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The role of parental support of autonomy and youth self-regulation in predicting substance use in
adolescents

by

Kathryn A. Lachance

A dissertation

submitted in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy in the Department of Psychology

Idaho State University

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To the Graduate Faculty:

The members of the committee appointed to examine the dissertation of Kathryn
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Human Subjects Committee Approval

July 18, 2019

Kathryn Lachance
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RE: regarding study number IRB-FY2019-243 : Self-Control and Health

Dear Ms. Lachance:

Thank you for your responses to a full-board review of the study listed above. Your responses are eligible for expedited review under FDA and DHHS (OHRP) regulations. This is to confirm that I have approved your application.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

You may conduct your study as described in your application effective immediately. The study is subject to renewal on or before July 17, 2020, unless closed before that date.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Tom Bailey (208-282-2179; email humsbj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

Human Subjects Committee Approval

July 24, 2020

Kathryn Lachance
Psychology
MS 8112

RE: Study Number IRB-FY2019-243: Self-Control and Health

Dear Ms. Lachance:

Your request to reopen the study listed above was reviewed at the Jul 24, 2020 8:30 AM MDT, meeting of the Idaho State University Human Subjects Committee.

This is to confirm that your request to reopen the study was approved.

The study is subject to continuing review on or before July 24, 2021, unless closed before that date.

As with the initial approval, changes to the study must be promptly reported and approved. Contact Tom Bailey (208-282-2179; email humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

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The Role of Parental Support of Autonomy and Youth Self-Regulation in Predicting Substance Use in Adolescents

Dissertation Abstract – Idaho State University (2021)

Alcohol is the leading cause of death for teens in the U.S. Effortful control and motivation orientations are associated with adolescent substance use. Parental support of autonomy has been associated with greater intrinsic self-regulation in academic work and with effortful control in adolescence. However, research is limited in examining the role of self-regulatory styles in youth outside the context of academics and how self-regulation mediates the relationship between parental support of autonomy and substance use. The current study examined how parental support of autonomy and self-regulation (autonomous functioning, effortful control, and executive functioning) predicted risk for substance use. A sample of 128 parent-youth dyads completed a series of computer-based questionnaires and executive function tasks. SEM analyses were used to examine the proposed model. Results indicated that effortful control significantly mediated the association between perceived parental support of autonomy and cigarette use, where higher autonomy support significantly predicted higher effortful control which in turn predicted decrease cigarette use. While similar patterns were noted for alcohol use, the mediated effect was not significant. Additionally, increased disinhibition significantly predicted increased cigarette use. Lastly, parental support of autonomy and self-regulation was not significantly associated with marijuana use. Findings add to the literature by further exploring mediated effects of self-regulation risk and protective factors simultaneously, which has not yet been identified in the field.

Key Words: parental support of autonomy, autonomous functioning, self-regulatory styles, substance use, alcohol use, executive functioning, effortful control, youth

Chapter 1: Literature Review

Alcohol is the leading factor in many teen deaths caused by car accidents, suicide, and homicide (“Underaged drinking,” n.d.). As of 2017, 443,000 adolescents had a diagnosed alcohol use disorder (AUD), and 2.2% of adolescents (aged 12 to 17) met criteria for a cannabis-related substance use disorder (“U.S. Department of HHS”, 2018). A longitudinal study, Monitoring the Future, has been recording prevalence of substance use since 1975 (Miech et al., 2018). In 2018, 23.5% of 8th graders, 43% of 10th graders, and 58% of 12th graders reported using alcohol with that year, and 9% of 8th graders, 26% of 10th graders and 42% of 12th graders endorsed having been drunk. When considering engagement in illicit drug use, in 2018, 19% of 8th graders, 36% of 10th graders, and 48% of 12th graders reported use in the last year. Importantly, both alcohol use and illicit drug use have increased compared to the prior year (Miech et al., 2018). Due to the high (and increasing) prevalence of substance use and disorders in adolescence, it is important to understand the associated risk and protective factors.

The present study considered self-regulation factors that may function as protective and risk factors for substance use in adolescence. The study investigated how factors of self-regulation (i.e., effortful control, motivation, executive functioning) mediate the relation between perceived parental support and substance use engagement in youth. As such, while the literature review considers, self-determination theory broadly, there is a specific focus on motivation (e.g., autonomous functioning). Subsequently, literature on how parental support of autonomy, effortful control, and executive functioning are interrelated are reviewed.

Due to the cross-sectional, survey-based design, causal statements (i.e. “causes”, “influences”, “effects”) about the relations between predictor and dependent variables were minimized. When these terms could not be avoided, they were used for the purpose of explaining

our hypothesized model and statistical analyses. No causal relations among variables were implied.

Self-Determination Theory and Motivation

Self-determination theory (SDT) posits that motivation development is influenced by volition, autonomy, and choice (Deci & Ryan, 2002). When examining this development, psychological needs (and their ability to be met) are hypothesized to play a key role in cultivating positive development. Competence (i.e., feeling effective in one's social environment and experiencing opportunities that are personally challenging), relatedness (i.e., feeling connected to others and feeling a sense of belonging), and autonomy (i.e., being the perceived source of one's own actions) are most notably considered since SDT proposes that, when these needs are met, individuals develop more autonomous motivation (Ryan & Deci, 2000b). External conditions that promote motivation growth are often examined in research and include parental factors such as scaffolding and support (Hammond, Müller, Carpendale, Bibok, & Liebermann-Finestone, 2012; Lengua, Honorado, & Bush, 2007).

Motivation is, in part, conceptualized by the orientation (i.e., what motivates the behavior; Deci & Ryan, 2002) and within SDT, motivation is conceptualized on a spectrum of controlled orientations (i.e., the amount to which a person is controlled by rewards, deadlines, and the orders of others) to autonomously oriented (i.e., the degree to which a person is oriented toward environmental factors that elicit intrinsic motivation; Ryan & Deci, 2000a; Deci & Ryan, 2000b; Deci & Ryan, 2002). This continuum is especially applicable for children and adolescents, as their motivational orientations may undergo rapid shifts throughout development. SDT suggests that, at its farthest point, extrinsic motivation is fully externally regulated. On the other end are more internal or autonomous regulation. Nurturing internalization of values in

socialization can generate more internally regulated forms of motivation (Ryan & Deci, 2000a; Deci & Ryan, 2002). On this spectrum of motivational style, an individual may be more autonomous (the extent to which someone's behavior is oriented toward their values) or more controlled (degree to which a person is controlled by external constraints). While youth do not typically display general motivational styles (i.e., motivational styles that are consistent across settings), youth who display greater internalized motivation across settings and behaviors often adopt more autonomous orientation styles in adulthood; while those with more externally derived regulation are typically more controlled in their generalized orientation (Ryan & Deci, 2000a).

Intrinsic motivation, similar to autonomous motivation, is when behaviors are driven by internal rewards (e.g., values). Extrinsic motivation, on the other hand, is when behaviors are motivated by external rewards (e.g., payment) and punishment. Of note, intrinsically based behavior is considered to be a more deepened form of motivation and has been associated with better outcomes (e.g., academics) in youth compared to extrinsically based behavior (Deci & Ryan, 2002). Thus, the ability to understand and predict factors that cultivate more intrinsically motivated styles may prove useful in fostering resiliency factors in youth.

Motivation Orientations and Substance Use

This review considers how motivation orientations (i.e., self-regulatory styles) in youth relate to substance use. However, due to the limited research in this population, motivation orientations in adults were also considered to achieve a more complete review. Prior research has shown a relation between motivation orientations and substance use in adult populations. Wong & Rowland (2013) examined drinking patterns in college students. This research supported that higher autonomy orientation predicted less drinking-related problems compared to those who had higher controlled orientations. Additionally, those with more controlled orientations used

more illicit drugs compared to those with lower controlled orientations. Other studies have demonstrated similar results when examining motivation orientation and substance use (Chawla, Neighbors, Logan, Lewis, & Fossos, 2009). In such studies, those with more autonomous orientations consumed less alcohol within a week compared to those with a more controlled orientation. When examining this relation's replicability when considering cultural factors, Nguyen and Neighbors (2013) demonstrated variations across ethnicities and cultures. Higher controlled orientation was related to heavier drinking in white individuals. However, when considering this pattern in Asian Americans, this finding was not consistent; Asian Americans with a higher controlled orientation reported less consumption of alcohol. Authors suggested that this discrepancy may be due to norms-based approval or disapproval of drinking where in Asian-American communities, peers are less approving of alcohol use and thus are less likely to drink compared to those who are white.

Although a large amount of the research in motivation orientations has primarily focused on adult populations, an emerging amount of research has examined the impact of motivation on youth substance use. In this research, motivation isolated to a particular context (e.g., academics) is considered. Previous research has explored academic motivation (i.e., academic self-regulatory styles) and its association with alcohol consumption in high school students (Wormington et al., 2011). Results indicated that those with a higher degree of intrinsic regulation endorsed less drinking overall compared to youth with higher levels of external regulation. Relatedly, Wong (2008) examined the effects of more autonomous self-regulatory styles in academics and its association with perceived parental autonomy support and substance use. Results suggested that those with more identified academic regulation style showed better outcomes (measured by

academic performance, disruptive behavior, and substance use) than those who were more externally regulated: performing better in school.

In general, patterns appear to suggest that motivation orientations that are more autonomous (i.e., internally controlled) are associated with lower levels of problematic drinking; whereas, those with more controlled orientations (i.e., externally driven) often demonstrate drinking patterns that are more consistent with social beliefs. While most of the research reviewed has examined motivation and drinking in the U.S. culture, based on this research, controlled orientation is often associated with greater problems with drinking. Some research has examined differences between Asian and American cultures and how motivation orientations may predict drinking differently across these cultures (Nguyen & Neighbors, 2013); however, the extent to which this generalizes to other cultures is unknown. While the majority of research has examined adult populations, some research has examined adolescent drinking patterns and has shown comparable patterns (Wong 2008; Wormington et al., 2011). However, this research is limited to the relation between academic self-regulatory styles (i.e., the extent to which a youth is internally or externally motivated within the academic environment) and substance use rather than demonstrating the association between dominant autonomous functioning and substance use (similar to adult literature). Thus, whether more autonomous functioning is related to substance use in adolescence is still an under-researched area.

Effortful Control and Substance Use

Self-regulation can be conceptualized as an individual's ability to control or manage their behaviors, cognitive abilities (e.g., attention) and emotions (Baumeister & Vohs, 2004; Vohs & Baumeister, 2011). Behavioral self-regulation considers an individual's engagement in behaviors that are congruent with an individual's goals and values and emotional self-regulation is ones

ability to manage affective states. While cognitive self-regulation is a broad concept, one component is effortful control (i.e., the ability to suppress a dominant response in order to engage in a subdominant response). Given the extensiveness of content that self-regulation captures, the primary attention of this review will consider the association between effortful control and substance use.

A limited amount of research has examined effortful control within substance use research. These studies, however, have shown support for effortful control as a mediator when predicting early onset of substance use (substance use prior to age 15) through motivation orientation in adults. Research has implicated that autonomous and controlled orientations were associated with drinking frequency and quantity in college students with effortful control significantly mediating the relationship (Wong & Rowland, 2013). Specifically, those with autonomous orientations reported lower frequency in drinking compared to those with controlled orientations. Importantly, among individuals with autonomous orientations, those with higher effortful control consumed less alcohol compared to those with lower effortful control. Individuals with more controlled orientations reported greater substance-related problems.

Motivation and substance use has also been examined in adolescents, yet limited. As noted prior, in youth, motivation is examined through self-regulatory styles which occur on a spectrum from external (i.e., maintained through environmental reinforcers) to internal (i.e., maintains through the intrinsic value). Research has considered how academic involvement and peer substance use predicted related problems as moderated by adolescent self-regulation (Wills, Pokhrel, Morehouse, & Fenster, 2011). Results noted that self-regulation significantly moderated the association between negative life events and peer influence on adolescent substance use. Specifically, negative life events and peer substance use impacted individual's substance use to a

greater extent for those with low internal self-regulation abilities compared to those with high internal self-regulation.

When examining effortful control specifically, similar patterns are suggested. Wills, Walker, Mendoza, and Ainette (2006) suggest that greater effortful and behavioral control predicted lower drug and alcohol use. Wong (2008) also explored the effects of effortful control as a mediator for parental support of autonomy and academic performance on substance use. Results supported that effortful control mediated the relationship between parental autonomy support and youth outcomes (i.e., greater effortful control was associated with better academic performance and lower substance use/deviant behavior).

A small number of longitudinal studies have been completed considering effortful control and substance use. Piehler, Veronneu, and Dishion (2012) explored factors such as effortful control and social norms in the development of substance use from adolescence into adulthood. Findings suggested that greater effortful control in adolescence predicted fewer drug-related problems in adulthood. While only approaching statistical significance, the same pattern was present for alcohol-related problems. Additionally, when predicting alcohol problems in adulthood, for those with low self-regulation abilities, decreased exposure to substance use in adolescence was associated with greater risk for developing problematic drinking in adulthood compared to those with higher self-regulatory skills. Result implicate that self-regulatory skills may be protective in later development of substance use problems. Of note, when exposure to substance use in adolescence was high, self-regulation showed a reduced influence on the development of later alcohol related problems.

Broadly, effortful control has been demonstrated to influence relations between self-regulatory styles and motivation orientations and substance use and has shown independent

associations with youth outcomes (i.e., substance use, academic performance). However, while research has examined effortful control's associations with motivation orientations broadly in adults, the understanding of these associations in adolescents is still limited to self-regulatory styles within academic contexts. Further, only one study (Wong, 2008), to date, has examined the relation between effortful control and parental support of autonomy.

Family Support and Substance Use

Familial factors have been shown to play a role in the onset of substance use in youth. Parental supervision and monitoring during middle childhood have been considered in substance use later in adolescence (Chilcoat & Anthony, 1996). In this study, lower levels of parental supervision and monitoring predicted early onset drug use. Relatedly, research by Anderson and Henry (1994) identified that increased parental involvement and support were negatively associated with substance use in youth.

While parental monitoring and support have been widely explored, parental support of autonomy has only begun to be investigated in relation to childhood behaviors. Parental support of autonomy includes a parent's ability to minimize the use of control and pressure and help their children to learn to solve their own problems (Deci & Ryan, 2002). Primarily, this factor has been considered within academic performance where higher levels of youth perceptions of autonomy support predicted increased perceived competence, control understanding (i.e., the understanding of who or what controls the outcomes in their life), and academic self-regulatory styles in students (Grolnick, Ryan, and Deci, 1991; Grolnick & Ryan, 1989).

In considering parental support of autonomy and substance use in youth, Chilenski, Ridenour, Bequette, & Caldwell (2015) suggested greater perception of parental support of autonomy predicted more enriched school adjustment and performance. Furthermore, these

youth endorsed superior planning and decision-making skills, which predicted lower drug and alcohol use. These results are congruent with a previous study (Wong, 2008), where higher levels of perceived parental autonomy support decreased substance use and better academic performance.

Some research has examined perceived parental support of autonomy and associations with self-regulatory style and youth outcomes (i.e., substance use and academic performance). Further self-regulatory styles have been associated with effortful control. However, no research to date has examined inter-relations between parental support of autonomy, youth autonomous functioning, and effortful control in predicting to adolescent substance use. Further, while academic self-regulatory styles have been examined, given the tendency for youth motivation to differ based on context, understanding how a predominant motivation orientation may impact these relations still remains both useful and unexplored.

Executive Functions and Substance Use

Executive function can be conceptualized as a neurological construct of self-regulation composed of processes involved in abilities such as problem solving, information processing, task execution, reasoning, and working memory (Friedman et al., 2007). Nigg and colleagues (2006) evaluated the ability of executive functions, specifically response inhibition, to predict substance use problems in adolescents, longitudinally. Results suggested that poorer response inhibition predicted greater alcohol-related problems and drug use. Further, such neurobehavioral disinhibition has been implicated in greater risk for early onset substance use (Tarter et al., 2003). Expanding these findings, the effects of executive function, behavioral approach sensitivity (i.e., the amount someone is attracted to stimulating activities), and emotional decision making on dangerous behaviors have been examined in a sample of female

college students (Patrick, Blair & Maggs, 2008). Results suggested that higher alcohol consumption was associated with greater approach sensitivity and better working memory. This pattern was suggested for drug use, though only approaching significance. Furthermore, for individuals with low inhibitory control, poorer emotional decision making was associated with higher levels of alcohol use.

When studying executive functions more comprehensively, Riggs, Spruijt-Metz, Chou and Pentz (2012) examined cross-sectional associations between executive cognitive function and substance use in fourth graders. They found a negative association between cognitive proficiency and substance use engagement. Yet, Wilens et al. (2011) considered whether executive function deficit represented a broad risk factor for later cigarette and substance use. Adolescents were considered to have executive functioning deficits if they scored in the abnormally low range on 2 out of 6 executive function tasks. Executive function deficits were not associated with increase substance use in the examined sample.

Notably, executive functions have also been implicated in substance use behavior change where those with poorer executive cognitive functioning show lower behavior change and greater denial associated with substance use compared to those with higher executive cognitive functioning (Blume & Alan Marlatt, 2009), providing potential implications for best treatment practice when working with those with substance use problems.

Relations among Variables

While each variable examined above independently plays a role in substance use, their relations with one another also need to be considered. These relations may shed light on their joint effects on substance use.

Support of autonomy and youth positive outcomes

Studies have examined the extent to which parental support of autonomy predicts youth academic success through self-regulatory styles. The results indicated that a combination of strictness-supervision and autonomy support promotes academic success in adolescents (Liew, Kwok, Chang, Chang, & Yeh, 2014). These results are consistent with the research on parenting styles. Within this research, studies have suggested that authoritative parenting styles (high demandingness and high warmth) were associated with greater youth subjective well-being and self-esteem, lower defiance behaviors and better performance in school compared to authoritarian and permissive parenting styles (Chan & Koo, 2010). Similarly, research by Aunola, Viljaranta, Lehtinen, and Nurmi (2013) investigated the extent to which mothers' support for their children's sense of competence, autonomy and relatedness predicted their children's interest in math and reading among 152 1st-graders. Maternal support predicted children's interest in mathematics but not in reading. Children's mastery orientation was predicted by mothers' support for autonomy. Comprehensively, a meta-analysis examined the relation between parent autonomy support and child outcomes (Vasquez, Patall, Fong, Corrigan & Pine, 2016). Results showed that parental support of autonomy was related to greater academic achievement and indicators of adaptive psychosocial functioning (e.g., autonomous motivation, psychological health, engagement, positive attitudes).

Yet in older populations, the associations between parental support of autonomy and youth motivation are somewhat mixed. Jungert and Koestner (2015) examined the role of teacher and parent autonomy support on self-efficacy and science performance in 288 high school students. The results showed that teacher's autonomy support was significantly related to youth motivation, self-efficacy, and achievement. This pattern was not significant when examining

parent's autonomy support. In another study, researchers investigated autonomy and relatedness in late adolescents and emerging adults, examining the relationships with perceived parental support and psychological distress (Inguglia, Ingoglia, Liga, Coco & Cricchio, 2015). Youth autonomy and relatedness were predicted by parental support of autonomy and perceived parental support of autonomy was negatively associated with depression.

Support of autonomy has also been examined with providers and have shown similar results. Female adolescents in psychiatric inpatient units were exposed to a course where the instructor was either supportive of autonomy or more controlling (Savard, Joussemet, Pelletier, & Mageau, 2013). Within this clinical population, patients who received the autonomy-supportive course and perceived the instructor as more competent reported higher perceived task's value and less negative affect.

Considering the implications of parental support of autonomy and youth autonomous functioning, Lansford, Laird, Pettit, Bates & Dodge (2014) examined effects of parent's autonomy-supportive parenting during early and mid-adolescence. More parental psychological control predicted greater internalizing problems in both boys and girls and greater externalizing problems in girls. Importantly, while there is no research to-date examining parental support of autonomy and youth substance use, externalizing problems in youth have been associated with later development of substance use problems (Zucker & Fitzgerald, 1991).

Parental support of autonomy and youth effortful control

Aside from research completed by Wong (2008), which investigated effortful control as a mediator for parental support of autonomy and academic performance on substance use, to this author's knowledge, no research has examined the associations between parental support of autonomy and effortful control. However, research has considered how parenting more broadly

may influence effortful control. Lengua, Honorado & Bush (2007) found that mother's limit setting and scaffolding predicted higher effortful control at follow-up testing. Further, mother's responsiveness and socialization in early childhood predicted greater effortful control at follow-up (Kochanska, Murray & Harlan, 2000). Parenting factors have been associated with substance use; however, to date, limited research has examined how effortful control may mediate this effect. Additionally, while the association between effortful control and substance use has been reported, the empirical evidence is still limited and warrants further investigation.

Parental support of autonomy and youth executive function

Two studies have examined the relation between parental support of autonomy and executive function. The goal of the study was to examine the potential mediating role of child language in the prospective relation between maternal autonomy support and child executive functioning. The results suggested that child language played a mediating role in the relation between maternal autonomy support and child performance on impulse control tasks but not for working memory and set shifting (Matte-Gagné & Bernier, 2011). However, considering executive function's robust association with substance use, it is important to explore the role of parental support of autonomy in its relation with executive function as a potential protective factor. Another study has examined autonomy support in teachers and student's executive functioning outcomes (Sosic-Vasic, Keis, Lau, Spitzer & Streb, 2015). This study found that students whose teachers were more supportive of autonomy made fewer errors on executive function tasks compared to those who had more controlling teachers.

While the role of parental support of autonomy in youth executive functioning is limited, research has examined additional parenting factors and has shown associations with executive functioning in youth. Hammond, Müller, Carpendale, Bibok, & Liebermann-Finestone (2012)

explored the effects of parental scaffolding of children's problem solving on the development of executive function. Scaffolding was found to predict improved executive functioning in early childhood, longitudinally.

Importantly, when considering broad parenting dimensions as they relate to child executive functioning, autonomy support was the strongest predictor of executive functioning at each age, independent of general cognitive ability and maternal education (Bernier, Carlson & Whipple, 2010). This finding further bolsters support for continued examination of parental support of autonomy in predicting youth outcomes. While parenting factors and executive functioning have separately been linked to substance use outcomes, the relations between these factors have not yet been explored. Further, effortful control, another aspect of self-control, has been shown to mediate parental support of autonomy's influence on substance use outcomes (Wong 2008). Thus, executive function as an aspect of self-control, may also mediate this relationship and warrants investigation.

Autonomous functioning/self-regulatory styles and executive functioning

The associations between autonomous functioning and self-regulatory styles as conceptualized in self-determination theory and executive functioning have not been explored. Outcomes associated with academic self-regulation (e.g., academic procrastination) have been explored in relation to executive functioning as well as motivation considered broadly. However, this line of research is limited and is in need of further investigation. Of the research that has been conducted, Rabin, Fogel & Nutter-Upham (2011) examined subcomponents of self-reported executive functioning associated with academic procrastination in a college sample. The executive function domains of initiation, planning, inhibition, self-monitoring, working memory, and organization were significant predictors of academic procrastination.

One prior study has considered relations between executive functions, motivation, and teachers' support of autonomy (Sosic-Vasic, Keis, Lau, Spitzer & Streb, 2015). The study primarily examined cognitive flexibility (i.e., inhibition, working memory, set-shifting) and academic self-regulation in middle school students. Students who endorsed greater autonomy support from teachers demonstrated better academic outcomes and performed better on executive function tasks compared to those who perceived teachers as more controlling. Further, students who demonstrated greater ability in cognitive flexibility endorsed higher levels of intrinsic self-regulation and performed better in school compared to students who had lower cognitive flexibility.

Better academic performance has been negatively associated with substance use (Wong & Rowland, 2013) and support of autonomy and motivation have been associated with academic performance (Wong, 2008). As such, a mediated effect of support for autonomy and motivation on substance use may be present. Given parental influences on deviant behaviors in youth, exploring parental support of autonomy in how it relates to substance use may provide relevant information in understanding the development of early onset substance use.

Effortful control and executive functioning

Blair & Razza (2007), examined the role of self-regulation in emerging academic ability in early childhood. Results indicated that the various aspects of child self-regulation, including effortful control and executive function, accounted for unique variance in the academic outcomes independent of general intelligence, suggesting that each may independently influence academic ability. However, one review has examined the distinctness of these constructs and has suggested considerable similarities and overlaps in the definitions, core components, and measurement of EC and EF. Such lack of differences in studies has resulted in suggestions that effortful control

and executive functions are distinct due to research focus (i.e. theoretical camps) rather than true differences in measurement of abilities (Zhou, Chen, & Main, 2012). An empirical study was conducted to examine these constructs. Bridgett, Oddi, Laake, Murdock, & Bachmann (2013) demonstrated that effortful control and executive functioning are strongly associated and overlapping constructs. Yet, this study's results indicated that effortful control is related to the executive function of updating/monitoring information in working memory, but not inhibition. While both are related to substance use, it is unclear the extent to which effortful control and executive function represent unique mediating factors in understanding substance use risk. As such, examining both when considering additional variables such as parental support of autonomy would aid in parsing out this relation.

Summary of Past Research

In general, existing research indicates that more autonomous motivation orientations are associated with lower levels of problematic drinking (Nguyen & Neighbors, 2013). Effortful control has also been shown to mediate the relation between academic self-regulatory styles and substance use in adolescents and has shown independent associations with youth outcomes (i.e., substance use and academic performance; Wong 2008; Wong & Rowland, 2013). Parental support of autonomy has been associated with academic self-regulatory styles and indirectly associated with youth outcomes (i.e., substance use and academic performance; Wong 2008). Lastly, both working memory and inhibition are associated with substance use (Nigg et al., 2006; Tarter et al., 2003), however, executive function and its association with substance use is inconclusive (Wilens et al., 2011).

While extensive research has been completed, gaps are still noted in the literature. Prior research that has examined parental styles and scaffolding showing significant effects in

predicting adolescent risk behaviors, including substance use (Chan & Koo, 2010; Hammond et al., 2012). Further, autonomy orientation has been linked to a number of outcomes in adulthood, including substance use problems. However, minimal research has examined the role of youth autonomy and the parent's facilitation of this with regard to substance use risk. Further, to date, no research has examined global autonomous functioning in youth (compared to context dependent self-regulation). Additionally, self-regulation has been associated with effortful control in youth (Wong, 2008). However, this research is minimal.

While autonomy support has been associated with improved executive function, limited research has examined the relationship between executive function and autonomous orientation (e.g., Susic-Vasic et al., 2015). One study reported that impaired executive function was associated with impairment in motivation (Carlson et al., 2002), though motivation was measured more broadly and thus the findings might not be relevant for autonomous orientation (Carlson et al., 2002). Thus, to date, there is limited research examining how these factors relate to each other concurrently. Given the lack of research looking at self-regulation factors simultaneously, this area has very little research done and is somewhat exploratory in nature in determining if any one facet is more impactful compared to others. Lastly, while some studies have suggested that executive functioning and effortful control are the same construct, yet the terminology has arose through different fields of study, other studies have argued that they are related yet distinct. Bridgett and colleagues (2013) found that effortful control was related to updating/monitoring in working memory but not inhibition. Similarly, Blair et al (2007), suggested that self-regulation accounted for academic performance independent of intelligence of inhibitory control. Yet, research has argued that there is a high overlap between definitions, components, and measurements of effortful control and executive function such that authors

have argued that the distinctions are not “true” (Zhou et al., 2012). Thus, there is a gap in evaluating these constructs together to determine the level of overlap and predictive utility in examining substance use in youth.

The above noted gaps leave some questions to be answered: Does parental support of autonomy influence risk for early onset of substance use? For instance, does low parental support of autonomy increase the risk for substance use and is this relationship mediated by youth autonomous functioning? To what extent do other facets of self-regulation (i.e., effortful control and executive functioning) mediate the relation between parental support of autonomy and youth substance use? Relatedly, which factors of self-regulation most strongly influence this relation? Lastly, do these mediated effects differ across gender?

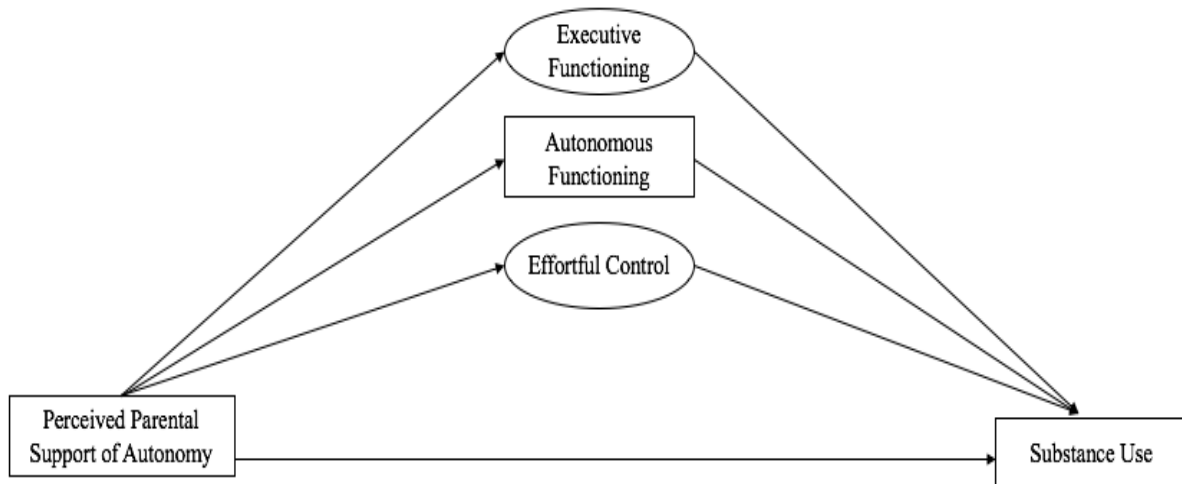
Overview of the Current Study

The aims of the current study were to (1) examine the relationship between parental support of autonomy and adolescent substance use as mediated by youth autonomous functioning, executive function, and effortful control, (2) examine the correlations between the mediators: autonomy of behavior, effortful control, and executive function, and (3) conduct an exploratory analysis examining gender differences in the mediated effects.

It was hypothesized that higher levels of perceived parental support of autonomy would be significantly associated with decreased substance use in youth. This relation would be mediated by greater autonomous functioning, effortful control, and executive functions. It was predicted that all aspects of self-regulation would be associated with substance use, with lower scores representing greater risk. Given the exploratory nature of examining gender differences, it was unclear the extent to which the models would differ across groups.

Figure 1

Proposed Model to Examine the Mediated Effects of Executive Functioning, Autonomous Functioning, and Effortful Control in Youth on the Association between Perceived Parental Support of Autonomy and Youth Substance Use.



Chapter 2: Methods

Participants and Design

Participants were recruited via a flyer that indicated participation in a “Self-Control & Health Online Study” which was posted on social media and in schools and clinics, nationally. Data were collected from youth-caregiver dyads across the U.S.. Eight hundred thirty-one parents expressed interest in the study (738 community individuals, 93 SONA students; See Table 1). Of these 831 parents, 157 youth entries were completed, and 128 participants were retained in the final sample ($M_{age} = 15.2$, $SD = 1.8$, See Table 1). Youth entries were not included if the entered ID number did not match that assigned (e.g., missing, not valid), if data were missing on all variables, or if repetitive responses were noted across items. Youth completed surveys on the internet. They were asked questions on perceived parental support of autonomy, self-regulatory style, effortful control, history of substance use and demographic variables. Youth also completed a number of computer-based executive function tasks. Predictor variables included parental support of autonomy. Mediator variables include effortful control, executive functioning, and autonomous functioning. All factors were investigated in their relation to substance use (outcome variable). There was no manipulation of variables due to the nature of the design.

Importantly, while data were recruited nationally, a disproportionate amount of the sample was comprised of SONA participants from Idaho. As such, parents were at least some college level education, from a rural state, and parents themselves received compensation where youth were only entered into the raffle. These factors may have influenced youth motivation and effort when participating as they were not being directly rewarded. Access to substances is likely different for a rural state where differences in legality of substances (e.g., marijuana) is more

restrictive. Lastly, parenting characteristics may be different given their education where parental monitoring, responsiveness, and support for autonomy may be different compared to parents with different educational levels. As a result, approximately 1/3 of the data may represent a unique subset of the population (e.g., rural, higher education).

Power

MacCallum and colleagues' method (MacCallum, Borwne, Sugawara, 1996) was used to determine appropriate sample size. This method considers the statistical power of the data to identify an overall good fit of a theoretical model in structural equation modeling using the root mean error of approximation (RMSEA). A test of close fit compares a null model with a RMSEA of .05 and an alternative model with a RMSEA of .08 (Hu & Bentler, 1995). A test of not close fit indicates the model does not fit the population, and a test of exact fit suggests the only error present is related to sampling error (MacCallum et al., 1996). The target sample size was estimated using a statistical power of .80 indicating that if the null hypothesis is false, there is 80% probability the null hypothesis will be appropriately rejected.

The proposed model included two latent variables; each is estimated by three observed indicators. Age, ethnicity, and academic achievement were controlled for in analyses. Given that research has suggested differences in prevalence of externalizing problems across gender (Leadbeater, Kuperminc, Blatt, & Hertzog, 1999), a group comparison was utilized in analyses. As such, there were 156 unique pieces of data. Forty-seven parameters were estimated in the model (10 paths per group, three disturbances, six error terms, three correlations between mediators, and six factor loadings per group). The disturbances, correlations among mediators, and error terms were not expected to differ across group. With 156 pieces of data and 47 estimated parameters, the study model was estimated to have 109 degrees of freedom. Based on

the method to MacCallum et al., (1996) outline, a *df* of approximately 100, and a sample size of 132 would yield a power of .80 for a test of close fit. Thus, this author intended to collect data from at least 132 students. While this was met, the final sample fell slightly short in order to maintain integrity of the data, and thus analyses were completed underpower.

Materials

Support of Autonomy

The Perceived Parental Autonomy Support Scale (P-PASS; Mageau et al., 2015; Appendix A) includes 24-questions that examine youth's perception of autonomy support across a range of behaviors including choice, rationale for demands and limits, acknowledgement of feelings, threats of punishment, performance pressures and criticisms that induce guilt in the youth. The P-PASS is rated on a 7-point scale (1 = *do not agree at all*, 7 = *very strongly agree*). Two broad scales are identified: Autonomy-Support (offering choice within limits, explaining reasons behind demands, being aware of and accepting child's feelings) and Psychological Control (threatening to punish the child, inducing guilt, encouraging performance goals). The measure has been shown to be valid and reliable with high internal consistency ($\alpha > .89$) and convergent validity with measures of the same construct (Mageau et al., 2015). The current study's Cronbach alphas ranged from .82 to .93, indicating good internal consistency.

The P-PASS ale provides two composite scores. Autonomy support is the composite of primary interest and is composed of offering choice within certain limits, explaining the reasons behind demands, rules, and limits, and being aware of, accepting, and recognizing the child's feelings subscales. Psychological control is derived from threatening to punish the child, inducing guilt, and encouraging performance goals subscales. Each broad composite score is computed by averaging all subscales within the composites. While psychological control could

be reverse-scored and averaged to compute a single composite that represents autonomy support, it is theorized that both autonomy and control are two separate factors, thus research examines them as distinct constructs. For the purpose of this research, autonomy support was the primary variable used in analyses. Scores on this subscale can range from 12 to 84.

Autonomous functioning

The Index of Autonomous Functioning (IAF; Weinstein, Przybylski & Ryan, 2012; Appendix B) measures autonomy based on three theoretically driven subscales examining self-congruence, interest-taking, and low susceptibility to control. The IAF is a 15-item self-report questionnaire rated on a 5-point scale (1 = *not at all true*, 5 = *completely true*); the range of the scale is from 15 to 75. The scale has been shown to be valid and reliable and has a coherent factor structure (prior Cronbach alphas ranging .53–.90), strong predictive ability, and correlations with other measures that are believed to measure similar constructs (Weinstein, Przybylski & Ryan, 2012). The current study's Cronbach alphas ranged from .62 to .82, indicating questionable to good internal consistency.

Self-regulatory styles

The Academic Self-Regulation Questionnaire (SRQ-A; Ryan & Connell, 1989; Appendix C) is a 32-item measure that assesses reasons why children do their school work. Responses are rated on a 4-point scale (4 = *very true*, 1 = *not at all true*); the range of the scale is 32 to 128. Four scales are derived: external regulation, introjected regulation, identified regulation, and intrinsic motivation; a relative autonomy index can be determined by computing a weighted average of all the scales. Psychometric studies have shown high internal consistency across scales (prior Cronbach alphas ranging from .62 to .82). The current study's Cronbach alphas ranged from .74 to .92, indicating good internal consistency.

The Index of Autonomous Functioning derives scores in authorship/self-congruence, susceptibility to control, and interest-taking subscales. To determine the index of autonomous functioning score, the five reverse-scored items and the other 15 items are averaged. Given that the index of autonomous Functioning has not been used in adolescents younger than 17, the total autonomous functioning score was compared to the Academic Self-Regulatory autonomous functioning score. To determine the autonomous functioning score of the academic self-regulatory style, the average of all subscales (external regulation, introjected regulation, identified regulation, and intrinsic motivation) is computed, and a weighted average is derived across scales ($2 \times \text{intrinsic} + \text{identified} - \text{introjected} - 2 \times \text{external}$).

Effortful Control

Effortful control was be evaluated using the Early Adolescent Temperament Questionnaire-Revised (EATQ; Ellis & Rothbart, 2001; Appendix D). The questionnaire is self-report and assesses temperament and self-regulation across activities (e.g., I have a hard time finishing things on time). Three subscales are calculated: attention, inhibitory control, and activation control. Six items loading onto attention focusing/shifting, five items pertaining to inhibitory control, and five items comprising the activation control subscale. Youth rate these questions on a 5-point scale of 1 (almost always untrue) to 5 (almost always true). Validation and reliability studies showed that for all scales maintained in the measure, prior coefficient alphas ranged .64–.81, and exploratory factor analyses of the temperament scores highlighted four clear factors, including effortful control. With the exception of shyness and inhibitory control, convergence with parent-report was high (Capaldi, & Rothbart, 1992). The current study's Cronbach alphas ranged from .58 to .83, indicating variable internal consistency (poor to good).

The EATQ provides scores within temperament scales (activation control, affiliation, attention, fear, frustration, high intensity pleasure/urgency, inhibitory control, pleasure sensitivity, perceptual sensitivity, and shyness) and behavioral scales (aggression and depressive mood). The average of attention (scores ranging from 6 to 30), inhibitory control (scores ranging from 5 to 25), and activation control (scores ranging from 5 to 25) subscales were calculated and used as observed indicator of the latent variable of effortful control. Higher scores are indicative of an individual that is high on that trait.

Executive function tasks

One type of executive function was measured: Inhibitory control. Inhibitory control includes being able to voluntarily inhibit a dominant response as well as an individual's ability to ignore irrelevant stimuli. For the purpose of this study, only inhibition was examined, as it has been related to substance use and demonstrates less overlap with effortful control (Bridgett, Odi, Laake, Murdock, & Bachmann, 2013). Given that all mediators were examined simultaneously, looking at an executive function that is proposed to be most distinct from effortful control limited multicollinearity among variables.

Stroop task. One measure of inhibitory control included a color-word interference task. The Stroop task (Stroop, 1935) involves cognitive inhibition of overlearned reading responses and has been normed on individuals from 12-years to 60-years of age (Jensen & Rohwer, YEAR). A modified version of the Stroop task was administered through PsyToolkit (Stoet, 2010; Stoet, 2017) where a series of color words were presented on the screen in incongruent ink colors (e.g., the word red printed in blue colored ink). One-hundred trials (which has been previously used in both adult and child samples; Barkley 1991; Scarpina & Tagini 2017) was used in the current study. Participants were instructed to provide the color of the word rather than

reading the word by selecting “r” for red, “g” for green, “b” for blue, and “y” for yellow.

Number of errors on the incongruent trials was used in the analyses and lower scores are suggestive of better performance.

This measure has been shown to be both valid and reliable. Factor analysis has identified three distinct factors including color-naming, interference factor, and speed factor (Jensen, 1965). While the interference factor cannot be reliably assessed by a single administration, it shows high reliability (.93) as a composite of at least 10 administrations (Jensen, 1965). This test has also demonstrated construct validity, correlating with other measures of executive function and where individuals who performed more poorly on the Stroop generally had left hemisphere or diffuse brain injuries (Homack & Riccio, 2004).

The current study indicated a mean response time of approximately 90 seconds across compatible and incompatible trials. This was comparable with an average response across experimental and control trials of 86 seconds indicated in prior research (Stroop, 1935).

Flanker task. The second measure of inhibition included the Flanker Task (Eriksen & Eriksen, 1974). In this task, participants saw five letters at a time and were asked to respond to the middle letter. If the middle letter is an X or C, then the individual was instructed to hit the A button, and if the letter in the middle is a V or a B, they selected the L button. Two hundred forty trials were used in the current study, consistent with prior research (Huyser et al., 2011). For the purpose of this study, number of errors on the incongruent trials was the variable used in the analyses with lower scores suggestive of better performance.

This task has shown moderate test-retest reliability (mean practice effect = .79), has been positively associated ($r = .52$) with other validated measures of inhibition (i.e., D-KEFS), suggesting convergent validity and has shown discriminant validity with low correlations ($r =$

.06) on measures that do not assess inhibition (i.e., PPVT-4; Zelazo et al., 2015). Thus, the flanker task appears to be an adequate measure of inhibition.

Prior research indicated error rates between 5-7% (or 93-95% accuracy) and response times between 405 ms to 423 ms (Eriksen & Eriksen, 1974). The current study indicated notably slower response times with means across congruent and incongruent trials at 691 ms and 713 ms, respectively. Accuracy indicated a generally poorer performance compared to prior research with a mean accuracy around 70%.

Go/no go task. The last measure of inhibition was measured by the Go/No Go Task (Verbruggen & Logan, 2008). In this task, participants were instructed to press the space bar when a “go” stimulus appears, within 2 seconds, and to inhibit responding when a “no go” stimulus appears. In this task, number of commission (i.e., hitting the button when told to refrain) errors on no-go trials was the measure of inhibition. Thus, higher scores are indicative of poorer inhibition abilities. Three blocks of 64 trials (192 trials) were used in the current study, consistent with the task developers (Verbruggen & Logan 2008). Research comparing the go/no-go task to other measures of response inhibition (i.e., stop-signal task) showed no significant differences ($p = .12$) between the two reaction time measures (Zheng, Oka, Bokura, & Yamaguchi, 2008), suggesting convergent validity. Additionally, research has shown divergence of the go/no-go task where low associations are present when compared to tests of IQ (Schulz et al., 2007). Taken together, it is suggested that the go/no-go task has support for convergent and discriminant validity.

The current data indicated a somewhat lower mean accuracy (86%) compared to prior research (96%). Additionally, the mean response time in the current study was longer (616.3 ms) compared to prior research (559 ms; Verbruggen & Logan, 2008).

Substance use

A portion of the Washington State Healthy Youth Survey (HYS, 2014; Appendix E) was used to measure onset and frequency of alcohol and drug use. Seven items assess frequency of substance use in the last 30 days. These questions were modified to also consider lifetime use. Two questions were used to assess heavy alcohol/drug use across lifetime and within the last 2 weeks. Four items asked about age of onset across a variety of substances. Two checklist questions assessed problems related to substance use for the past year and lifetime. Two questions were added to assess amount consumed on a typical drinking/drug use episode. One question was added to assess number of binge drinking episodes within the last year.

The Healthy Youth Survey has shown moderate to high levels of test-retest reliability for over 90% of the items within the measure. Items with inadequate reliability were for behaviors with low-prevalence (e.g., cocaine use). The measure's validity has been suggested across six studies where reported data are congruent with age and gender base-rates expected nationally (HYS, 2014).

Dependent variables for substance use primarily included problems associated with substance use, frequency of use, and consumption amount. Problems associated with substance use were treated as count variables (number of problems endorsed). Frequencies of use were considered ordinal variables (where 1 = *none* and 5 = *10 or more times/days*). Amount of consumption was treated as a continuous variable. Each category of substances were examined separately (i.e., alcohol, cigarettes, marijuana, illegal substances, prescription drugs).

Demographics

A 6-item demographics questionnaire (Appendix F) was used to assess gender, age, grade, ethnicity, religiosity, and family income.

Procedures

Families were recruited through Facebook, Craigslist, and flyers dispersed within Idaho schools, consistent with a convenience sample. Parents who were interested followed a link noted on the flyer to access the consent form on Qualtrics. They were prompted to provide their youth's email address for questionnaires to be dispersed. Parents who had follow-up questions were encouraged to contact the primary researcher prior to giving consent. Once consent was completed, youth were contacted to provide assent and complete questionnaires and executive functioning tasks. Youth in the community who participated were provided with a \$5 or \$10 amazon gift card (depending on when they signed up for the study). SONA participants received 3 credits. All youth were entered into a raffle for a chance to win a \$75 Amazon gift card.

Analytic Plan

Structural equation modeling (SEM) was used to analyze the data. As SEM takes a confirmatory approach to data analyses and tests how well the data fits a theoretical model. MPlus (Muthén, & Muthén, 1998) uses the maximum likelihood method to estimate the parameters. In this process, an estimated covariance matrix is compared to the observed covariance matrix (the data) to see if the matrices are similar. If they are, the program stops. If they are not, the system adjusts the first guess and checks again. If these matrices are similar prior to the maximum allowed iterations, then the model based on the data and the theoretical model converge. Prior to examining the proposed model paths, measurement models were determined. The latent factor of executive function was estimated by: Flanker task, Go/No go task and Stroop Task error scores. The latent factor of effortful control was estimated by activation control, inhibitory control, and attention scores determined by the Early Adolescent Temperament Questionnaire. Model fit was examined using the chi-square goodness-of-fit

statistic and incremental fit indices. Standard cutoffs for incremental fit indices are .90 for an adequate fit, and .95 for an excellent fit (Hu & Bentler, 1999). Values equal to or less than .06 on the RMSEA are indicative of excellent fit (Hu & Bentler, 1999).

A structural model was run to examine relations among the variables. In the first hypothesized model, the *a* path is the effect of perceived parental support of autonomy on youth executive function, the *b* path is the effect of youth self-regulation (i.e., executive functioning, autonomous functioning, and effortful control) on substance use controlling for perceived parental support of autonomy, and the *c*' path was the effect of perceived parental support of autonomy on youth substance use while controlling for youth executive functioning. Since substance use variables (cigarette, alcohol and marijuana use in the last 30 days) were count variables, the structural model was run treating the dependent variable as such. Rather, log likelihood values between nested models were compared to identify if models differed significantly. If the difference between log likelihoods was significant when comparing the chi square cut off, the larger model was utilized; whereas if the difference was not significant, the more parsimonious model was favored. Effects of gender were controlled for but interaction between gender and predictors via group comparisons were not estimated due to limited power.

Outcome variables (i.e., frequency of alcohol use, cigarette use, and marijuana use in the last 30 days) are count variables. Thus, traditional model fit indices could not be calculated. Instead, log likelihood (LL) was used to indicate the overall model fit. Models were compared with each other using the deviance statistic ($-2 \times$ the difference in the LL of two models). Non-significant paths were fixed at 0 to improve the overall model fit. The best fitting model for each type of substance was compared with models that unconstrained a fixed path (i.e., allowing a path held at 0 to correlate with variables in the models). These models were compared to the

best-fitting model by the difference in their log likelihood (LL), a measure of an overall model fit. As $-2LL$ has a chi-square distribution, the models were compared by a chi-square test with 1 degree of freedom. If $-2LL$ of the two models exceed the critical value for a chi square test of significance at 1 degrees freedom difference (3.84), the models are considered different, and the more complex model (the model with the path freely estimated) should be selected. However, if $-2LL$ of the two models are not significantly different from one another, the more parsimonious model (i.e., the model with the paths fixed at 0) must be accepted.

Chapter 3: Results

Descriptive statistics and recruitment data were presented in Table 1. One hundred twenty-eight participants were in the final sample. Normality of the variables was examined using skewness and kurtosis statistics, histograms, P-P plots, and detrended plots. Skewness is a measure of lack of symmetry in a variable's distribution; whereas, kurtosis examines the "peakedness" of the data (Kim, 2013). In a normal distribution, skewness and kurtosis are zero, so variables close to being normally distributed have skewness and kurtosis scores close to zero. A z-score was computed to determine if skewness and kurtosis was significantly different from a normal distribution. Skewness/kurtosis values were divided by their respective standard errors and compared to a cut-off of 1.96 (or -1.96 ; Kim, 2013). IAF, as well as all executive function variables showed significant skewness/kurtosis. IAF, Go No Go Tasks, Stroop Task, and Flanker task error variables were most improved by square root transformation. All other major variables have skewness and kurtosis z-scores that fell below 1.96 (see Table 2).

Given that, even after transformation, some variables were significantly skewed or had significant kurtosis, the assumption of multivariate normality for continuous variables is likely violated. However, SEM is relatively robust to violation of normality and therefore, SEM is still appropriate for the data (Chou & Bentler, 1995). There were some missing data in the analyses. All data were missing at random (i.e., data were missing due to other factors, not the variables that have missing data; Enders, 2010; Little & Rubin, 2002; Rubin, 1976). Missing data were estimated using full information maximum likelihood in the SEM analyses.

Table 1*Recruitment and Demographic Data*

Child Gender	Recruitment		
Male	70	SONA	48
Female	54	Facebook	50
Transgender	1	Other Social Media	3
Gender nonconforming	1	Word of mouth (e.g., friend)	11
Self-Identify	0	School	2
Did not answer	2	Researcher	1
		Did not answer	13
Academic Grade	Child's State of Residence		
7th	10	Idaho	59
8th	24	Alabama	1
9th	31	California	9
10th	15	Virginia	3
11th	29	Pennsylvania	3
12th	15	Arizona	9
Did not answer	4	Kentucky	1
		Texas	5
Ethnicity		Minnesota	1
Asian	3	Illinois	1
African American	18		
Native American/Alaskan			
Native	3	Massachusetts	2
White/Caucasian	95	Wisconsin	1
Mexican	3	Missouri	1
Multiracial	2	Florida	1
Did not answer	4	Georgia	1
		Washington	1
Religious Affiliation		Maryland	1
Non-religious	55	Michigan	4
Agnostic	2	Nebraska	1
Catholic	18	Did not answer	23
Christian	28		
Lutheran	3		
Methodist	2		
LDS	17		
Buddhist	1		
Did not answer	4		

Table 2*Skewness and Kurtosis Statistics for Predictor and Mediating Variables***Untransformed Variables**

	Skewness			Kurtosis		
	S Statistic	S Error	Z-Score	K Statistic	K Error	Z-Score
Go/No Go Commission Errors	1.35	0.27	5.02	0.42	0.53	0.79
Flanker Errors (Incongruent Trials)	1.06	0.27	3.97	-0.38	0.53	-0.71
Stroop Errors (Incongruent Trials)	0.62	0.27	2.33	-1.49	0.53	-2.81
Autonomy Support	-0.11	0.22	-0.52	-0.75	0.43	-1.77
Activation Control	0.02	0.22	0.09	-0.37	0.43	-0.87
Attention	0.13	0.22	0.62	-0.50	0.43	-1.16
Inhibitory Control	-0.14	0.22	-0.65	-0.20	0.43	-0.46
Index of Autonomous Functioning (IAF)	0.74	0.22	3.46	0.45	0.43	1.06

Square Root Transformed Variables

	Skewness			Kurtosis		
	S Statistic	S Error	Z-Score	K Statistic	K Error	Z-Score
Go/No Go Commission Errors	0.63	0.27	2.34	-0.67	0.53	-1.25
Flanker Errors (Incongruent Trials)	0.48	0.27	1.81	-0.91	0.53	-1.72
Stroop Errors (Incongruent Trials)	0.34	0.27	1.28	-1.55	0.53	-2.92
Index of Autonomous Functioning (IAF)	0.56	0.22	2.61	0.14	0.43	0.34

Cronbach alphas of the SRQ-A, EATQ, IAF, and P-PASS were generally consistent with prior studies. Effortful control's Cronbach alpha was .83. Within the perceived parental support of autonomy scale, autonomy support's Cronbach alpha was .93. On the Index of Autonomous Functioning, the IAF Cronbach alpha was .63.. All Cronbach alphas are reported in Table 3.

Table 3*Cronbach Alpha Scores across Subscales of Predictor Variables*

Autonomy Support	.93
Offering choice	.90
Explaining reasoning	.85
Recognizing feelings	.82
Effortful control	.83
Activation Control	.69
Attention	.67
Inhibitory Control	.58
IAF	.63
Authorship	.82
Susceptibility	.62
Interest	.71

Substance use was endorsed by about 25% of individuals in the current sample with alcohol being the most frequently endorsed followed by cigarettes and marijuana/hashish. These three substances, given their higher frequency of endorsement were the three substances tested in the analyses (see Table 4). Specifically, variables were frequency of cigarette use in the past 30 days, frequency of alcohol use in the past 30 days, and frequency of marijuana use in the past 30 days.

Table 4*Substance Use Endorsement Over the Past 30 Days*

Cigarettes	
% denied use	71.9
% endorsed use	25.8
Alcohol	
% denied use	68.8
% endorsed use	29.6
Marijuana/ Hashish	
% denied use	78.1
% endorsed use	20.3
Illegal drug	
% denied use	81.3
% endorsed use	17.1
Use a pain killer to get high	
% denied use	81.3
% endorsed use	17.1
Prescription Drugs	
% denied use	78.9
% endorsed use	18.8

A correlation matrix was used to examine the correlations between variables of interest and demographic variables (Table 5a–5c). Gender (male = 1; female = 2) and ethnicity (nonwhite = 0; white = 1) variables were dichotomized in order to control for these variables in analyses. In addition to relations amongst variables of interest with demographic variables, correlations amongst executive function variables were examined and were inconsistently correlated. The proposed latent factor indicators (Flanker and Stroop interference scores, and Go/No Go commission errors) were not significantly correlated with each other (r range: $-.27$ to $-.26$, p range: $.02$ – $.81$). Only Commission errors and the Stroop interference score were significantly correlated. Accuracy variables (Go/No Go accuracy and Flanker and Stroop accuracy on incongruent trials) were significantly correlated with each other at $p < .01$ (r s = $.45$ – $.78$). Error

variables (Go/No Go commission errors and Flanker and Stroop errors on incongruent trials) significantly correlated ($ps = <.01-.02$; $rs = .26-.71$). Given weak correlations with the proposed latent indicators and prior research suggesting concern with the interpretability of interference scores (Papp et al., 2020), Go/No Go commission errors and Flanker and Stroop errors on incongruent trials were examined in the final analyses as a latent construct for executive function. Specifically, given the use of error variables, higher scores indicate higher disinhibition (or poorer inhibition). When considering variables used in structural models, effortful control subscales significantly correlated with each other, and disinhibition error terms significantly correlated with each other. In addition to these considerations for latent constructs, autonomy support was significantly associated with IAF, effortful control subscales, frequency of cigarette use in the past 30 days, and frequency of alcohol use in the past 30 days. Disinhibition and effortful control variables inconsistently correlated with substance use variables. IAF significantly correlated with frequency of alcohol use and marijuana use in the past 30 days (see Table 5c).

Table 5a*Correlations between Predictor and Mediator Variables and Demographic Variables*

	Child Gender ^a	Child Age	Grade	Ethnicity ^a	Income
Autonomy Support	-.09	-.14	-.02	.17	.09
Activation Control	.01	-.04	-.03	.01	.13
Attention	-.04	-.05	.03	.20*	.25**
Inhibitory Control	.02	-.09	.04	.28**	.02
Effortful Control	-.01	-.07	.02	.19*	.16
IAF	.08	.01	.14	.30**	.01
Stroop Errors Incongruent Trial	.07	-.08	-.06	-.27*	.37**
Go/No Go Commission Errors	.11	.24*	.23*	-.25*	-.40**
Flanker Errors Incongruent Trial	.27*	.26*	.27*	-.21	-.37**

^a Point-biserial correlation

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5b*Correlations between Dependent Variables and Demographic Variables*

	Gender ^a	Age	Grade	Ethnicity ^a	Income
Cigarettes Use (30days)	.16	.19*	.13	-.31**	-.12
Alcohol Use (30 days)	.29**	.31**	.20*	-.49**	-.03
Marijuana Use (30 days)	.26**	.36**	.22*	-.43**	.05

^a Point-biserial correlation

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5c*Correlations between Predictor, Mediating, and Outcome Variables used in Final Structural Models*

	Auton. Support	Activ. Control	Attention	IAF	Inhib. Control	Go/No Go Comm. Errors	Flanker Errors Incong. Trial	Stroop Errors Incong. Trials	Cigarette Use (30 Days)	Alcohol Use (30 Days)
Activation Control	.44**									
Attention	.39**	.67**								
IAF	.49**	.49**	.61**							
Inhibitory Control	.52**	.45**	.55**	.57**						
Go/No Go Commission Errors	-.03	.08	.13	.19	-.08					
Flanker Errors Incongruent Trial	.15	.07	.20	.30**	.07	.71**				
Stroop Error Incongruent Trials	.25*	.17	.42**	.11	.11	.26*	.27*			
Cigarette Use (30 Days)	-.22*	-.04	-.23*	-.16	-.37**	.27*	.21	.08		

Alcohol Use (30 Days)	-.29**	-.14	-.22*	-.20*	-.35**	.35**	.31**	.14	.71**	
Marijuana Use (30 Days)	-.17	-.08	-.15	-.24**	-.33**	.33**	.25*	.19	.53**	.71**

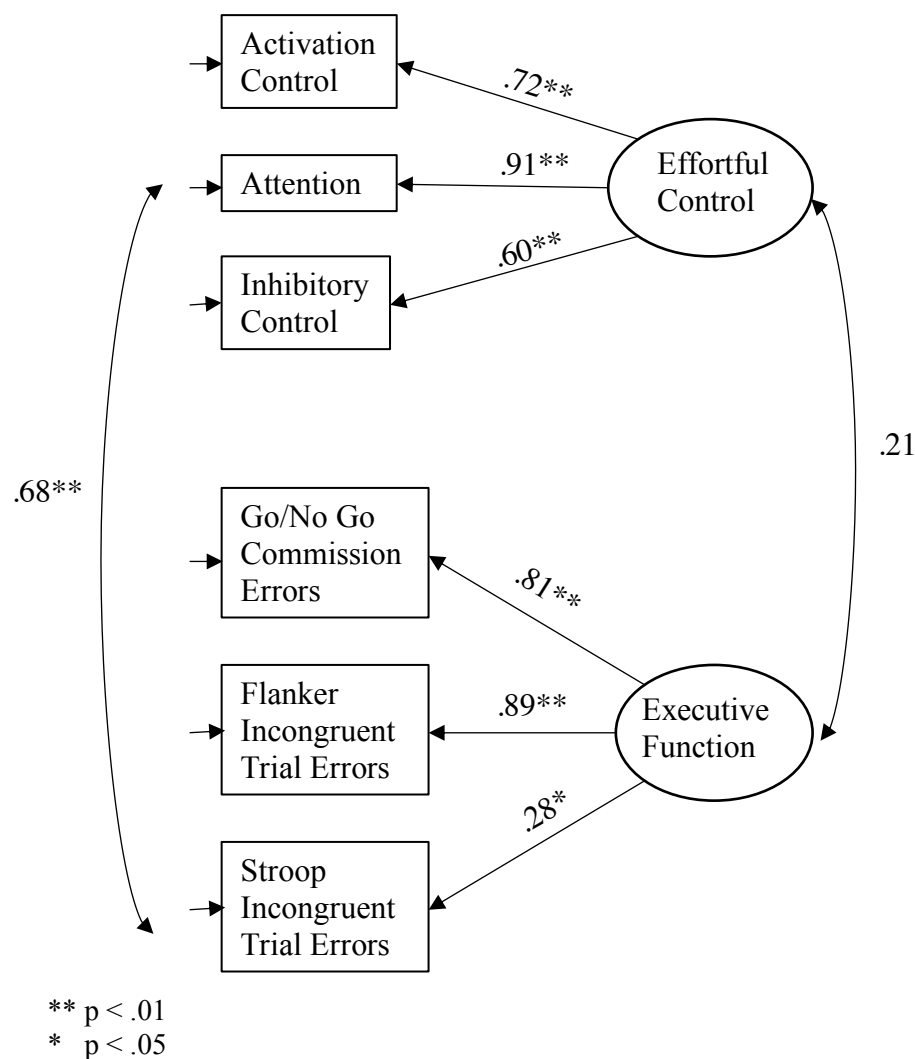
** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Mplus Version 7 (Muthén, & Muthén, 1998) was used to run structural equation modeling (SEM). In all analyses the first parameter in each latent factor was fixed to 1 in order to define the scaling of construct. Prior to examining the relations between parental support of autonomy, self-regulation variables, and substance use, the measurement models of effortful control and executive function were evaluated (Figure 2). Measurement models examined whether the three observed indicators for effortful control (i.e., attention, inhibitory control, activation control) and the three observed indicators of executive function (Commission errors of Go/No Go, and Flanker and Stroop errors on the incongruent trials) measured the factor well. Modification index showed that the error terms of attention and Stroop error variables significantly correlated with each other. This correlation was estimated in the model. Overall, the measurement model fit the data very well, $\chi^2 (7) = 10.44, p = .17$, CFI = .98, TLI = .96, RMSEA = .06

Figure 2

Measurement Model for the Latent Constructs of Effortful Control and Executive Function



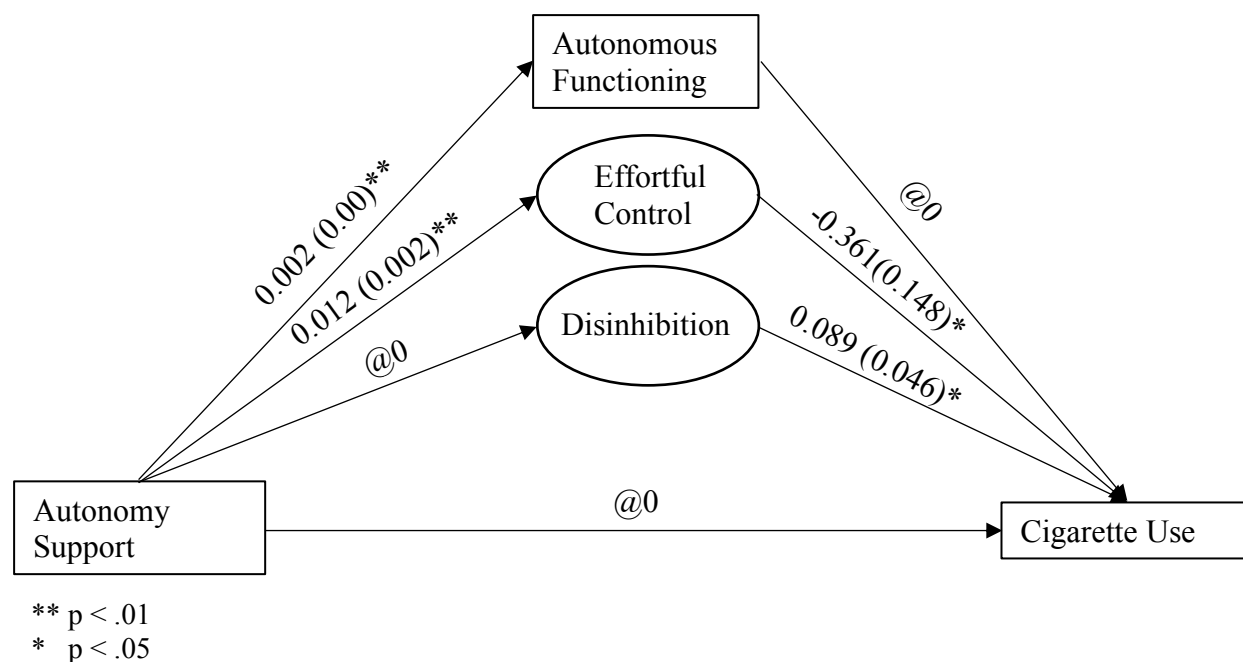
Note. Numbers presented were standardized factor loadings and correlations among variables.

The first structural model examined whether effortful control, disinhibition, and autonomous functioning mediated the relation between autonomy support and cigarette use (Figure 3). The predictor was perceived parental support of autonomy. The mediators were autonomous functioning (observed variable), effortful control (latent construct) and disinhibition (latent construct). The dependent variable was frequency of cigarette use in the past 30 days.

Non-significant paths were fixed to 0 to improve fit (Loglikelihood [LL] = -915.15). Each fixed path was unconstrained and compared with the model presented in Figure 3. First, autonomy support was allowed to predict disinhibition (LL = -915.01). This model was not significantly different from the original model ($\chi^2[1] = 0.29$, n.s.). Following this test, autonomy support was allowed to predict cigarette use (LL = -914.70). When compared to the original model, the -2LL difference was 0.90 and not significant ($\chi^2[1] = 0.90$, n.s.). Lastly, autonomous functioning was allowed to predict cigarette use (LL = -915.14) which was a -2LL difference of 0.02 compared to the original model ($\chi^2[1] = 0.02$, n.s.). None of the models were significantly different from the original model. As such, the most parsimonious model (i.e., the original model) was considered the best model.

Figure 3

Structural Mediation Model Predicting to Frequency of Cigarette Use in the Past 30 Days



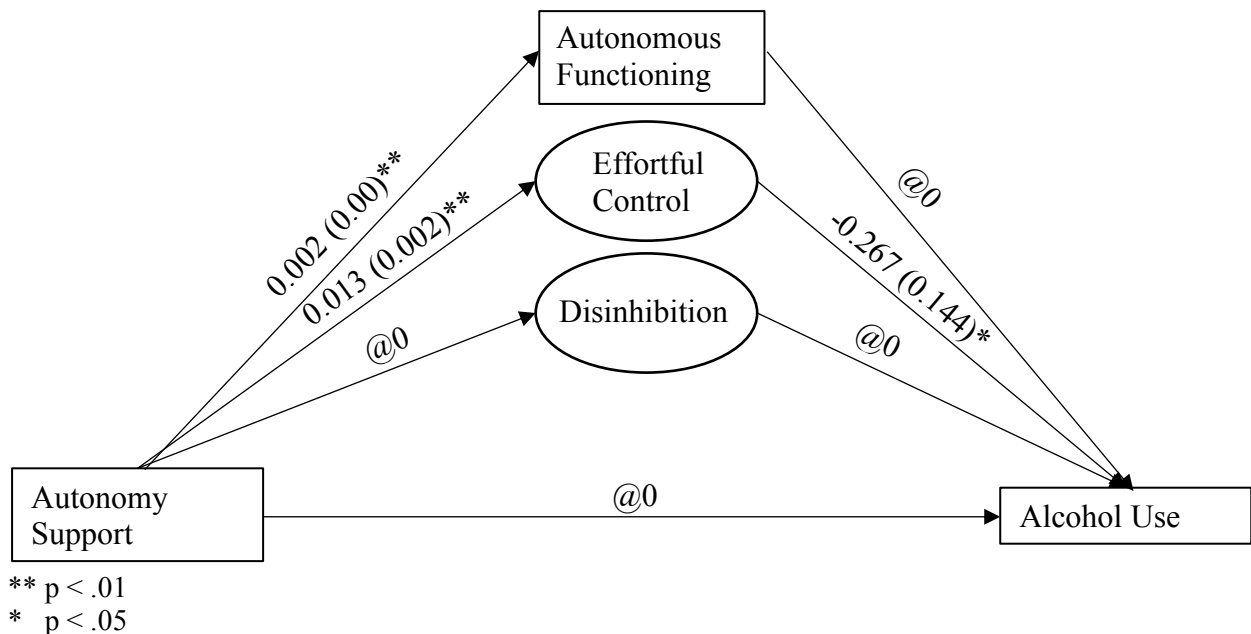
Note. Numbers presented were unstandardized factor loadings with the standard errors in the parentheses.

Considering the most parsimonious model as shown in Figure 3, effortful control significantly mediated the association between autonomy support and cigarette use ($ACI = -0.008, -0.001, p < .05$). As autonomy support increased by 1 standard deviation ($SD = 25.4$), frequency of cigarette use decreased by 11% ($e^{.012*25.4*-0.36}$) via effortful control. Disinhibition was positively associated with cigarette use. Specifically, as disinhibition increased by 1 unit, frequency of cigarette use increases by 9% ($e^{.09}$). Of note, this effect was only significant when considering standardized (compared to unstandardized) betas. Autonomy support also significantly predicted autonomous functioning. As autonomy support increased by 1 SD, the square root transformation autonomous functioning increased by .05.

The second structural model focused on alcohol use. Similar to the first model, non-significant paths were fixed to 0 to improve overall model fit ($LL = -895.55$; Figure 4). Autonomy support was then allowed to predict alcohol use with a model LL of -894.61 with a nonsignificant $-2LL$ difference ($\chi^2(1)=1.88, n.s.$). Then, disinhibition was allowed to predict frequency of alcohol use in the model ($LL = -894.41$) and the $-2LL$ difference was not significantly different from the original model ($\chi^2(1)=2.29, n.s.$). Lastly, autonomous functioning was allowed to predict frequency of alcohol use ($LL = -895.54$) and the $-2LL$ difference was not significantly different from the original model ($\chi^2(1)=0.02, n.s.$). None of the models significantly differed when compared to a chi square significant cut off at 1 degree of freedom. Given nonsignificant comparisons across models, the most parsimonious model (i.e., the original model) was retained.

Figure 4

Structural Mediation Model Predicting to Frequency of Alcohol Use in the Past 30 Days



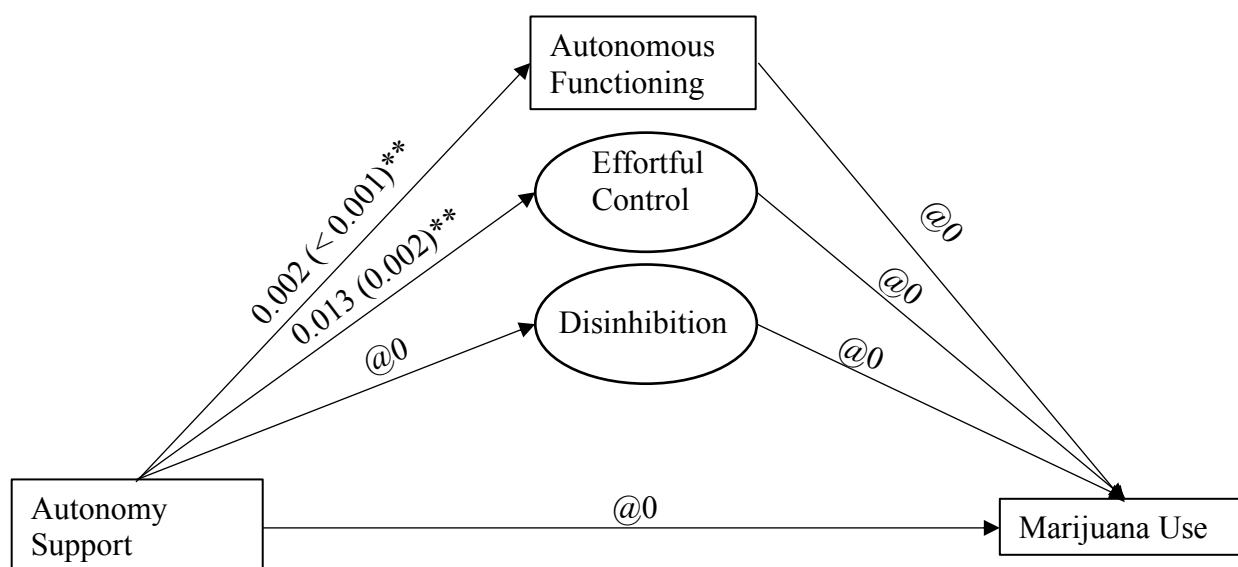
Note. Numbers presented were unstandardized factor loadings. Ethnicity was controlled for in the model.

As shown in Figure 4, higher autonomy support significantly predicting higher effortful control and autonomous functioning. Specifically, as autonomy support increased by 1 SD, square root transformed autonomous functioning increased by .05 unit, and effortful control increased by .33 unit. Higher effortful control significantly predicted decreased frequency of alcohol use when considering standardized (but not unstandardized) betas. As effortful control increased by 1 unit, the expected frequency of alcohol use decreased by approximately 23% ($e^{-0.267}$). Notably, effortful control did not significantly mediate the relation between autonomy support and cigarette use (ACI = -0.007, 0.0001, n.s.).

The third structural model examined the mediation model of autonomy support predicting marijuana use by effortful control, inhibition, and autonomous functioning. Age was significantly associated with the outcome variable and was controlled for in the model. In the most parsimonious model, none of the predictors or mediators were significantly associated with frequency of marijuana use and as such were all fixed to 0s (Figure 5; LL = -853.11). This model did not differ significantly when effortful control (LL = -852.44; $\chi^2(1)=1.33$, n.s.), disinhibition (LL = -852.99; $\chi^2(1)=.23$, n.s.), autonomy support (LL = -852.96; $\chi^2(1)=0.29$, n.s.), or autonomous functioning (LL = -852.20; $\chi^2(1)=1.83$, n.s.) was allowed to predict marijuana use. As such, the most parsimonious model is considered the best model (Figure 5).

Figure 5

Structural Mediation Model Predicting to Frequency of Marijuana Use in the Past 30 Days



Note. Numbers presented were unstandardized factor loadings. Age was controlled for in the model.

Autonomy support significantly predicted both autonomous functioning and effortful control. Specifically, as autonomy support increases by 1 SD, square root transformed autonomous functioning increases by .05 and effortful control increases by .33. Neither predictor nor mediating variables were significantly associated with marijuana use in the last 30 days.

Chapter 4: Discussion

The purpose of the study was to examine how three aspects of self-regulation (autonomous functioning, effortful control and executive functioning) mediate the effect of parental support of autonomy on substance use. The findings support some of the hypotheses. When considering frequency of cigarette use, higher autonomy support significantly predicted higher effortful control which in turn predicted decreased cigarette use. Additionally, increased disinhibition significantly predicted increased cigarette use. However, autonomy support was not significantly associated with disinhibition, nor did it directly relate to cigarette use. When predicting alcohol use, similar patterns were identified where autonomy support significantly predicted higher effortful control and higher effortful control predicted decreased alcohol use, though the mediated effect was not significant. Disinhibition was not significantly associated with alcohol use. In the final model predicting marijuana use, neither the predictor variable nor any mediators was significant. However, greater autonomy support significantly predicted greater autonomous functioning and effortful control.

The current study did not demonstrate a direct significant relation between perceived parental support of autonomy and substance use variables: i.e., after controlling for self-regulation (mediators), autonomy support was not associated with substance use variables. This is inconsistent with prior research where higher levels of parental autonomy predicted decreased substance use (Chilenski et al., 2015); however, it is consistent with prior research examining its relation in mediation models. Specifically, the effortful control mediation model for parental support of autonomy and cigarette use noted significant results which were consistent with prior research (Wong, 2008). Additional studies have also noted effortful control's significant negative relation with alcohol and drug use (Wills et al., 2006; Wong & Rowland, 2013). In the present

study, this relation was implicated for cigarette and alcohol use but not for marijuana use. Further, research by Nigg and colleagues (2006) suggested that poorer response inhibition predicted greater alcohol-related problems and drug use. Such neurobehavioral disinhibition has also been implicated in greater risk for early onset substance use (Tarter et al., 2003). Expanding these findings, the current study indicated poorer inhibition was related to greater frequency of cigarette use (but not marijuana or alcohol use) in the past 30 days. It is possible that differences in disinhibition's relation across substances is related to substance type. Youth with higher disinhibition, such as for youth with ADHD (Gilbert et al., 2004), may self-medicate with cigarette use due to the nicotine (a stimulant). The lack of strong findings may also be related to the type of variable investigated. Prior research predominantly examined substance-related problems and the current study examined frequency of substance use. This issue is discussed in more detail below.

Autonomous functioning (i.e., being the perceived source of one's own actions; Ryan & Deci, 2000b) was significantly associated with perceived parental support of autonomy. Nevertheless, while perceived autonomy support predicted adolescents' autonomous functioning, autonomous functioning was not associated with any substance use variables. This finding is inconsistent with prior research which has suggested more autonomous (i.e., identified) academic self-regulation in youth is significantly associated with decreased drinking-related problems (Wong & Rowland, 2013). In adult samples, motivation orientation (i.e., controlled vs autonomously oriented) was associated with the amount of alcohol consumption within a week (Chawla et al., 2009). Inconsistencies in findings may be due to a number of reasons. First, as noted above, within youth samples, prior research has examined drinking-related problems whereas the current study examined frequency. Given there may be less access to substances for

youth compared to adults, frequency of alcohol use may not differ as widely across individuals of different regulation styles and thus problems or binge drinking on a given occasion may be more appropriate to measure for this population. Further, the measure used to examine substance use (the Washington Health Youth Survey) while based on validated measures is not commonly used outside the national study. As such, comparing the current study's results to prior research using different measures (e.g., Daily Drinking Questionnaire, Mai & Neighbors, 2016; Drinking and Drug History Form for Adults, Nigg et al., 2005; Revised Drug Use Screening Inventory, Tarter et al., 2003) may make it difficult to draw comparative conclusions. Lastly, self-determination theory proposes that youth self-regulation styles can differ across contexts until a more generalized motivation orientation is developed in adulthood (Ryan & Deci, 2000a; Deci & Ryan, 2000b; Deci & Ryan, 2002). It is possible that the general motivation orientation is still developing in adolescence. The relations between self-regulation styles and other variables may be more difficult to detect.

Collectively, the current study adds to prior research by (1) examining autonomous functioning broadly in adolescents compared specific contexts as noted with prior research (e.g., Wong, 2008) and (2) considering multiple aspects of self-regulation simultaneously to identify unique contributions of each mediator in assessing substance use risk. Parent support of autonomy's association with both autonomous functioning and effortful control is consistent with self-determination theory where external conditions that promote competence, relatedness, and autonomy (e.g., parental support and scaffolding) enable individuals to become more autonomous and intrinsically motivated (Ryan & Deci, 2000b). Here, supportive parents likely provide youth the opportunity to problem-solve and learn appropriate ways to navigate their environment. As a result, youth develop a sense of efficacy and control in their environment and

over their behaviors. Autonomy support did not directly predict substance use. Given that parental factors are most influential when youth are younger and past research has suggested adolescents are more influenced by peers (Mrug & McCay, 2013), during adolescence it is possible that peers are more of a direct influence on substance use compared to parents. Rather, parental factors such as support foster the internalization of youth self-control which influence their behavior. It then stands to reason that exploring the moderated effect of social groups within this mediation model would be beneficial in understanding a youth's risk and protective factors within their environment.

Interestingly, while effortful control predicted both cigarette use and alcohol use, which was consistent with prior research, none of the self-regulation factors as measured in this study were associated with marijuana use. Prior research examining self-regulation and marijuana use and related problems have suggested that both emotional and behavioral self-control predict use and marijuana-related problems in adults (Dvorak & Day, 2015). Dvorak & Day (2015)'s findings were consistent with another study research examining how behavioral and emotional self-control affect alcohol, marijuana, and tobacco use (Wills et al., 2006). However, Wills and colleagues defined substance use as a latent factor with all three substances as indicators, so it is unclear the extent to which marijuana use individually was related to self-control. Moreover, given that accessibility to marijuana will differ by state due to differences in legality, it is possible that current results are influenced by the data being primarily collected from Idaho where accessibility is restricted (as marijuana is illegal in the state) compared with other areas in the U.S. Such restriction of accessibility and variability by state might have made it difficult to detect an effect. Nevertheless, prior research suggests that self-control predicts marijuana use which is inconsistent with the present study. It is possible that behavioral and emotional self-

control are stronger predictors of substance use compared with cognitive elements of self-control. As this study predominately measured cognitive aspects of self-regulation, the discrepancy in findings may have to do with the type of self-control being measured. Further, marijuana may be more difficult to obtain in some areas compared to tobacco and alcohol. The current study, while having similar endorsement of use rates across all three substances, had lower frequency reported for marijuana use. It is possible that this reduced frequency made it difficult to detect relations between marijuana use and other variables in this study. Of note, this is the first time such patterns have been found, and therefore replication is needed in future research.

One final consideration regarding patterns of results in the current study includes the timing in which data was collected. The majority of the data in the current study was collected during the COVID-19 pandemic. It is unclear at this point how the pandemic may have impacted the results. A few considerations should be noted. First, shifts in typical parenting may have occurred related to stress from the pandemic, where parents may have increased supervision/monitoring or were more controlling related to stress. Alternatively, less supervision in some households may have occurred due to fluctuating school schedules. When considering access and opportunity to use substances, adolescents were not gathering with peers and thus access and opportunity may have been restricted.

Limitations

The current study offers important additions to the current literature; however, it is not without limitations. First, given noted concerns with recruitment (e.g., predominantly ID sample with parents in higher education) results of this study may not generalize to other samples. Additionally, after data cleaning procedures, the sample size was smaller than intended, and

analyses were likely underpowered. Thus, results may be unstable (e.g., larger standard errors), and potential significant associations may not have been detected. Future research should aim to attain an adequately powered sample with minimal missing data. Further, in the final sample, some Cronbach alpha scores were in the poor to questionable range indicating less stable internal consistency of some subscales. This could produce less reliable/stable results as well.

Additionally, given that the study was completed online, no behavioral observations of effort/attention were obtained. As such, data on executive functions may not be as accurate compared to lab-based administration. This may have occurred due to lower control for environmental distractions and inability to determine if participants understood instructions. Future research could consider in-person administration of assessments. Additionally, attention checks to assess data quality should be included if surveys are completed on the internet. The study was correlational, and therefore casual relations between variables cannot be assumed. Future studies may consider experimental manipulation of variables in order to more accurately establish causality. Further, the study was cross-sectional, resulting in an inability to establish temporal relations. As noted above, instead of parental support of autonomy influencing self-control, it is possible that increased parental autonomy support is due to higher self-control among some adolescents. Longitudinal designs following youth from early childhood through adolescence may better assess the temporal relations between parental support of autonomy and aspects of self-control.

Future directions

In addition to addressing limitations of the current study, further future directions are noted. The current study only examined frequency of substance use for alcohol, marijuana, and cigarette use. Given possible restriction in range of the frequency variable as discussed above,

using other variables (e.g., problems related to use, binge use of substances) may better identify relations among risk and protective factors.

Additionally, the current study examined disinhibition as a component of executive functioning (Bari, & Robbins 2013; Nigg et al., 2006). Further research is needed to examine different aspects of executive function and how they may differentially affect risk for substance use. For example, higher alcohol consumption has been associated with greater approach sensitivity and better working memory in female college students (Patrick, Blair & Maggs, 2008). Understanding specific executive functioning impairments that might be associated with increased substance use risk could aid in identifying vulnerable clinical populations. In addition to assessing executive function more thoroughly, it may be beneficial to have a measure of both parent-reported support of autonomy and youth perceptions of support to examine how they correlate together as well as to determine which may be a stronger predictor of self-regulation. Prior research and the current study have demonstrated that youth perceptions of autonomy support were associated with substance use (Chilenski, Ridenour, Bequette, & Caldwell, 2015; Wong 2008). Continued research is needed to understand correlations between parent-reported autonomy support and adolescent-perceived parental support in relation to substance use.

The current study considered predominantly cognitive aspects of self-regulation. Emotional and behavioral self-regulation should also be considered in relation to substance use (Baumeister & Vohs, 2004; Vohs & Baumeister, 2011). Specifically, some research has identified how behavioral self-control moderated the association between negative life events and peer substance use's effect on adolescent substance use (Wills, Pokhrel, Morehouse, & Fenster, 2011). Understanding these interactions allows for better understanding of substance use in adolescence and which vulnerabilities are likely to lead to these behaviors.

Lastly, parental supervision and monitoring during middle childhood have been investigated with respect to their influence on substance use in adolescence (Chilcoat & Anthony, 1996). However, how these variables are associated with self-regulation when considering risk for substance use has not yet been examined (i.e., the mediated effects). Future research may examine how different aspects of parenting collectively, such as how parental supervision, support, and monitoring affect self-regulation when predicting substance use in adolescence.

Conclusions

Despite the above limitations, the current study extends prior literature examining multiple aspects of self-regulation simultaneously in their influence in the relation between parental support of autonomy and substance use variables. Such research is important due to the high and increasing prevalence of substance use and disorders in adolescence (Miech et al., 2018). The current study adds to the literature by further exploring the simultaneous mediated effects of self-regulation factors when considering the association between parental support and individual substance use variables in adolescents, which had not previously been identified in the field. Parental support and monitoring have been shown to play a role in the onset of substance use in youth (e.g., Chilcoat & Anthony, 1996). The current study builds upon this literature by exploring parental support of autonomy in predicting youth substance use. Specifically, while there was no direct effect of parental support on youth substance use, we found indirect effects on cigarette use via effortful control. Further, effortful control significantly predicted alcohol use. There was no indirect (or mediated) effect of parental support via disinhibition or autonomous functioning on the frequency of alcohol, cigarette, or marijuana use; however, disinhibition was significantly related to frequency of cigarette use. This is notable for

identification of at-risk youth as those who present with poorer inhibition (as is the case for some youth with ADHD) may be at greater risk for engagement in cigarette use. Collectively, the current study adds to the literature considering environmental (autonomy support) and internal (self-regulation) factors in identifying risk for alcohol, cigarette, and marijuana use individually. The study draws attention to characteristics for youth that may increase risk for engagement in substances aiding in early identification and intervention for at-risk populations.

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Appendix A

Perceived Parental Autonomy Support Scale (P-PASS)

Mageau, G. A., Ranger, F., Joussemet, M., Koestner, R., Moreau, E., & Forest, J. (2015). Validation of the Perceived Parental Autonomy Support Scale (P-PASS). *Canadian Journal of Behavioural Science*, 47, 251-262. FI = 0.85.

Please answer the following questions about your mother and father while you were growing up. If you did not have any contact with one of your parents (for example, your father), but another parent of the same sex lived with you (for example, your stepfather), please answer the questions about this other adult. If you did not have any contact with one of your parents, and no other adult of the same sex lived with you, please leave the questions about this parent blank.

Using the scale bellow, please indicate the extent to which you agree with each of the statements regarding your mother and father's behaviors.

Do not agree at all 1	Hardly agree 2	Slightly agree 3	Somewhat agree 4	agree 5	Strongly agree 6	Very strongly agree 7
1. My parents gave me many opportunities to make my own decisions about what I was doing.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7					
2. When my parents asked me to do something, they explained why they wanted me to do it.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7					
3. When I refused to do something, my parents threatened to take away certain privileges in order to make me do it.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7					
4. My point of view was very important to my parents when they made important decisions concerning me.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7					
5. My parents refused to accept that I could want simply to have fun without trying to be the best.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7					
6. When my parents wanted me to do something differently, they made me feel guilty.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7					
7. My parents encouraged me to be myself.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7					
8. Within certain limits, my parents allowed me the freedom to choose my own activities.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7					
9. When I was not allowed to do something, I usually knew why.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7					
10. I always had to do what my parents wanted me to do, if not, they would threaten to take away privileges.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7					
11. My parents believed that, in order to succeed, I always had to be the best at what I did.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7					
12. My parents made me feel guilty for anything and everything.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7					
13. My parents were able to put themselves in my shoes and understand my feelings.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7					

14. My parents hoped that I would make choices that corresponded to my interests and preferences regardless of what theirs were.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7
15. When my parents wanted me to do something, I had to obey or else I was punished.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7
16. My parents were open to my thoughts and feelings even when they were different from theirs.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7
17. In order for my parents to be proud of me, I had to be the best.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7
18. When my parents wanted me to act differently, they made me feel ashamed in order to make me change.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7
19. My parents made sure that I understood why they forbid certain things.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7
20. As soon as I didn't do exactly what my parents wanted, they threatened to punish me.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7
21. My parents used guilt to control me.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7
22. My parents insisted that I always be better than others.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7
23. When I asked why I had to do, or not do, something, my parents gave me good reasons.	Mother 1 2 3 4 5 6 7 <i>Father*</i> 1 2 3 4 5 6 7
24. My parents listened to my opinion and point of view when I disagreed with them.	<i>Father*</i> 1 2 3 4 5 6 7 Mother 1 2 3 4 5 6 7

Appendix B

Index of Autonomous Functioning (IAF)

Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2012). The index of autonomous functioning: Development of a scale of human autonomy. *Journal of Research in Personality*, 46, 397-413.
doi: 10.1016/j.jrp.2012.03.007

Instructions: Below is a collection of statements about your general experiences. Please indicate how true each statement is of your experiences on the whole by circling the number that best represents your experience. Remember that there are no right or wrong answers. Please answer according to what really reflects your experience rather than what you think your experience should be.

1 = not at all true, 2 = a bit true, 3 = somewhat true, 4 = mostly true, and 5 = completely true

- | | |
|--|-------------------|
| 1. My decisions represent my most important values and feelings. | 1 – 2 – 3 – 4 – 5 |
| 2. I do things in order to avoid feeling badly about myself. | 1 – 2 – 3 – 4 – 5 |
| 3. I often reflect on why I react the way I do. | 1 – 2 – 3 – 4 – 5 |
| 4. I strongly identify with the things that I do. | 1 – 2 – 3 – 4 – 5 |
| 5. I am deeply curious when I react with fear or anxiety to events in my life. | 1 – 2 – 3 – 4 – 5 |
| 6. I do a lot of things to avoid feeling ashamed. | 1 – 2 – 3 – 4 – 5 |
| 7. I try to manipulate myself into doing certain things. | 1 – 2 – 3 – 4 – 5 |
| 8. My actions are congruent with who I really am. | 1 – 2 – 3 – 4 – 5 |
| 9. I am interested in understanding the reasons for my actions. | 1 – 2 – 3 – 4 – 5 |
| 10. My whole self stands behind the important decisions I make. | 1 – 2 – 3 – 4 – 5 |
| 11. I believe certain things so that others will like me. | 1 – 2 – 3 – 4 – 5 |
| 12. I am interested in why I act the way I do. | 1 – 2 – 3 – 4 – 5 |
| 13. I like to investigate my feelings. | 1 – 2 – 3 – 4 – 5 |
| 14. I often pressure myself. | 1 – 2 – 3 – 4 – 5 |

Appendix C

Academic Self-Regulation Questionnaire (SRQ-A)

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, 57, 749-761.

Please read the following scenarios and rate your reason for engaging in each (very true, sort of true, not very true, not at all true)

A. Why do I do my homework?

1. Because I want the teacher to think I'm a good student.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

2. Because I'll get in trouble if I don't.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

3. Because it's fun.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

4. Because I will feel bad about myself if I don't do it.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

5. Because I want to understand the subject.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

6. Because that's what I'm supposed to do.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

7. Because I enjoy doing my homework.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

8. Because it's important to me to do my homework.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

B. Why do I work on my classwork?

9. So that the teacher won't yell at me.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

10. Because I want the teacher to think I'm a good student.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

11. Because I want to learn new things.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

12. Because I'll be ashamed of myself if it didn't get done.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

13. Because it's fun.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

14. Because that's the rule.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

15. Because I enjoy doing my classwork.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

16. Because it's important to me to work on my classwork.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

C. Why do I try to answer hard questions in class?

17. Because I want the other students to think I'm smart.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

18. Because I feel ashamed of myself when I don't try.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

19. Because I enjoy answering hard questions.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

20. Because that's what I'm supposed to do.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

21. To find out if I'm right or wrong.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

22. Because it's fun to answer hard questions.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

23. Because it's important to me to try to answer hard questions in class.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

24. Because I want the teacher to say nice things about me.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

D. Why do I try to do well in school?

25. Because that's what I'm supposed to do.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

26. So my teachers will think I'm a good student

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

27. Because I enjoy doing my school work well.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

28. Because I will get in trouble if I don't do well.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

29. Because I'll feel really bad about myself if I don't do well.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

30. Because it's important to me to try to do well in school.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

31. Because I will feel really proud of myself if I do well.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

32. Because I might get a reward if I do well.

- a. Very true
- b. Sort of true
- c. Not very true
- d. Not at all true

Appendix D

Early Adolescent Temperament Questionnaire Short Form- Revised

Lesla K. Ellis and Mary K. Rothbart (1999)

Directions

On the following page you will find a series of statements that people might use to describe themselves. The statements refer to a wide number of activities and attitudes.

For each statement, please circle the answer that best describes how true each statement is **for you**. There are no best answers. People are very different in how they feel about these statements. Please circle the first answer that comes to you.

You will use the following scale to describe how true or false a statement is about you:

Circle number:

- 1
- 2
- 3
- 4
- 5

If the statement is:

- Almost always untrue of you
- Usually untrue of you
- Sometimes true, sometimes untrue of you
- Usually true of you
- Almost always true of you

How true is each statement for you?	Almost always untrue	Usually untrue	Sometimes true, sometimes untrue	Usually true	Almost always true
1) It is easy for me to really concentrate on homework problems.	1	2	3	4	5
2) I have a hard time finishing things on time.	1	2	3	4	5
3) It's hard for me not to open presents before I'm supposed to.	1	2	3	4	5
4) When someone tells me to stop doing something, it is easy for me to stop.	1	2	3	4	5
5) I do something fun for a while before starting my homework, even when I'm not supposed to.	1	2	3	4	5
6) The more I try to stop myself from doing something I shouldn't, the more likely I am to do it.	1	2	3	4	5
7) If I have a hard assignment to do, I get started right away.	1	2	3	4	5
8) I find it hard to shift gears when I go from one class to another at school.	1	2	3	4	5

9) When trying to study, I have difficulty tuning out background noise and concentrating.	1	2	3	4	5
10) I finish my homework before the due date.	1	2	3	4	5
11) I am good at keeping track of several different things that are happening around me.	1	2	3	4	5
12) It's easy for me to keep a secret.	1	2	3	4	5
13) I put off working on projects until right before they're due.	1	2	3	4	5
14) I tend to get in the middle of one thing, then go off and do something else.	1	2	3	4	5
15) I pay close attention when someone tells me how to do something.	1	2	3	4	5
16) I can stick with my plans and goals.	1	2	3	4	5

Appendix E

Washington State Healthy Youth Survey (2014)

Instructions:

This is not a test, so there are no right or wrong answers. Answer the questions by circling one of the answers that best applies to you. If any question does not apply to you, or you are not sure of what it means, just leave it blank.

During the past 30 days, on how many days did you:

1. Smoke cigarettes?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10–29 days
- f. All 30 days

2. Drink a glass, can, or bottle of alcohol (beer, wine, wine coolers, hard liquor)?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

3. Use marijuana or hashish (weed, hash, pot)?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

4. Not counting alcohol, tobacco, or marijuana, use another illegal drug?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

5. Use loziderb?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

6. Use a pain killer TO GET HIGH, like Vicodin, OxyContin (sometimes called Oxy or OC) or Percocet (sometimes called Percs)?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

7. Use prescription drugs not prescribed to you?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

In your lifetime, within an average month, how many days did you:

8. Smoke cigarettes?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10–29 days
- f. All 30 day

9. Drink a glass, can, or bottle of alcohol (beer, wine, wine coolers, hard liquor)?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

10. Use marijuana or hashish (weed, hash, pot)?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

11. Not counting alcohol, tobacco, or marijuana, use another illegal drug?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

12. Use loziderb?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

13. Use a pain killer TO GET HIGH, like Vicodin, OxyContin (sometimes called Oxy or OC) or Percocet (sometimes called Percs)?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

14. Use prescription drugs not prescribed to you?

- a. None
- b. 1–2 days
- c. 3–5 days
- d. 6–9 days
- e. 10 or more days

15. Think back over the last 2 weeks. How many times have you had five or more drinks in a row? (A drink is a glass of wine, a bottle of beer, a shot glass of liquor, or a mixed drink).

- a. None
- b. Once
- c. Twice
- d. 3–5 times
- e. 6–9 times
- f. 10 or more times

16. How many times in the past year (12 months) have you been drunk or high at school?

- a. Never
- b. 1–2 times
- c. 3–5 times
- d. 6–9 times
- e. 10 or more times

How old were you the first time you:

17. Used marijuana? _____

18. Smoked a cigarette, even just a puff? ____

19. Had more than a sip or two of beer, wine, or hard liquor (for example vodka, whiskey, or gin)? _____

20. Began drinking alcoholic beverages regularly, that is, at least once or twice a month? _____

21. In the past year, which of the following happened because you drank alcohol or used drugs? Choose all that apply:

- a. I did not use alcohol or drugs in the past year.
- b. I did not have any problems from drinking alcohol or using drugs in the past year.
- c. I missed classes or school.
- d. I failed classes or dropped out of school.
- e. I got sick (vomited) or had a hangover.
- f. I felt depressed, anxious, scared, or had other emotional problems.
- g. I got hurt or injured.
- h. I hurt or injured someone else.
- i. I got in trouble with my parents or family.
- j. I did things I didn't want to do or regretted afterward.

22. In your lifetime, which of the following happened because you drank alcohol or used drugs? Choose all that apply:

- a. I did not use alcohol or drugs in the past year.
- b. I did not have any problems from drinking alcohol or using drugs in the past year.
- c. I missed classes or school.
- d. I failed classes or dropped out of school.
- e. I got sick (vomited) or had a hangover.
- f. I felt depressed, anxious, scared, or had other emotional problems.
- g. I got hurt or injured.
- h. I hurt or injured someone else.
- i. I got in trouble with my parents or family.
- j. I did things I didn't want to do or regretted afterward.

23. On a typical drinking episode, how many drinks do you typically consume?

24. Of the drug (not alcohol) that you most frequently use, how much do you typically consume when using? _____

25. How many times in the 6 months have you had (for females) greater than 3 alcoholic drinks OR (for males) greater than 4 alcoholic drinks in a 2-hour period? ____

Appendix F

Demographics

1. How do you identify your gender?
 - a) Male
 - b) Female
 - c) Transgender
 - d) Gender nonconforming
 - e) Self-identify: _____
2. How old are you? _____
3. What grade are you currently in?
 - a) 7th grade
 - b) 8th grade
 - c) 9th grade
 - d) 10th grade
 - e) 11th grade
 - f) 12th grade
4. How do you identify your ethnicity (Check all that apply)?
 - a) Asian
 - b) African American
 - c) Native American/ Alaskan Native
 - d) White/Caucasian
 - e) Self-identify: _____
5. Which best characterizes your religious affiliation?
 - a) Non-religious
 - b) Catholic
 - c) Christian
 - d) Lutheran
 - e) Methodist
 - f) Latter Day Saints
 - g) Jewish
 - h) Islam
 - i) Hindu
 - j) Buddhist
 - k) Self-identify: _____
6. Typically, how well do you perform in school compared to your peers?
 - a) Below Average (GPA lower than 2.0)
 - b) Average (GPA between 2.0 and 3.0)
 - c) Above Average (GPA above 3.0)
7. How many people live at home with you (not including yourself)? _____

Completed by parents after their consent:

8. What is your approximate annual household income? _____
9. How did you (or your child) hear about this study? _____
10. What state does your child live in?