable toward ATOD Use, three items; and (h) Parental Attitudes Favorable toward Antisocial Behavior, three items. The school domain includes the following subscales: (a) School Opportunities for Prosocial Involvement, five items; (b) School Rewards for Prosocial Involvement, four items; (c) Poor Academic Performance, two items; and (d) Lack of Commitment to School, six items. The individual/peer domain includes: (a) Religiosity, one item; (b) Belief in the Moral Order, four items; (c) Rebelliousness, three items; (d) Friends' Delinquent Behavior, six items; (e) Friends' Use of Drugs, four items; (f) Peer Rewards for Antisocial Behavior, four items; (g) Favorable Attitudes toward Antisocial Behavior, five items; (h) Favorable Attitudes toward ATOD Use, four items; (i) Low Perceived Risks of Drug Use, four items; (j) Early Initiation of Drug Use, four items; and (k) Sensation Seeking; three items.

For this study, scales were selected based on their relevance to the LST program theory. The LST program aims to reduce the following risk factors: (a) low perceived risks of drug use, (b) early initiation of drug use, (c) friends' delinquent behavior and drug use, (d) favorable attitudes and peer rewards for antisocial behavior, (e) favorable attitudes toward substance use, (f) rebelliousness, and (g) sensation seeking (EPISCenter, 2013). The LST program aims to bolster the following protective factors: (a) social skills, and (b) interaction with prosocial peers. Thus, from the list of available scales, the following scales, all from the individual/peer domain, were utilized in this study: (a) Rebelliousness, (b) Friends' Delinquent Behavior, (c) Friends' Use of Drugs, (d) Peer Rewards for Antisocial Behavior, (e) Favorable Attitudes Toward Antisocial Behavior, (f) Favorable Attitudes Toward ATOD Use, (g) Low Perceived Risks of Drug Use, (h) Early Initiation of Drug Use, and (i) Sensation Seeking (PCCD, 2011).

Internal consistency estimates of reliability are reported for the following scales. Estimates were calculated using item responses from students in the studied population. Per guidance from George and Mallery (2003), the following thresholds are used to interpret the Cronbach's alpha coefficients: $\geq .9$ is excellent, $\geq .8$ is good, $\geq .7$ is acceptable, $\geq .6$ is questionable, $\geq .5$ is poor, and $\leq .5$ is unacceptable.

Rebelliousness. The Rebelliousness subscale of the PAYS, comprised of three items, assesses feelings of disconnectedness from society, lack of regard for rules, and lack of commitment to success and responsibility. An example of an item from this subscale is: *I ignore rules that get in my way.* Students rate their agreement with these items as either *Very false*, *Somewhat false*, *Somewhat true*, or *Very true* (Glaser et al., 2005; PCCD, 2011). Scale reliability was $\alpha = .77$, which was considered acceptable.

Peer Rewards for Antisocial Behavior. Using four items, this subscale assesses social norms about delinquency, such as whether students experience any positive feedback from their peers for engaging in antisocial behaviors. An example of an item from this subscale is: *What are the chances you would be seen as cool if you smoked cigarettes?* Students rate their agreement using the following responses: *No or very little chance, Little chance, Some chance, Pretty good chance, or Very good chance* (Glaser et al., 2005; PCCD, 2011). Scale reliability was acceptable, $\alpha = .72$.

Favorable Attitudes Toward Antisocial Behavior. In adolescence, attitudes towards antisocial behavior often shift toward greater acceptability, which is a risk factor for engaging in such behaviors. This subscale measures these student attitudes using five items such as: *How wrong do you think it is for someone your age to take a handgun to school?* Students answer using the following Likert-style responses: *Not at all wrong, A little bit wrong, Wrong, or Very wrong* (Glaser et al., 2005; PCCD, 2011). The scale had good internal consistency, $\alpha = .81$.

Favorable Attitudes Toward ATOD Use. Similar to favorable attitudes toward antisocial behavior, the Favorable Attitudes Toward ATOD Use scale measures individual student's beliefs about the acceptability of ATOD use. Students answer four items such as: *How wrong do you think it is for someone your age to smoke marijuana?* They answer using the following responses: *Not at all wrong, A little bit wrong, Wrong, or Very wrong* (Glaser et al., 2005; PCCD, 2011). Scale reliability fell within the excellent range, $\alpha = .90$.

Low Perceived Risks of Drug Use. If a student believes that a drug is harmful, he/she is less likely to use the drug. Conversely, if a student deems a drug to be safe, he/she is more likely to use the drug. This subscale measures students' perceived risks of experimental and regular drug use through four items such as: *How much do you think people risk harming themselves*

(*physically or in other ways*) if they: *try marijuana once or twice?* Answer choices for these items include: *No risk, Slight risk, Moderate risk, or Great risk* (Glaser et al., 2005; PCCD, 2011). Reliability of this scale was good, $\alpha = .84$.

Early Initiation of Drug Use. Using drugs early in life puts students at greater risk of developing numerous negative long-term outcomes. This scale is comprised of four items including: *How old were you when you first: smoked marijuana?* Response options include: *Never have, 10 or younger, 11, 12, 13, 14, 15, 16, or 17 or older* (Glaser et al., 2005; PCCD, 2011). The internal consistency estimate of reliability for this scale was unacceptable, $\alpha = .42$. Results of analyses using this scale were interpreted with extreme caution.

Sensation Seeking. The Sensation Seeking subscale is designed to measure student characteristics such as impulse control, avoidance of harm, and risk-taking. Using three items such as: *How many times have you done the following things? Done what feels good no matter what,* the PAYS measures sensation seeking behaviors. Students respond using the following options: *Never; I've done it, but not in the past year; Less than once a month; About once a month; 2 or 3 times a month; or Once a week or more* (Glaser et al., 2005; PCCD, 2011). The scale demonstrated questionable internal consistency, $\alpha = .61$.

In addition to the above Likert scales which measure student beliefs and attitudes, students are also asked to report the frequency of exposure to events (e.g., peer arrest and drug use). These ratings are used to characterize the level of risk in students' immediate social environment. The following two scales represent student-reported incident counts.

Friends' Delinquent Behavior. This subscale of the PAYS, comprised of six items, requires students to report the delinquent behavior of their friends. Youths whose friends engage in delinquent behavior are more likely to also engage in delinquent behavior. An example of an

item from this subscale is: *Think of your four best friends (the friends you feel closest to). In the past year (12 months), how many of your best friends have been arrested?* Students respond by selecting a count between 0 (*None*) and 4 (Glaser et al., 2005; PCCD, 2011).

Friends' Use of Drugs. Similar to associating with friends who engage in delinquent behavior, associating with friends who use drugs is a predictor for individual drug use. Using four items, this subscale measures friends' use of drugs using items such as: *Think of your four best friends (the friends you feel closest to). In the past year (12 months), how many of your friends have used marijuana?* Students respond by selecting a count between 0 (*None*) and 4 (Glaser et al., 2005; PCCD, 2011).

Only risk factors are examined, as the PAYS does not provide any subscales that are directly related to the protective factors targeted by LST. Aside from these outcomes being important to the LST theory of change, Vicary and colleagues (2006) found inconsistent intervention effects between gender on attitudes and normative beliefs; thus, the inclusion of these scales should provide additional insight regarding their concerns.

The 2011 PAYS report suggested multiple steps to ensure student survey validity, some of which were utilized in the current study (PCCD, 2011). First, students who endorse use of a fake drug, derbisol, were eliminated from analysis. Second, inconsistent reporting of drug use will eliminate student surveys from the study. An example of inconsistent responding would be the scenario in which a student who reports daily use of cigarettes but also reports never using tobacco in his/her lifetime. If students were inconsistent across one of the following drugs: alcohol, cigarettes, prescription drugs, or marijuana, their responses were eliminated from the study.

Design and Data Analyses

Matching. The current study utilized a quasi-experimental, multi-level design using propensity score matching. Propensity score matching is a procedure that utilizes regression to model the propensity of being included in a treatment sample based on a number of factors (e.g., gender, race, SES, locale), allowing for causal inferencing using nonexperimental data. (Austin, 2011). Through this, matched sets were created at the school-level, which is the unit of randomization due to the universal delivery of LST. Specifically, this procedure matched schools implementing the treatment (LST) with schools not utilizing the treatment who are otherwise similar with regard to other potential covariates through a process known as within-caliper matching. Matched sets will be created considering schools that are most similar to treatment schools in gender distribution, socioeconomic status (i.e., percentage of low income students in the school as reflected in the percentage of youth receiving free or reduced-price lunch), locality (e.g., urban, suburban, or rural), aggregated community risk factor scale scores for the school (e.g., perceived availability of drugs), aggregated family risk factor scale scores for the school (e.g., poor family management, parental attitudes favorable to ATOD use), and aggregated school-based risk factor scale scores for the school (e.g., poor academic performance). This method of matching was selected based on the results of a power analysis using the Optimal Design program (Raudenbush et al., 2011). Given that the previously observed effect sizes for LST are small (around .1), a large control group is needed to increase the likelihood of detecting program effects.

Covariates. Once the best matched sample was created, treatment effects were estimated by comparing students in the intervention schools to students in control schools on the hypothesized outcome variables using two-level hierarchical modeling. The following covariates

(i.e., predictors) will be included in the analyses based on those used in the existing LST literature: gender, race, and SES (i.e., percentage of youth receiving free or reduced-price lunch). Both linear and non-linear models were analyzed.

Analyses. All analyses were conducted using SPSS (Version 23.0) and MPlus (Version 8). Testing of hypotheses (1) and (2), or the hypotheses addressing treatment effects on ATOD use and individual and peer risk factors, relied on the propensity score matching procedures that were described previously using SPSS and hierarchical modeling procedures in MPlus. Analyses for hypotheses (3) and (4) involving gender as a moderator for treatment effects were conducted using the PROCESS extension in SPSS.

Chapter 4

Results

Preliminary Considerations

Assumptions. Testing for assumptions of linearity, normal distribution, multicollinearity, and homoscedasticity were conducted in SPSS. All assumptions were reasonably met given the nature of the covariates and outcome variables. Outcomes related to ATOD use resulted in non-linear models; thus, the dispersion of counts was tested in MPlus to select the most appropriate non-linear model (e.g., poisson, binomial, negative binomial, or zero inflated). Risk factor scales follow a linear relationship and were grand-mean centered. Grand-mean centering was selected for the risk/protective factor outcome variables because it helps contextualize risk/protective factors within the district. It was less helpful to use group means (school-based) since the program is implemented universally.

Missing data. Since this study relied on a large dataset, missing data was inevitable. Missing-at-random data may be handled through imputation, deletion of incomplete student data, or maximum likelihood methods. Imputation replaces data that is missing using predefined parameters. Multiple imputation is a procedure that pools multiple imputed datasets into one resulting dataset. When considering deletion, listwise deletion of students missing any pieces of the required information, aside from demographic information, was not appropriate. Instead, students were only included in the analysis involving each of the specific substances or risk factor scales if they demonstrate complete information for that given analysis (i.e., pairwise deletion). On the other hand, full information maximum likelihood methods do not impute missing values, but instead use all available data to estimate a likelihood function and contribute to model estimation. This procedure often produces similar outcomes to those obtained through

multiple imputation. Because of its efficiency and minimal decision points when compared to multiple imputation, Full Information Maximum Likelihood (FIML) was conducted using MPlus to handle missing data. Participants with missing data on predictor variables were automatically excluded from analyses.

Matching Results

Using the FUZZY procedure in SPSS, a 0.3 match tolerance, and the covariates outlined in Chapter 3, 13 treatment schools were matched to 10 control schools. It was found that percent free and reduced-price lunch significantly predicted propensity for treatment ($\beta = -13.575, p < .001$), which meant that schools with lower percentages of youth who receive free or reduced-price lunch showed increased likelihood of receiving treatment. All other predictors (e.g., community risk factors, school risk factors, community poverty, locale) were not significant predictors of propensity for receiving treatment and were relatively balanced across treatment and control schools. Three treatment schools were not assigned a control match due to a lack of unique non-treatment schools that were similar to those schools, as the closest match for each of these schools was already included in the control sample. Demographic information for the final study sample are included in Table 4.

Table 4

Demographics of Treatment and Control Schools

Demographic variable	Treatment (<i>n</i> = 13)	Control (<i>n</i> = 10)	Total sample (<i>n</i> =23)
Community demographics			
Locality			
Urban	0 (0%)	1 (10%)	1
Suburban	10 (77%)	4 (40%)	14
Rural	3 (23%)	5 (50%)	8
Percent income below poverty	6.1%	13.2%	8.4%
School demographics			
Percent free and reduce price lunch	15.7%	34.3%	21.6%
Student demographics			
Total students	1,052 (68%)	494 (32%)	1,546
Race/ethnicity			
White	935 (89%)	437 (88.5%)	1,372
Other	117 (11%)	57 (11.5%)	174
Sex			
Female	542 (52%)	238 (51%)	780
Male	498 (48%)	225 (49%)	723
Age			
10	5 (0.5%)	2 (0.4%)	7
11	740 (70.3%)	318 (65.4%)	1,058
12	304 (28.9%)	158 (32.5%)	462
13	2 (0.2%)	8 (1.6%)	10

Outcome descriptive statistics. Descriptive statistics comparing the treatment and control groups on study outcome variables are presented in Table 5 (ATOD outcomes) and Table 6 (risk factor outcomes). Comparison of means and odds demonstrated between-group balance between variables such as 30-day cigarette use, lifetime alcohol use, and favorable attitude variables. Control schools demonstrated notably higher rates of lifetime cigarette use, and lifetime inhalant use. On risk/protective factor scales, control schools also showed higher scores on Low Perceived Risks of Drug Use, Early Initiation of Drug Use, and Friends' Delinquent

Behavior. Treatment groups demonstrated notably higher rates of Willingness to use Marijuana and Willingness to use Alcohol.

Table 5

Descriptive Statistics of Treatment and Control Students on ATOD Outcomes

Variable name	Treatment		Control		Total sample	
	<i>N</i>	Percent endorsed	<i>N</i>	Percent endorsed	<i>N</i>	Percent endorsed
30 Day Cigarette Use	1044	0.6	464	0.6	1508	0.6
Lifetime Cigarette Use	1048	3.6	480	9.4	1528	5.4
30 Day Marijuana Use	1042	0.0	460	1.1	1502	0.3
Lifetime Marijuana Use	1045	0.5	485	1.6	1530	0.8
30 Day Prescription Drug Use	1036	1.8	477	1.0	1513	1.6
Lifetime Prescription Drug Use	1038	2.6	475	1.9	1513	2.4
Five or More Drinks in Last 2 Weeks	1047	1.3	480	1.6	1527	1.3
30 Day Alcohol Use	1043	5.6	457	5.0	1500	5.4
Lifetime Alcohol Use	1041	19.2	486	19.1	1527	19.2
30 Day Inhalant Use	1049	4.9	493	5.7	1542	5.1
Lifetime Inhalant Use	1042	7.6	484	9.5	1526	8.2

Table 6

Descriptive Statistics of Treatment and Control Students on Risk Factor and Willingness Outcomes

Variable Name	Treatment			Control			Total Sample		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
Low Perceived Risks of Drug Use	1043	0.59	0.65	459	0.84	0.87	1502	0.66	0.73
Early Initiation of Drug Use	1044	0.43	0.96	463	0.63	1.30	1507	0.49	1.08
Sensation Seeking	1035	0.69	0.96	480	0.82	1.09	1515	0.73	1.01
Rebelliousness	1035	0.35	0.54	462	0.40	0.63	1497	0.37	0.57
Friends' Delinquent Behavior	1047	0.03	0.10	474	0.11	0.32	1521	0.05	0.20
Friends' Use of Drugs	1047	0.06	0.23	474	0.15	0.47	1521	0.09	0.32
Peer Rewards for Antisocial Behavior	1032	0.14	0.37	473	0.17	0.42	1505	0.15	0.38
Favorable Attitudes toward Antisocial Behavior	1049	0.29	0.45	471	0.32	0.45	1520	0.30	0.45
Favorable Attitudes toward ATOD Use	1051	0.12	0.42	468	0.13	0.37	1519	0.12	0.40
Willingness to Use Alcohol	1033	0.65	0.94	446	0.56	0.91	1479	0.62	0.93
Willingness to Use Marijuana	1036	0.07	0.39	448	0.08	0.47	1484	0.07	0.42
Willingness to Use Inhalants	1034	0.04	0.27	445	0.04	0.26	1479	0.04	0.27

Hierarchical Linear Model Results

All random-effects two-level multilevel models included age, race (i.e., White vs. non-White), and percent free/reduced priced lunch as covariates. Additionally, all models included 23 total clusters (i.e., 13 treatment schools and 10 control schools). Intraclass correlations between clusters in the majority of risk factor analyses were very low, ranging from .002 to .014, indicating that responses within clusters were minimally different from responses across clusters

(i.e., student responses were similar despite attending different schools). See Table 7 and Table 8 for full results.

ATOD outcomes. Only two models found significant effects of treatment on studied outcome variables. Significant treatment effects were found on lifetime prescription use, $\beta = 2.051$, $SE = 0.759$, $p = .007$. Treatment effects were not in the expected direction for this model; students in treatment demonstrated a log count increase of 2.051 in lifetime prescription use compared to control students. For 30-day cigarettes, the logit term predicting whether or not a student smoked in the last 30 days was significant, $\beta = -25.450$, $SE = 1.025$, $p < .001$. This demonstrates that participation in treatment reduced likelihood of smoking in the last 30 days. However, the overall count term predicting how much a student smoked in the last 30 days was not significant, $\beta = -3.741$, $SE = 61.537$, $p = .095$.

All other ATOD models did not demonstrate significant results of the LST program on drug use outcomes. Specifically, significant results were not detected for lifetime alcohol use, $\beta = 0.377$, $SE = 0.298$, $p = .207$, lifetime cigarette use, $\beta = -0.297$, $SE = 0.242$, $p = .219$, 30-day marijuana use, $\beta = -27.506$, $SE = 55.175$, $p = 0.618$, binge drinking, $\beta = 0.191$, $SE = 0.616$, $p = 0.756$, and lifetime inhalant use, $\beta = -0.121$, $SE = 0.272$, $p = 0.657$. In addition, significant treatment effects on 30-day alcohol use were not found on the overall frequency of use, $\beta = -0.480$, $SE = 0.621$, $p = .439$, or the associated logit term modeling initiation (i.e., whether the student drank during the last 30 days or not), $\beta = -0.825$, $SE = 0.703$, $p = .241$. Similar non-significant effects were found for 30-day inhalant use, $\beta = 0.783$, $SE = 0.461$, $p = 0.089$ and the associated logit term, $\beta = 0.693$, $SE = 0.551$, $p = 0.208$. In many of these models, the selected covariates, especially gender and percent free/reduced price lunch explained a significant portion of student-level variance.

Risk factor and scale outcomes. All risk factor and willingness scales were grand mean centered. Models examining treatment effects on Rebelliousness, $\beta = -0.022$, $SE = 0.061$, $p = .717$, Friends' Delinquent Behavior, $\beta = -0.035$, $SE = 0.022$, $p = .107$, Friends' Use of Drugs, $\beta = -0.036$, $SE = 0.028$, $p = .208$, Peer Rewards for Antisocial Behavior, $\beta = -0.025$, $SE = 0.028$, $p = .372$, Favorable Attitudes toward Antisocial Behavior, $\beta = -0.003$, $SE = 0.042$, $p = .950$, Low Perceived Risks of Drug Use, $\beta = -0.093$, $SE = 0.373$, $p = .804$, Sensation Seeking, $\beta = -0.160$, $SE = 0.105$, $p = .128$, Early Initiation of Drug Use, $\beta = -0.006$, $SE = 0.205$, $p = .976$ were not significant. Further, no significant effects of treatment were found across Willingness to Use Alcohol, $\beta = 0.102$, $SE = 0.084$, $p = .227$, Willingness to Use Marijuana, $\beta = 0.01$, $SE = 0.057$, $p = .863$, and Willingness to Use Inhalants, $\beta = 0.003$, $SE = 0.012$, $p = .803$.

Table 7

Hierarchical Linear Model Results for ATOD Outcomes

Outcomes/Covariates	30 Day Cigarette ^b				Lifetime Cigarette ^a				30 Day Alcohol ^b				Binge Drinking ^a			
	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>p</i>	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>p</i>	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>p</i>	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>p</i>
LST Treatment	23	-3.741	61.537	.095	23	-0.297	0.242	.219	23	-0.48	0.621	.439	23	0.191	0.616	.756
LST Log Term	23	-25.45	1.025	<.001	-	-	-	-	23	-0.83	0.703	.241	-	-	-	-
Gender	1468	0.74	202.44	.997	1488	0.769	0.241	.001	1460	0.714	0.052	<.001	1488	2.019	0.863	.019
Race	1468	4.487	71.69	.95	1488	-0.036	0.539	.947	1460	-0.14	0.168	.403	1488	0.522	0.127	<.001
Age	1468	0.441	817.08	1.00	1488	0.432	0.353	.221	1460	0.021	0.022	.325	1488	0.707	0.346	.041
% Free/Reduced Lunch	1468	0.942	381.19	.998	1488	3.261	0.199	<.001	1460	0.905	0.093	<.001	1488	3.356	0.334	<.001
	Lifetime Alcohol ^a				30 Day Marijuana ^a				Lifetime Marijuana ^a				30 Day Prescription ^a			
	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>p</i>	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>p</i>	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>p</i>	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>P</i>
LST Treatment	23	0.377	0.298	.207	23	-27.51	55.18	.618	23	1.031	0.812	.204	23	1.096	0.583	.06
Gender	1484	0.599	0.236	.011	1462	0.124	46.39	.998	1487	1.513	0.396	<.001	1472	0.521	0.365	.154
Race	1484	0.254	0.346	.462	1462	-13.37	381.6	.972	1487	0.723	0.621	.245	1472	-0.03	0.679	.961
Age	1484	0.224	0.239	.348	1462	-6.187	32.16	.847	1487	0.689	0.443	.12	1472	0.262	0.008	<.001
% Free/Reduced Lunch	1484	1.351	0.192	<.001	1462	-25.31	19.95	.205	1487	6.834	0.488	<.001	1472	2.3	0.23	<.001
	Lifetime Prescription ^a				30 Day Inhalant ^b				Lifetime Inhalant ^a							
	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>p</i>	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>p</i>	<i>N</i>	<i>Est.</i>	<i>SE</i>	<i>p</i>				
LST Treatment	23	2.051	0.759	.007	23	0.783	0.461	.089	23	-0.12	.272	.657				
LST Log Term	-	-	-	-	23	0.693	0.551	.208	-	-	-	-				
Gender	1470	-1.98	6.219	.75	1499	0.504	0.301	.095	1484	0.477	.262	.069				
Race	1470	-0.321	1.322	.808	1499	0.002	0.162	.992	1484	0.02	.429	.962				
Age	1470	0.734	0.53	.166	1499	0.668	0.066	<.001	1484	0.352	.047	<.001				
% Free/Reduced Lunch	1470	1.319	2.152	0.54	1499	1.194	0.234	<.001	1484	0.286	.887	.747				

Note: Bolded values indicate $p < .05$; ^apoisson distribution; ^binflated poisson distribution.

Table 8

Hierarchical Linear Model Results for Risk Factor and Willingness Outcomes

Outcomes/Covariates	Rebelliousness				Friends' Delinquent Behavior				Friends' Use of Drugs				Peer Rewards for Antisocial			
	<i>N</i>	β	<i>SE</i>	<i>p</i>	<i>N</i>	β	<i>SE</i>	<i>p</i>	<i>N</i>	β	<i>SE</i>	<i>p</i>	<i>N</i>	β	<i>SE</i>	<i>p</i>
LST Treatment	23	-0.22	0.061	.717	23	-0.035	0.022	.107	23	-0.036	0.028	.208	23	-0.025	0.028	.372
Gender	1458	0.134	0.029	<.001	1482	0.039	0.009	<.001	1482	0.058	0.017	<.001	1469	0.091	0.02	<.001
Race	1458	-0.1	0.066	.128	1482	-0.015	0.013	.237	1482	-0.026	0.029	.363	1469	-0.035	0.039	.366
Age	1458	0.131	0.032	<.001	1482	0.023	0.006	<.001	1482	0.059	0.015	<.001	1469	0.024	0.026	.356
% Free/Reduced Lunch	1458	0.162	0.108	.134	1482	0.128	0.045	.004	1482	0.22	0.049	<.001	1469	0.107	0.076	.156
Residual Variances	1458	0.306	0.023	<.001	1482	0.036	0.017	.034	1482	0.099	0.033	.003	1469	0.142	0.017	<.001
	Favorable Atti. Antisocial				Favorable Atti. ATOD				Low Perceived Risks of Drugs				Sensation Seeking			
	<i>N</i>	β	<i>SE</i>	<i>p</i>	<i>N</i>	β	<i>SE</i>	<i>p</i>	<i>N</i>	β	<i>SE</i>	<i>p</i>	<i>N</i>	β	<i>SE</i>	<i>p</i>
LST Treatment	23	-0.003	0.042	.95	23	0.01	0.035	.774	23	-0.093	0.373	.804	23	-0.16	0.105	.128
Gender	1480	0.141	0.026	<.001	1479	0.071	0.024	.003	1462	0.055	0.06	.363	1474	0.336	0.063	<.001
Race	1480	-0.037	0.04	.352	1479	-0.02	0.025	.515	1462	-0.099	0.244	.686	1474	-0.087	0.106	.413
Age	1480	0.093	0.038	.013	1479	0.057	0.026	.029	1462	0.054	0.079	.496	1474	0.081	0.054	.134
% Free/Reduced Lunch	1480	0.081	0.098	.409	1479	0.135	0.04	.001	1462	0.836	0.524	.11	1474	-0.072	0.258	.78
Residual Variances	1480	0.182	0.019	<.001	1479	0.154	0.024	<.001	1462	0.478	0.07	<.001	1474	0.965	0.058	<.001
	Early Initiation Drug Use				Willingness Alcohol				Willingness Marijuana				Willingness Inhalants			
	<i>N</i>	β	<i>SE</i>	<i>p</i>	<i>N</i>	β	<i>SE</i>	<i>p</i>	<i>N</i>	β	<i>SE</i>	<i>p</i>	<i>N</i>	β	<i>SE</i>	<i>p</i>
LST Treatment	23	-0.006	0.205	.976	23	0.102	0.084	.227	23	0.01	0.057	.863	23	0.003	0.012	.803
Gender	1467	0.358	0.108	.001	1439	0.187	0.065	.004	1444	0.063	0.025	.012	1439	0.015	0.014	.285
Race	1467	0.026	0.097	.789	1439	-0.021	0.104	.836	1444	-0.023	0.037	.528	1439	-0.008	0.025	.736
Age	1467	0.128	0.065	.048	1439	0.129	0.047	.006	1444	0.06	0.03	.044	1439	0.011	0.017	.512
% Free/Reduced Lunch	1467	0.661	0.199	.001	1439	-0.008	0.174	.964	1444	0.108	0.085	.204	1439	0.069	0.035	.047
Residual Variances	1467	1.061	0.131	<.001	1439	0.844	0.038	<.001	1444	0.116	0.034	<.001	1439	0.069	0.015	<.001

Note: Bolded values indicate $p < .05$; Atti. = Attitude; All scales were grand-mean centered.

Moderation Results

The following sections address the moderation effects of gender on the various treatment outcomes examined through this study. See Table 9 and Table 10 for further details on all models.

Significant moderation effects. The moderation effect of gender on the relationship between LST treatment and ratings of Friends' Delinquent Behavior was found to be significant, $\beta = -0.057$, $t(1478) = -2.54$, $p = .011$. An examination of conditional effects of each gender on treatment outcomes demonstrates that while the moderation effect of gender is significant for both girls, $\beta = -0.063$, $t(1478) = -4.039$, $p = .0001$, and boys, $\beta = -0.119$, $t(1478) = -7.479$, $p < .001$, the moderation effect of boys on treatment outcomes was stronger, with treatment leading to a -0.199 reduction in rating of Friends' Delinquent Behavior in boys. See Figure 2 for model diagram and graphed interaction effects.

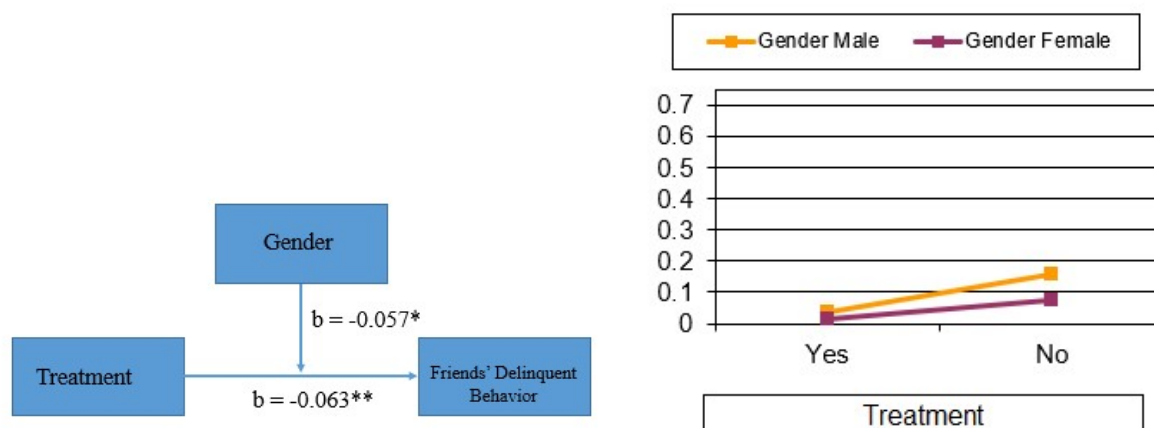


Figure 2. Gender moderation of treatment effects on Friends' Delinquent Behavior.

* $p < .05$, ** $p < .01$, *** $p < .001$.

The moderation effect of gender on the relationship between LST treatment and ratings of Friends' Use of Drugs was found to be significant, $\beta = -0.098$, $t(1478) = -2.67$, $p = .008$. An

examination of conditional effects of each gender on treatment demonstrates that while the moderation effect of gender is significant for both girls, $\beta = -0.050$, $t(1478) = -1.972$, $p = .049$, and boys, $\beta = -0.148$, $t(1478) = -5.652$, $p < 0.001$, the moderation effect of boys on treatment outcomes was stronger, with treatment leading to a -0.148 reduction in rating of Friends' Delinquent Behavior in boys. See Figure 3 for model diagram and graphed interaction effects.

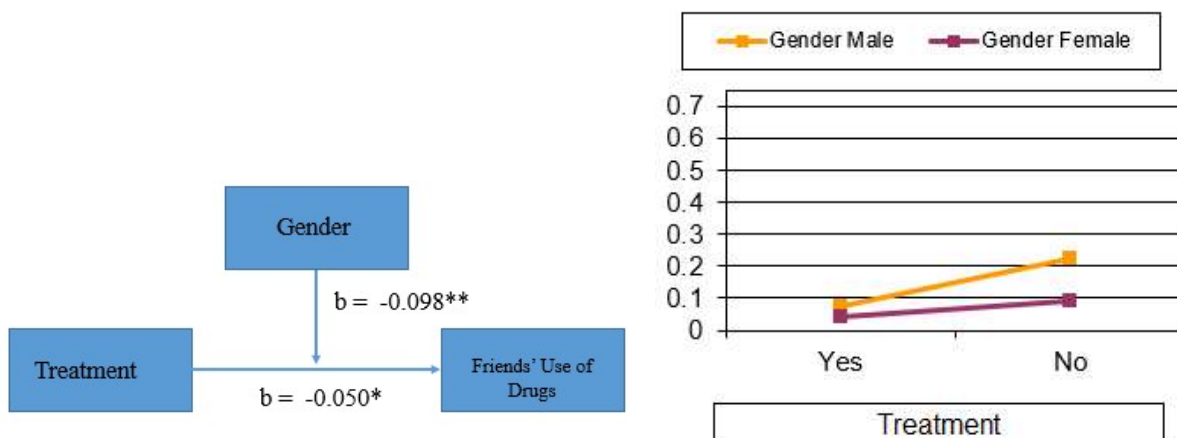


Figure 3. Gender moderation of treatment effects on Friends' Use of Drugs.

* $p < .05$, ** $p < .01$, *** $p < .001$.

A significant moderation effect of gender on the relationship between LST treatment and Early Initiation of Drug Use was also observed, $\beta = -0.420$, $t(1463) = -3.50$, $p < .001$. Conditional effects for boys were observed, $\beta = -0.444$, $t(1478) = -5.13$, $p < .001$. For boys, participation in LST treatment led to a -0.444 reduction in ratings of Early Initiation of Drug Use. See Figure 4 for model diagram and graphed interaction effects.

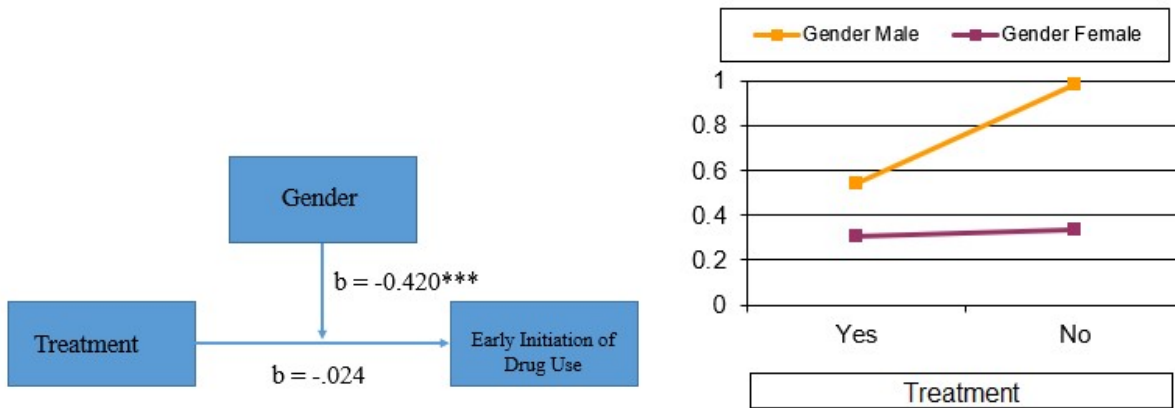


Figure 4. Gender moderation of treatment effects on Early Initiation of Drug Use.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Another significant moderation effect of gender on the relationship between treatment and lifetime cigarette use was observed, $\beta = -0.075$, $t(1484) = -2.012$, $p = .044$. An examination of conditional effects of each gender on treatment outcomes demonstrates that while the moderation effect of gender is significant for both girls, $\beta = -0.0545$, $t(1484) = -2.103$, $p = .036$, and boys, $\beta = -0.129$, $t(1484) = -4.844$, $p < .001$, the moderation effect of boys on treatment outcomes was stronger, with treatment leading to a -0.129 reduction in lifetime cigarette use in boys. See Figure 5 for model diagram and graphed interaction effects.

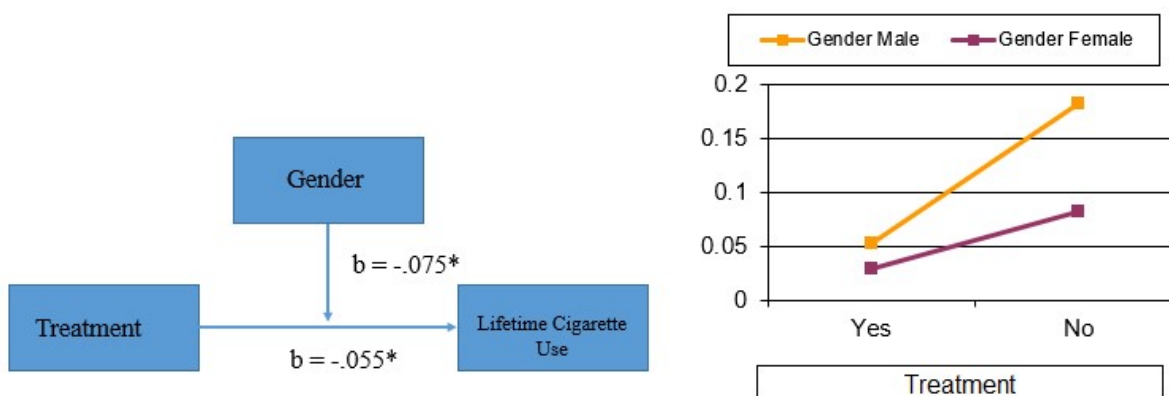


Figure 5. Gender moderation of treatment effects on Lifetime Cigarette Use.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Moderation effects were also significant for lifetime alcohol use, $\beta = -0.216$, $t(1480) = -2.369$, $p = .018$. Conditional effects were observed for boys such that treatment led to a -0.140 reduction in lifetime alcohol use ratings, $\beta = -0.140$, $t(1480) = -2.131$, $p = .033$. See Figure 6 for model diagram and graphed interaction effects.

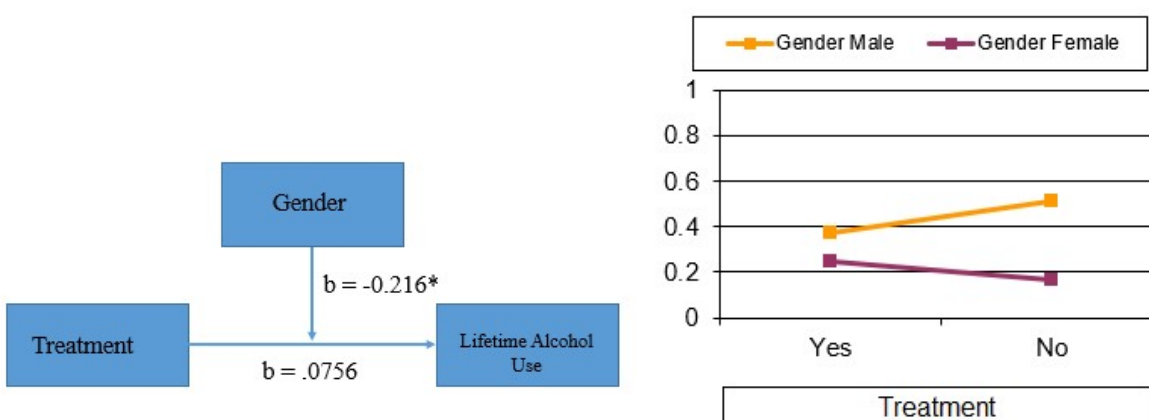


Figure 6. Gender moderation of treatment effects on Lifetime Alcohol Use.

* $p < .05$, ** $p < .01$, *** $p < .001$.

The moderation effect of gender on the relationship between LST and Willingness to Use Alcohol was significant, $\beta = -0.232$, $t(1435) = -2.152$, $p = .031$. Unlike the majority of moderation outcomes, conditional effects were only observed for girls in an unexpected direction, $\beta = .18$, $t(1480) = -2.414$, $p = .016$. For girls, participation in LST treatment to a .18 increase in ratings of Willingness to Use Alcohol. See Figure 7 for model diagram and graphed interaction effects.

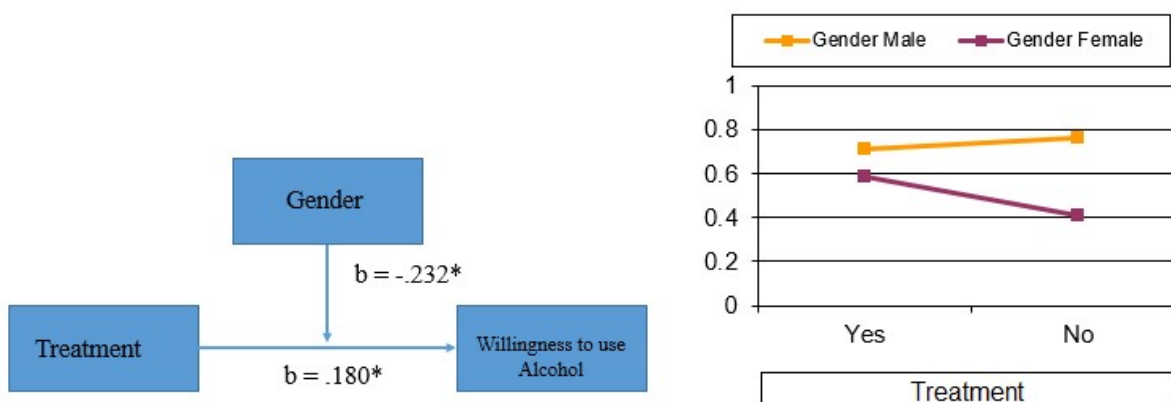


Figure 7. Gender moderation of treatment effects on Willingness to Use Alcohol.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Non-significant moderation effects. When examining moderation effects of gender on the relationship between treatment and ATOD-related outcomes, no evidence was found to support gender as a moderator of LST effects on 30-day prescription drug use, $\beta = -0.022$, $t(1468) = -1.002$, $p = 0.317$; 30-day cigarette use, $\beta = 0.017$, $t(1464) = 1.641$, $p = .101$; 30-day marijuana use, $\beta = -0.034$, $t(1458) = -1.726$, $p = .085$; 30-day alcohol use, $\beta = -0.036$, $t(1456) = -1.124$, $p = .261$; 30-day inhalant use, $\beta = -0.036$, $t(1495) = -0.906$, $p = 0.365$; lifetime marijuana use, $\beta = -0.026$, $t(1483) = -0.994$, $p = .320$; lifetime inhalant use, $\beta = -0.016$, $t(1480) = -0.291$, $p = .771$; lifetime prescription drug use, $\beta = -0.022$, $t(1466) = -0.296$, $p = .767$; and binge drinking, $\beta = 0.010$, $t(1484) = 0.387$, $p = .699$. In addition, no significant moderation effects were observed for Willingness to Use Marijuana, $\beta = .0208$, $t(1440) = 0.434$, $p = .665$, or Willingness to Use Inhalants, $\beta = -0.038$, $t(1435) = -1.232$, $p = .218$. See Figures 8 through 18 for model diagrams and treatment/control comparisons.

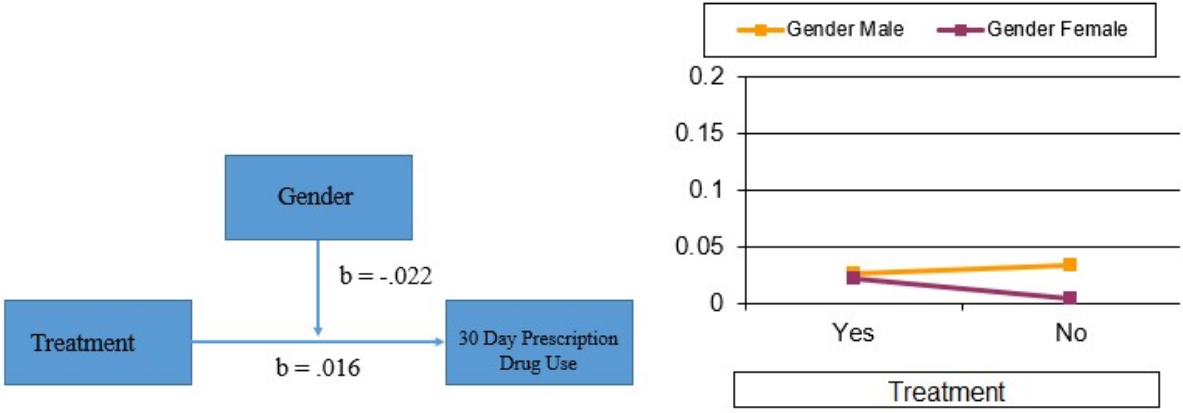


Figure 8. Gender moderation of treatment effects on 30 Day Prescription Drug Use. Note: Model was not significant.

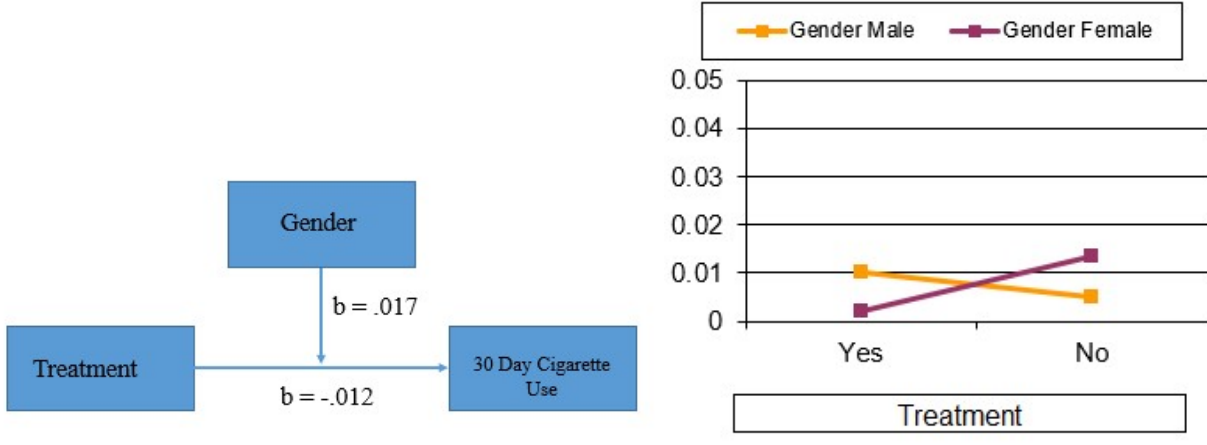


Figure 9. Gender moderation of treatment effects on 30 Day Cigarette Use. Note: Model was not significant.

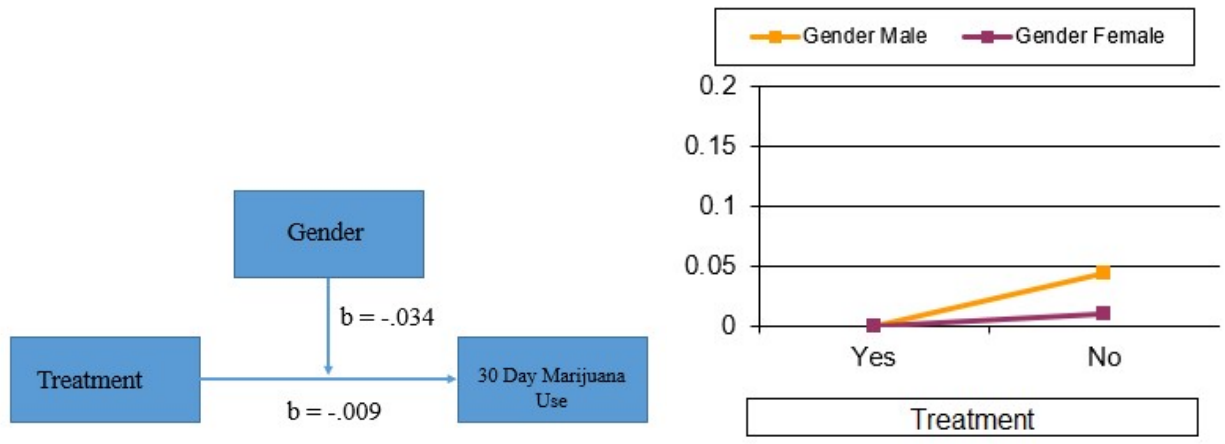


Figure 10. Gender moderation of treatment effects on 30 Day Marijuana Use. Note: Model was not significant.

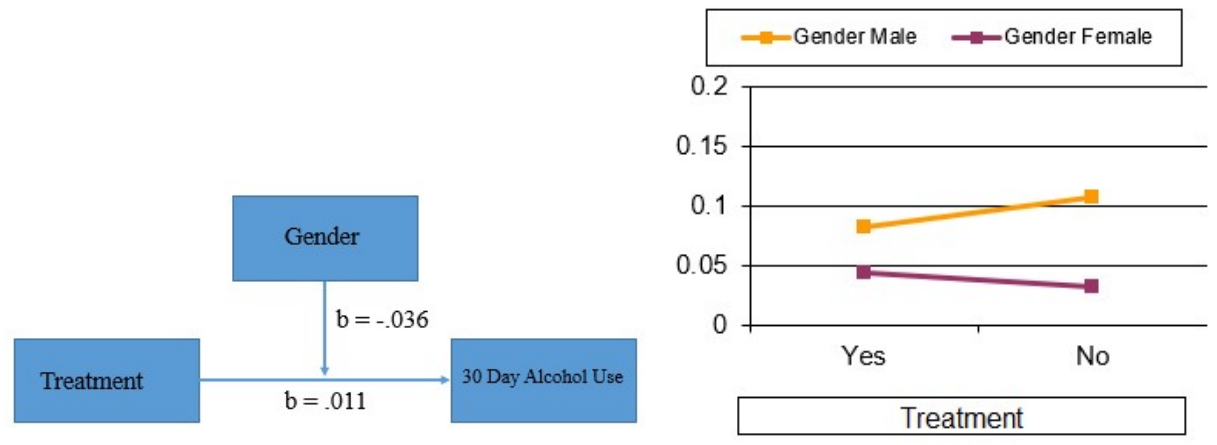


Figure 11. Gender moderation of treatment effects on 30 Day Alcohol Use. Note: Model was not significant.

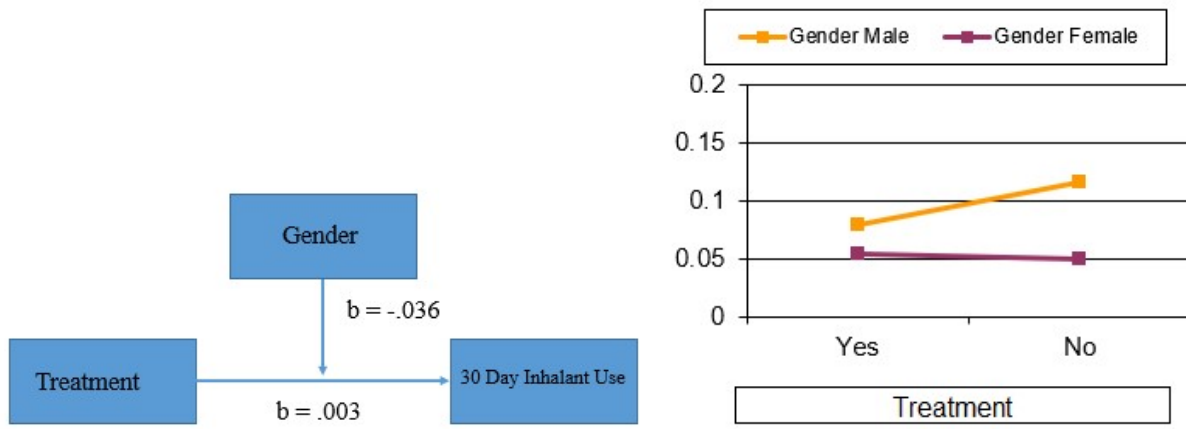


Figure 12. Gender moderation of treatment effects on 30 Day Inhalant Use. Note: Model was not significant.

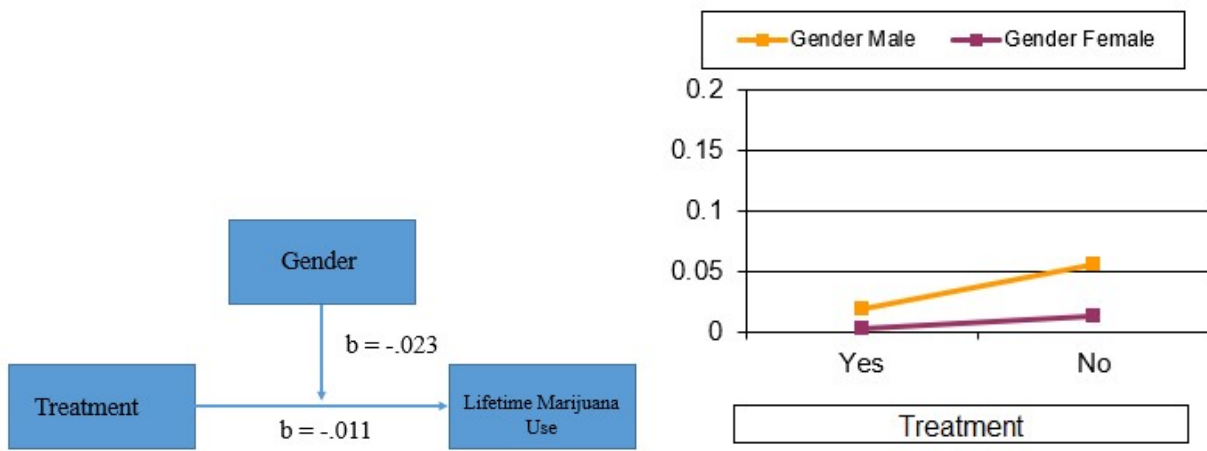


Figure 13. Gender moderation of treatment effects on Lifetime Marijuana Use. Note: Model was not significant.

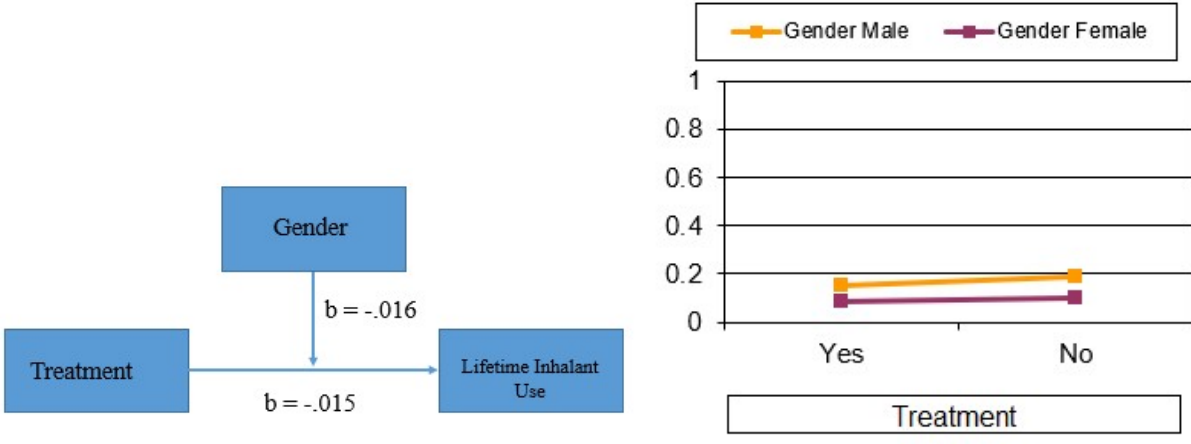


Figure 14. Gender moderation of treatment effects on Lifetime Inhalant Use. Note: Model was not significant.

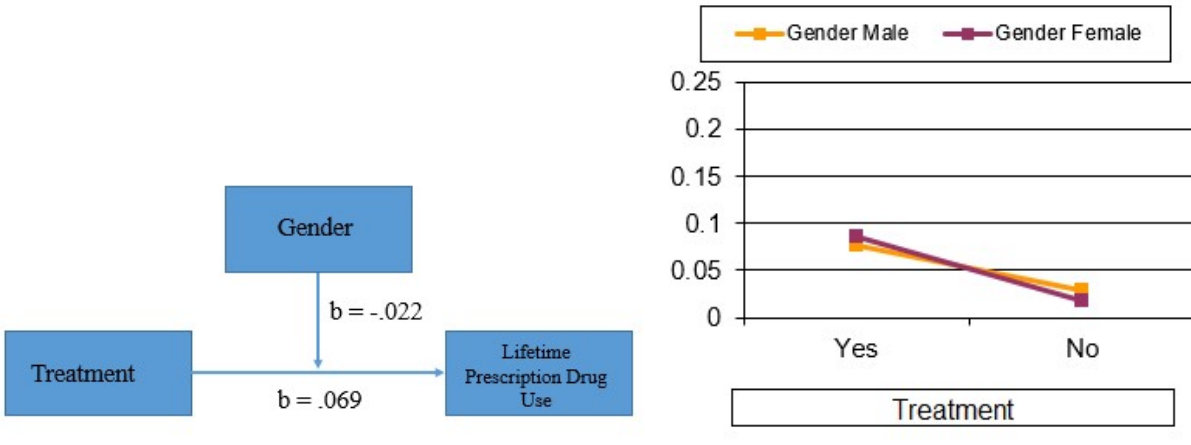


Figure 15. Gender moderation of treatment effects on Lifetime Prescription Drug Use. Note: Model was not significant.

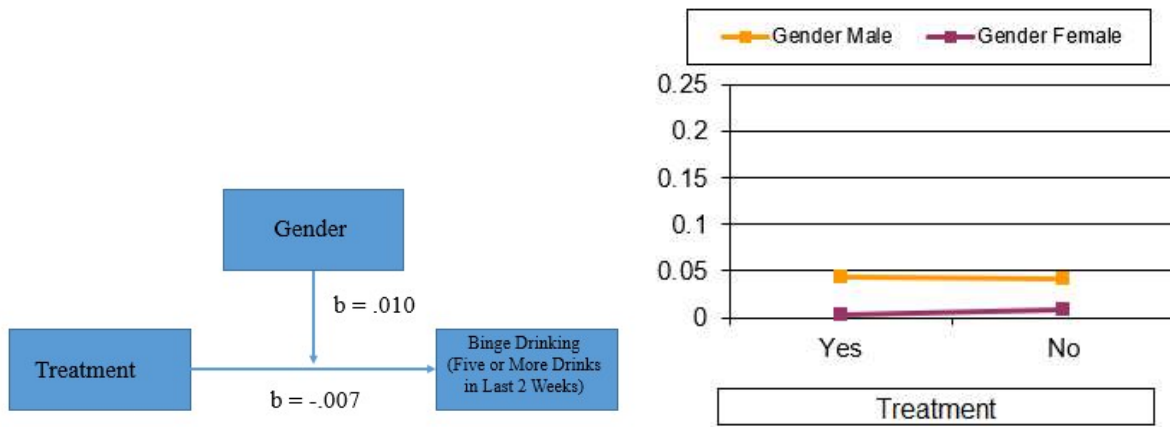


Figure 16. Gender moderation of treatment effects on Binge Drinking. *Note:* Model was not significant.

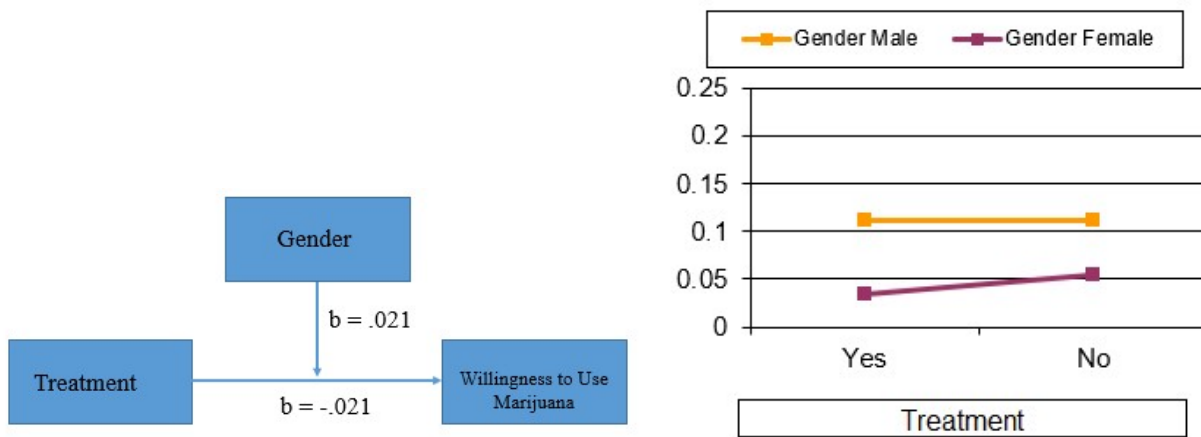


Figure 17. Gender moderation of treatment effects on Willingness to Use Marijuana. *Note:* Model was not significant.

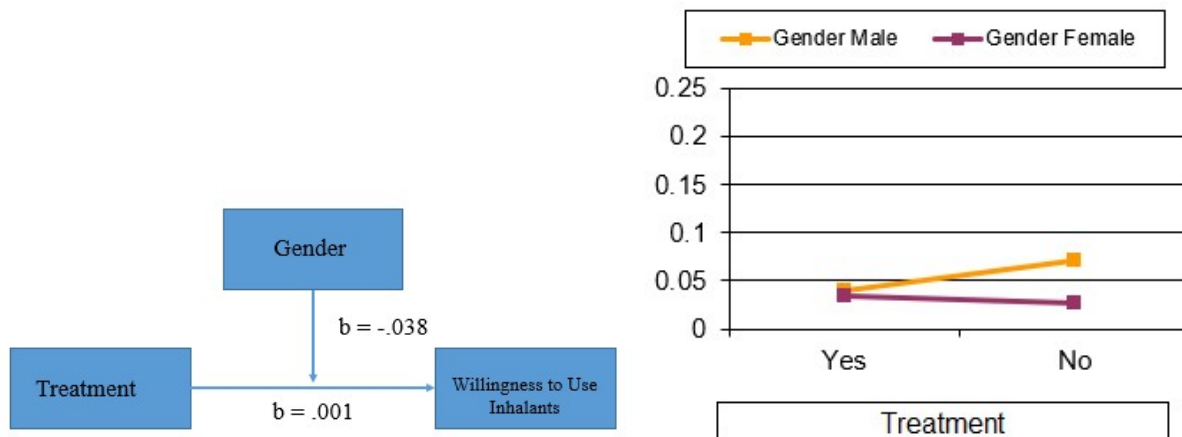


Figure 18. Gender moderation of treatment effects on Willingness to Use Inhalants. *Note:* Model was not significant.

For the risk/protective factor outcomes, no evidence was found in support of gender as a moderator of the relationship between LST treatment and Rebelliousness, $\beta = -0.036$, $t(1454) = -0.561$, $p = 0.575$; Peer Rewards for Antisocial Behavior, $\beta = -0.071$, $t(1465) = -1.64$, $p = .102$; Favorable Attitudes toward Antisocial Behavior, $\beta = -0.074$, $t(1476) = -1.48$, $p = .139$; Favorable Attitudes toward ATOD Use, $\beta = -0.007$, $t(1475) = -0.155$, $p = .877$; Low Perceived Risk of Drug Use, $\beta = 0.045$, $t(1458) = 0.548$, $p = .584$; and Sensation Seeking, $\beta = -0.147$, $t(1470) = -1.31$, $p = .190$. See Figures 19 through 24 for model diagrams and treatment/control comparisons.

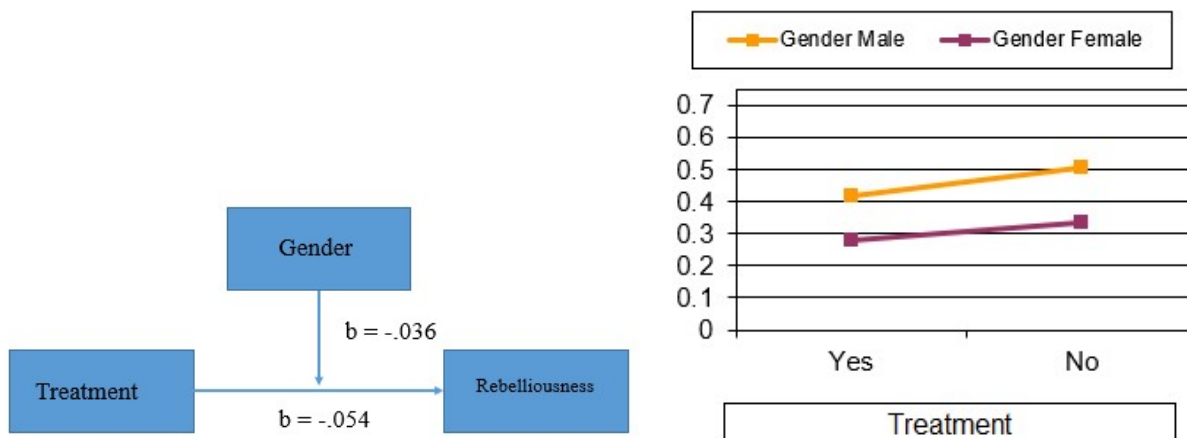


Figure 19. Gender moderation of treatment effects on Rebelliousness. *Note:* Model was not significant.

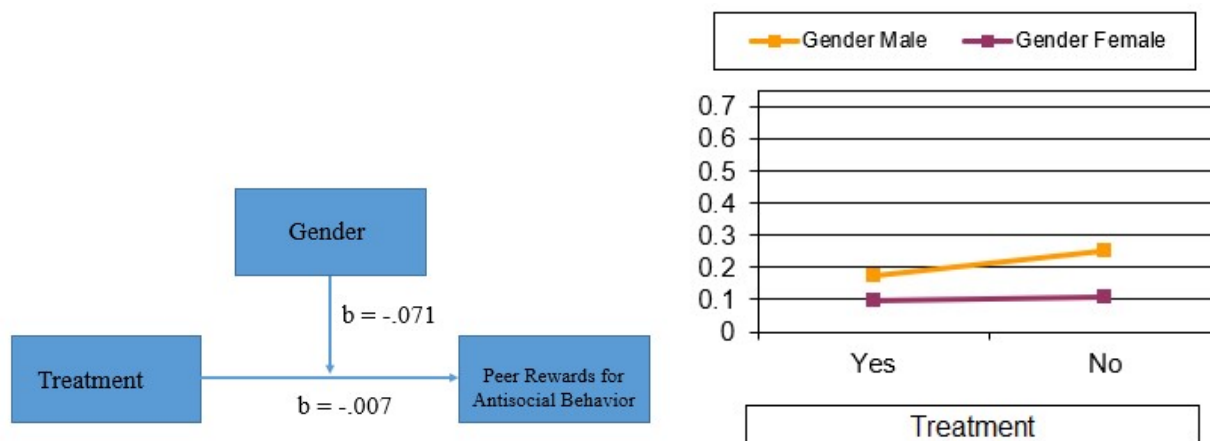


Figure 20. Gender moderation of treatment effects on Peer Rewards for Antisocial Behavior. *Note:* Model was not significant.

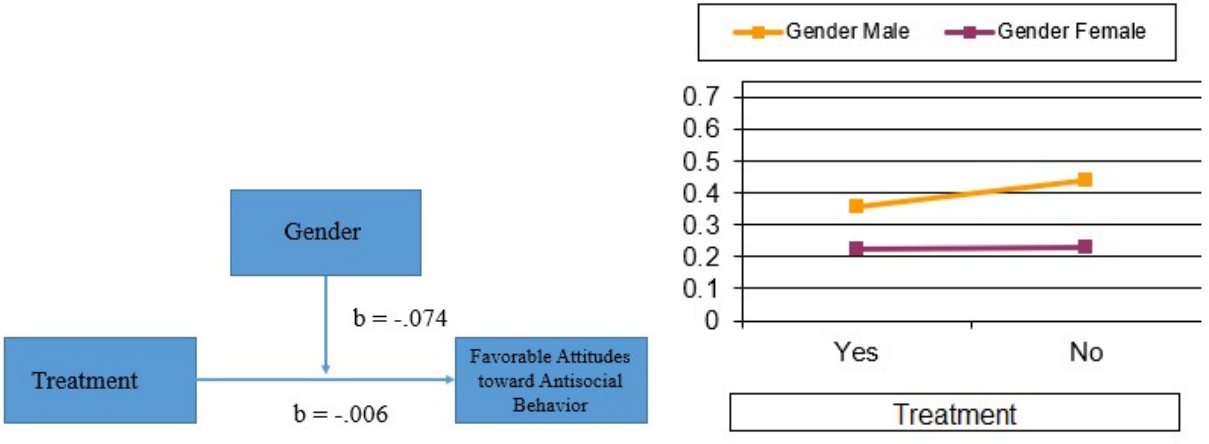


Figure 21. Gender moderation of treatment effects on Favorable Attitudes toward Antisocial Behavior.

Note: Model was not significant.

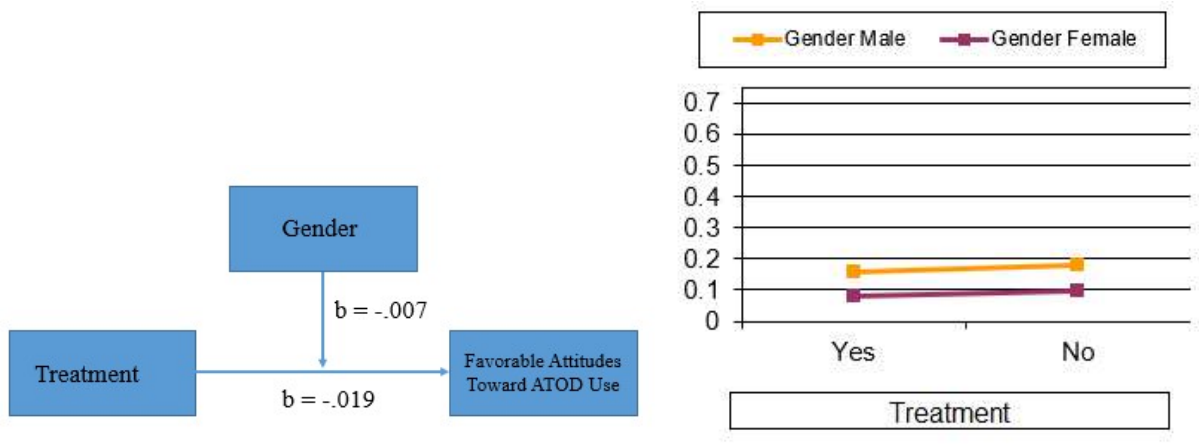


Figure 22. Gender moderation of treatment effects on Favorable Attitudes toward ATOD Use. Note:

Model was not significant.

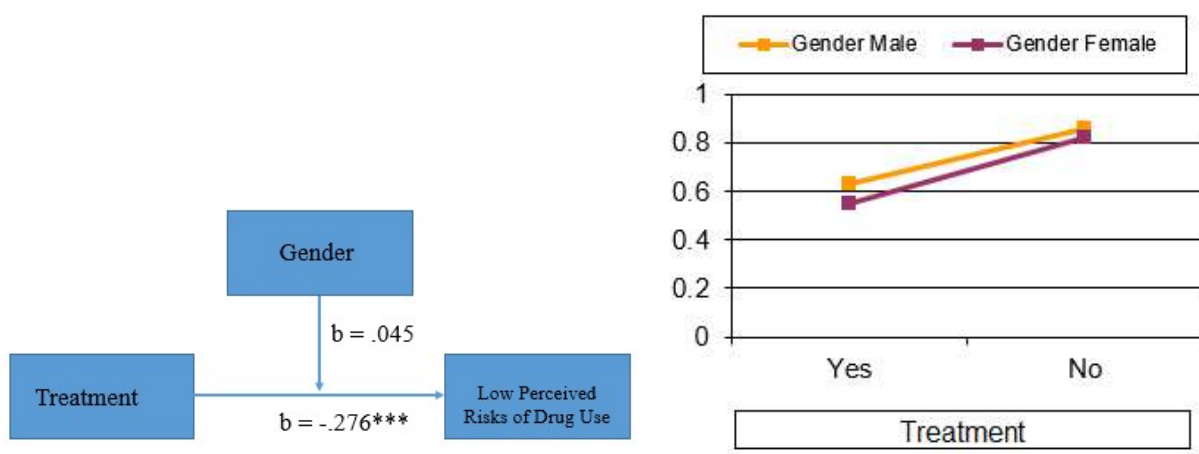


Figure 23. Gender moderation of treatment effects on Low Perceived Risks of Drug Use. Note: Model was not significant.

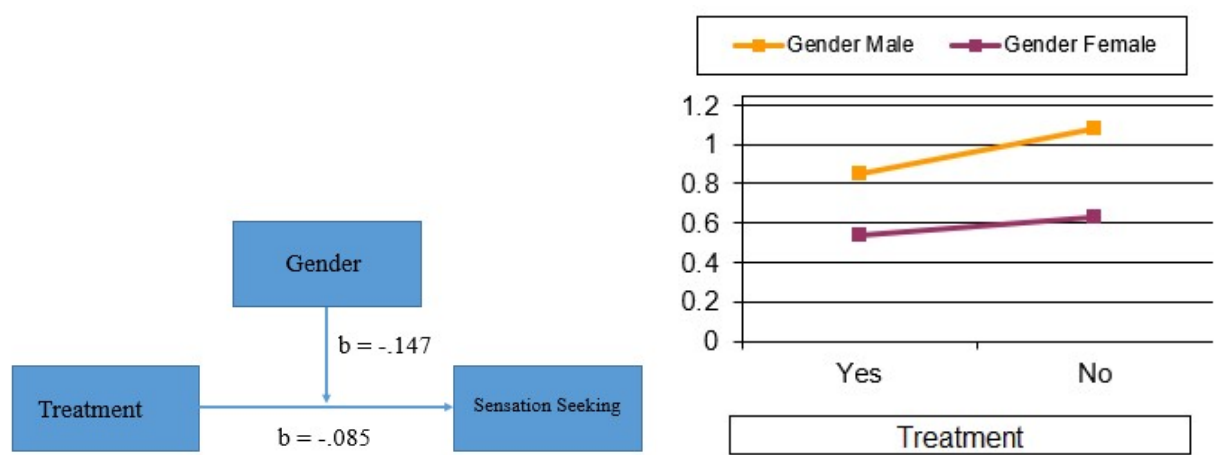


Figure 24. Gender moderation of treatment effects on Sensation Seeking. Note: Model was not significant.

Table 9

Moderation Results for ATOD Outcomes

Effects	30 Day Cigarette				Lifetime Cigarette				30 Day Alcohol				Binge Drinking				Lifetime Alcohol			
	N	β	SE	p	N	β	SE	p	N	β	SE	p	N	β	SE	p	N	β	SE	p
LST Treatment	1468	-0.0115	0.0072	.108	1488	-0.0545	0.026	.036	1460	0.011	0.022	.616	1488	-0.01	0.019	.715	1484	0.076	0.063	.230
Gender	1468	-0.0087	0.0086	.316	1488	0.0996	0.031	.001	1460	0.074	0.027	.006	1488	0.032	0.022	.146	1484	0.34	0.076	.000
LST Treatment X Gender	1468	0.0169	0.0103	.101	1488	-0.0749	0.037	.044	1460	-0.04	0.032	.261	1488	0.01	0.027	.699	1484	-0.22	0.091	.018
	Willingness: Alcohol				30 Day Marijuana				Lifetime Marijuana				Willingness: Marijuana				30 Day Prescription			
	N	β	SE	p	N	β	SE	p	N	β	SE	p	N	β	SE	p	N	β	SE	p
LST Treatment	1439	0.1797	0.0745	.016	1462	-0.009	0.014	.509	1487	-0.01	0.018	.550	1444	-0.02	0.033	.531	1472	0.016	0.016	.292
Gender	1439	0.3524	0.0909	<.001	1462	0.0338	0.017	.040	1487	0.042	0.022	.053	1444	0.056	0.04	.164	1472	0.028	0.019	.130
LST Treatment X Gender	1439	-0.2322	0.1079	.032	1462	-0.0338	0.02	.085	1487	-0.03	0.026	.320	1444	0.021	0.048	.665	1472	-224	0.022	.317
	Lifetime Prescription				30 Day Inhalant				Lifetime Inhalant				Willingness: Inhalant							
	N	β	SE	p	N	β	SE	p	N	β	SE	p	N	β	SE	p				
LST Treatment	1470	0.0689	0.0515	.181	1499	0.0033	0.028	.907	1484	-0.02	0.039	.688	1439	0.006	0.021	.769				
Gender	1470	0.0119	0.0626	.849	1499	0.0612	0.033	.068	1484	0.084	0.046	.071	1439	0.043	0.026	.095				
LST Treatment X Gender	1470	-0.0222	0.075	.767	1499	-0.0364	0.04	.365	1484	-0.02	0.056	.771	1439	-0.04	0.031	.218				

Note: Bolded values indicate $p < .05$.

Table 10

Moderation Results for Risk Factor Outcomes

Effects	Rebelliousness				Friends' Delinquent Behavior				Friends' Use of Drugs				Peer Rewards for Antisocial				Favorable Atti. Antisocial			
	N	β	SE	p	N	β	SE	p	N	β	SE	p	N	β	SE	p	N	β	SE	p
LST Treatment	1458	-0.05	0.0454	.234	1482	-0.0627	0.0155	<.001	1482	-0.05	0.0255	.048	1469	-0.0073	0.0299	.807	1480	-0.006	0.0346	.873
Gender	1458	0.177	0.054	.001	1482	0.0816	0.0186	<.001	1482	0.135	0.0305	<.001	1469	0.1463	0.0358	<.001	1480	0.2056	0.0415	<.001
LST Treatment X Gender	1458	-0.04	0.0645	.575	1482	-0.0565	0.0222	.011	1482	-0.098	0.0366	.008	1469	-0.0705	0.043	.102	1480	-0.074	0.0496	.139
	Favorable Atti. ATOD				Low Perceived Risks of Drugs				Sensation Seeking				Early Initiation Drug Use							
	N	β	SE	p	N	β	SE	p	N	β	SE	p	N	β	SE	p				
LST Treatment	1479	-0.02	0.0316	.556	1462	-0.2757	0.0571	.000	1474	-0.085	0.0785	.277	1467	-0.0237	0.0837	.777				
Gender	1479	0.084	0.0379	.028	1462	0.0347	0.0688	.614	1474	0.452	0.0933	<.001	1467	0.6527	0.1009	<.001				
LST Treatment X Gender	1479	-0.01	0.0452	.877	1462	0.0449	0.082	.584	1474	-0.147	0.112	.190	1467	-0.4199	0.1203	<.001				

Note: Bolded values indicate $p < .05$.

Chapter 5

Discussion

Adolescent substance use is a public health issue that many have attempted to address using a variety of evidence-based substance use programs such as Botvin LifeSkills Training (LST). Although many highly controlled studies have demonstrated positive effects of LST, further study was required to determine real-world effectiveness. The purpose of this study was to determine whether students who received treatment demonstrated positive outcomes as compared to other students who did not receive treatment, which was examined using hierarchical linear models. Moderation effects of gender on treatment were also examined.

Hierarchical Model Outcomes

No significant differences between students who received treatment and those who did not receive treatment were evident based on comparisons of all studied risk factor scale outcomes. While this contradicts the existing results of researcher-controlled studies of LST, these findings are aligned with those reported in other LST effectiveness studies (Botvin et al., 1995; Botvin & Kantor, 2000; Vicary et al., 2006). While these results do not align with initial study hypotheses, they continue to illustrate the research-to-practice gap in program implementation (Vicary et al., 2006).

In addition, no significant program effects were detected on the majority of ATOD outcome variables. Prior studies have demonstrated LST program effects in student populations demonstrating a low incidence of substance use (Botvin et al., 2003). However, it is plausible that the low base rates of substance use in the 6th-grade sample population made program effects on ATOD outcomes difficult to detect. The only desired LST effect detected through hierarchical

modeling was how treatment lowered students' odds of smoking in the past 30 days when compared to students in the control group.

Considering the limited treatment effects on the majority of ATOD outcomes, the significant but undesirable program effects on lifetime prescription drug use were surprising. The LST program does not address non-medical prescription drug use explicitly, but instead provides instruction regarding smoking and media pressures (Botvin, n.d.). The current trends in prescription opioid use and non-medical use of other prescription drugs are largely fueled by erroneous long-standing beliefs that prescription opioids are less harmful than illicit drugs because they were prescribed by a physician (Foundation for a Drug-Free World, 2019). The treatment students not only failed to learn about prescription drug abuse, but they also may have had higher access to prescription drugs because the treatment group was overall wealthier than the control group.

In addition, because of the national crisis regarding prescription drug abuse, especially prescription opioid abuse, many state organizations such as the Commonwealth Prevention Alliance, funded by the PA Commission on Crime and Delinquency, have launched large-scale media campaigns which aim to reduce opioid misuse (Commonwealth Prevention Alliance, n.d.). Although all students within the same state would presumably have exposure to the same media campaign, students who received the media training and substance education elements of the LST program may be less receptive to the prevention campaign than those who did not receive LST. This could be due to heightened mistrust of advertising campaigns, even if they are anti-drug campaigns. As a result, LST program developers may consider including more drug education elements in the elementary program that specifically address prescription drug use, rather than solely targeting cigarette use at this age.

Another important consideration is that while LST treatment did not serve as a significant predictor of many of the studied outcomes, covariates such as gender, age, and free/reduced-price lunch explained a significant portion of the variance in various multilevel models explored. Prior work has demonstrated LST program effects on elementary students even when domains such as gender, race, and family structure were controlled (Botvin et al., 2003). However, desirable program effects were previously only found on smoking frequency, annual drinking frequency, anti-drinking attitudes, self-esteem, and perceived friends' anti-drinking attitudes. Program effects were not reported for many of the outcomes examined through the current study, despite their alignment with the LST logic model (EPISCenter, 2015).

When initially examining between group demographics in lifetime cigarette use, significant LST program effects were expected. However, this model did not demonstrate significant differences between treatment and control students because free/reduced price lunch explained the largest portion of variance. Free/reduced price lunch was used as a proxy for socio-economic status in the current study. The disproportionate impact of cigarettes and tobacco on those who are economically disadvantaged is well-documented; thus, the model results align well with national and global trends in cigarette use (U.S. National Cancer Institute and World Health Organization, 2016). Previous studies of the LST elementary school program may have over-inflated program results because they did not include any measure of socio-economic status as a covariate.

Moderation Outcomes

The majority of moderation effects were observed such that boys experienced stronger treatment effects than girls on risk factors related to friends' maladaptive behaviors, early drug use, lifetime cigarette use, and lifetime alcohol use. Girls also demonstrated benefits from the

program in Friends' Delinquent Behavior, Friends' Use of Drugs, and Lifetime Cigarette Use. These findings contradict results by Vicary and colleagues (2006) who found some specific proximal program effects on only girls. In explaining their results, the authors noted that such effects may have been due to the access that girls had to older boys within their K-12 school setting, allowing them to practice their LST skills in real life. The same results may not have occurred because the majority of students in the current study's treatment sample were drawn from elementary schools (i.e., only one treatment intermediate school), removing the opportunity for girls to practice their skills on older boys.

The LST program has specific elements that target social skills. Social circles are important for both boys and girls, but the importance of friend groups is typically amplified for adolescent girls, who are rewarded for social dependency (Amaro et al., 2001). The girls who received LST may have already had strong baseline skills in seeking and maintaining friendships with more positive peer groups, whereas the boys may have gained skills in these areas as a result of participating in the LST program. Such peer groups would have a higher disapproval for drug use than more maladaptive peer groups.

Without treatment, adolescent boys may be more inclined to do things that increase their social desirability among their peers (i.e., trying to look "cool" and "manly"). This effect was also found in previous work demonstrating that peer pressure increased boys' substance use more than for girls; explanations of these effects could be due to traditional concepts of masculinity and related substance-use behaviors (Whaley, Hayes, & Smith, 2016). Boys who received LST program may have been able to better resist these pressures, thus decreasing their overall peer-related risk factors.

Moderation effects of gender were not found between treatment and individual risk factors such as rebelliousness and sensation-seeking. Boys in the current study generally demonstrated higher levels of sensation-seeking than girls, but the differences between treatment and control boys in sensation seeking were not significant. Prior work has demonstrated neurobiological sex differences in both of these areas such that adolescent males generally demonstrate higher levels of sensation-seeking or impulsivity than adolescent females (Kuhn, 2015). It is possible that the LST program as it is currently designed could not overcome boys' neurobiologically-based risk in these areas.

One significant conditional effect was observed for only girls in treatment on Willingness to Use Alcohol; however, the direction of this effect was unexpected. Treatment increased girls' willingness to use alcohol in the current study, while there were minimal differences between the higher ratings of boys in treatment and control on this outcome. The scope and sequence of the LST elementary program does not include specific instruction on alcohol use but instead primarily emphasizes smoking information (Botvin, n.d.). Unlike the other drugs assessed using willingness variables, alcohol is a legal, age-controlled substance that is commonly used recreationally. LST does not rely on "just say no" tactics such as other common substance use prevention programs. One explanation could be that the assertiveness and decision-making components of the program gave girls the skills to think about alcohol use in a responsible way. While girls in treatment endorsed higher willingness to use, the willingness variable does not include any time parameters regarding when the student would use alcohol. Thus, it is possible that girls in treatment provided realistic responses regarding their willingness to use alcohol at some point in their lives (e.g., after they turn 21 years old).

Conversely, it is plausible that the increase in girls' Willingness to Use Alcohol ratings were truly an unintended, iatrogenic effect of participating in LST treatment. As previously mentioned, the elementary program does not include content about the dangers of alcohol use. Instead, the content of the LST treatment emphasizes social skills, specifically building and maintaining social connections. The lack of alcohol lessons and the emphasis on building and maintaining social connections may have left girls more susceptible to peer influences which promote alcohol use. In an effort to build and maintain friendships, girls in treatment may have espoused greater willingness to use alcohol, especially since it is a socially accepted substance.

Limitations

The studied sample had some limitations due to the lack of racial/ethnic diversity and an urban student population. This limits the generalizability of the study results to most students who are ethnic minorities or live in urban settings. Further, because this is a study of students in Pennsylvania, interpretation of results should be limited to the state with possible extensions to states and school districts with otherwise similar profiles to those included in this study. These types of limitations are inherent to a study of ecological effectiveness, but they do not decrease the value of the potential findings.

Some limitations regarding the outcomes of the propensity matching procedure shared are acknowledged. The only significant predictor of treatment propensity was the percent of free and reduced priced lunch students in the school, so the treatment and control groups were still unbalanced on this characteristic meaning the control group had overall higher poverty rates (i.e., 15.7% in treatment, 34.3% control). The samples were also unbalanced regarding school locale. However, the matching procedure produced reasonable balance on student demographics. Because of the high reliance of this study on student-level outcomes as a measure of overall

effects of school programming, this balance in student variables is a strength of this study despite the other imbalanced community and school demographics.

While the matching procedure produced relatively balanced groups at the school-level (i.e., 13 treatment schools, 10 control schools), the size of the control schools led to a low degree of balance in the total number of students in the control schools. This may have impacted the overall power in detecting program outcomes. However, the lack of detection of program effects could also be due to the low overall incidence of substance-use and risk-taking behaviors in 6th-grade students.

Although overall LST program effects were not detected when comparing treatment and control schools, it is possible that it is due to low implementation fidelity. Unfortunately, while the community coalitions routinely collect implementation fidelity data for schools receiving their supports, no data were available regarding the implementation fidelity of LST for any treatment schools. Thus, while it is plausible that the lack of program effects could be due to poor implementation rather than program design or quality, ascertaining potential causes of these overall poor outcomes is not possible without such fidelity measures.

Future Directions

This study did not find the same degree of intervention results as those which are touted by the LST program developers (Botvin et al., 1995; Botvin & Kantor, 2000; Crowley et al., 2014). While this study provides another realistic illustration of how this program functions outside of highly controlled, researcher-driven randomized trials, it also demonstrates the importance of imposing research-style controls that may be critical for achieving program effects. One important element of data missing from this study is implementation fidelity data. Future effectiveness studies should track implementation data in a systematic way to examine

how implementation fidelity impacts program outcomes (e.g., difference between schools with high implementation fidelity and low implementation fidelity).

The current study did not explicitly study outcomes related to many of the protective factors targeted by LST. Future studies should not only study these protective outcomes, but they should also study the real-world relationship between the development of protective skills on the distal outcomes of LST (i.e., reduced antisocial behavior). This would clarify the theorized relationship between the program scope/sequence and desired outcomes.

Given the age of the study population, girls' substance use was overall low, but research has shown that the gender gap in substance use is growing smaller, especially as children progress through adolescence (Amaro et al., 2001). While this prior work found some proximal benefits of the LST program on girls, those effects did not last through adolescence.

Modifications within the curriculum may include components specifically targeting skills needed to support girls in later adolescence, such as bolstering self-esteem that tends to plummet throughout female puberty (Amaro et al., 2001). Although previous studies modifying the LST program did not find promising effects, they did not modify the program specifically with a focus on gender (Vicary et al., 2006). These modifications then could be compared to a group receiving the standard LST program.

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- *School Psychology Practicum Student*, Ferguson Township Elementary School, September 2016-May 2016.
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RESEARCH PRESENTATIONS

- Soni, C., Frank, J., & Schussler, D. (2018, February). Grit.0: Measurement Considerations of the Child Grit Scale. Paper presented at National Association of School Psychologists Annual Conference, Chicago, IL.
- Soni, C., Schaefer, B., & Nelson, P. (2017, February). True Grit: Can Grit be Accurately Measured in Children? Poster presented at National Association of School Psychologists Annual Conference, San Antonio, TX.
- Soni, C., Schaefer, B., & Nelson, P. (2016, October). True Grit: Can Grit be Accurately Measured in Children? Poster presented at Association of School Psychologists of Pennsylvania Annual Conference, State College, PA.

PROFESSIONAL MEMBERSHIPS

- American Psychological Association, Division 16, student member (2017-Present)
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