

A COMPARATIVE TEST OF THE
SOCIAL STRUCTURE AND SOCIAL LEARNING MODEL
OF SUBSTANCE USE AMONG SOUTH KOREAN ADOESCENTS

By

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I dedicate my dissertation to my wonderful husband, Minwoo, loving parents Jung-Nim and Duck-Hun and my older sister, Soyoung.

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Abstract of Dissertation Presented to the Graduate School
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This purpose of this study is to test Akers's general Social Structure and Social Learning model (SSSL) model of crime and deviance on substance use behaviors among adolescents. This study attempts to gauge the validity and cross-cultural generalizability of the SSSL model by utilizing a sample of 1,021 high school students drawn from a non-American cultural setting, South Korea. The data for this dissertation consist of self-reported individual-level survey data including measures of all of the main explanatory variables found in social learning, social bonding and self-control theories. The analysis therefore includes a comparison of the effects of the social learning variables in the SSSL with the effects of social bonding and self-control variables in expanded models. Also this study measures all four social structural components of the SSSL model with measures drawn from census data in Busan (formerly Pusan) in South Korea. To examine this multi-level data, several Hierarchical Linear Models (HLM) and Hierarchical Generalized Models (HGLM) are used. The chief hypothesis to be tested is that the effects of the structural variables on adolescent substance use are mediated by social learning variables and more so than they will be mediated by bonding/self-control variables. The findings from the analyses provide supportive evidence for the SSSL model. Social learning variables substantially mediate the

impact of social structural components on adolescents' substance use (alcohol, depressants, and tobacco). On the other hand, social bonding and self-control variables do not mediate the relationship between social structural influence and individual substance use behaviors as much as social learning variables do. Rather, social bonding and self-control variables appear to be moderated by the social structural variables. The social learning variables have significant and greater mediation effects compared with the effects of social bonding and self-control variables. Overall, this study found support for the validity and generalizability of the SSSL model to a non-Western society. The contributions, limitations, and implications of the study for future research are presented.

CHAPTER 1 INTRODUCTION

Purposes of the Present Study and Its Contribution to Knowledge

In the field of criminology, there are relatively few comprehensive and integrated theoretical frameworks that can be used to investigate the relationship between structural level risk factors and youth's substance and drug use. Among them, Akers' (1998) Social Structure and Social Learning (SSSL) model proposes the social learning process as the principal process by which social structure, including society, community and neighborhoods contexts and characteristics as well as sociodemographic and other variables have an effect on crime, deviance, and substance use. The SSSL model is an elaboration of social learning theory which integrates macro level factors with individual level factors in accounting for behaviors. As a cross-level theoretical explanation, the SSSL is designed to guide ecological research exploring social structural influence on deviant and criminal behaviors, including adolescent substance and drug use. Akers argues that social learning variables "substantially" mediate the effects of structural variables on delinquency and crime. One application of this general hypothesis is that adolescents who reside in socially disorganized neighborhoods are more likely to engage in delinquent and substance use behavior because they more often associate with substance using peers, are more exposed to deviant role models, and more likely to experience reinforcing consequences of their deviant and substance use behaviors. In a review of Akers' SSSL model, Krohn (1999) suggests that this integrative model has potential advantages in exploring neighborhood influence on adolescents' delinquency and substance use. Since the emergence of the SSSL model, a relatively small but growing number of studies have attempted to examine the main propositions of the theory in the United States (Bellair, Roscigno, & Velez, 2003; Haynie, Silver & Teasdale, 2006; Holland-Davis, 2006; Lanza-Kaduce & Capece, 2003; 2006; Lee, Akers, & Borg, 2004; Verrill, 2008;

Wu, Eschbach, & Grady, 2008). But most of these studies failed to include all of the predictors that the theory required. That is, perhaps, partially due to lack of comprehensive data that include all of social learning variables at the individual level, as well as various type of structural level predictors as indicators presented in the SSSL model. Moreover, none of these studies have used samples drawn from different societies with different social and cultural contexts from American society. Therefore, there is no study examining whether the social learning process mediates structural level influences on adolescents' substance use behaviors in different cultural contexts. As stated by Akers, the SSSL model is not culture or society bounded. Therefore, if the model is a general one, then it should be supported not only by research in America but in other societies as well. The research reported in this dissertation makes a contribution to our knowledge by adding additional specification and test of the SSSL model to the small number of studies thus far and by being the first to test the model in a non-western cultural context.

Moreover, the current study contributes by using empirical measures of all of the social structural variables specified in the SSSL (differential social organization, differential location in the social structure, theoretically defined structural variable and differential location in primary and secondary groups) and empirical measures of all four of the major social learning concepts (differential association, definition, imitation, and differential reinforcement). As noted above, this has been done in only a very few of the previous tests of the model.

This study also goes beyond all of the previous studies by measuring other social psychological variables drawn from other major criminological theories, social bonding and self-control theory, to test the extent to which they offer processes mediating macro-level factors on individual substance use as alternatives to the social learning processes that are proposed in the SSSL theory. That is, none of the previous research testing the SSSL model

has provided findings on not only the social learning variables but other social psychological variables which potentially could mediate structural effects. It would be beneficial in testing and perhaps improving the SSSL model by examining if alternative variables have additional and perhaps stronger mediating effect than the social learning variables. In sum, this study not only tests the major proposition of the SSSL model, testing whether the social learning variables mediate structural influences on adolescents substance use, but also incorporates social bonding and self-control variables to compare the relative mediation effects of the three different sets of variables among youth in the non-western society of South Korea.

Such multilevel study is also particularly critical to advancement of the literature examining substance use and delinquency in South Korea in general as well. To the best of my knowledge, no study has been conducted which considers multilevel factors, both neighborhood and individual influence on adolescence substance use behavior with South Korean samples. Additionally, the structural level data used in this study are drawn from South Korean census data (15 districts in Busan). One of the strengths of these data is that the census districts are exactly matched with the districts where the participants who attended the schools in which data were collected resided in Busan, South Korea. It overcomes the methodological problems commonly found in multilevel studies using structural variables from U.S. census data, which often have unmatched residential contexts information and the school districts where surveys are generally conducted. Finally, this study utilizes Hierarchical Linear Modeling (HLM) to analyze nested data appropriately. Recent advancements by Raudenbush and Bryk (2002) consider not only the variation of contextual influences on adolescents' substance use behaviors, but also the influences of individual level variables.

The Problem of Adolescent Substance Use In the United States and South Korean

Substance use by adolescents has been a long time public concerns as one of the pervasive and costly social challenges in most countries. The detrimental effects and problems associated with drug and substance use have been well documented by a large body of research. The major concern is the well known harmful effects of substance use on individuals' health and well-being and its relationship to delinquency and crime. In the United States, it has resulted in tens of thousands of deaths for youths annually, according to the 2000 National Institution on Drug Abuse report (Lazarou, Pmeranz, & Corey, 1998).

Substance use is also very expensive for the entire society. The estimated annual costs for drug-related problems has continued to increase (Perl, 2003). As a result of it, the projected annual expenditure of the United States government on drug control policy for Fiscal Year (FY) of 2009 was \$14.1 billion. It represents an increase of \$459 million from the \$13.7 billion FY 2008 budget (Office of National Drug Control Policy, 2009).

Besides the excessive cost of substance and drug use, adolescents' drug use is particularly problematic because it entails other seriously harmful problems. A large body of research reports that illicit (i.e., marijuana, stimulant, and inhalants) and licit drug (i.e., alcohol, tobacco use) use among adolescents represents an important risk factor for the development of psychological, biological, interpersonal and social problems (Office of Applied Studies, 2009a; Lindström, 2008; Sakai, Hall, Mikulich-Gilbertson, & Crowley, 2004; Valente, Hoffman, Ritt-Olson, Lichtman, & Jonson, 2003; Valente, Gallaher, & Mouttapa, 2004). Furthermore, adolescent substance and drug use is linked to various lifetime problems, such as the greater risk of developing abusive or substance dependent behaviors and the higher risk of later delinquency and criminal behaviors (Akers, 1985; Barnes, Barns & Patton, 2005; Brook, Pahl, Balka, & Fei, 2004; Fergusson & Horwood, 1996; Hawkins et al., 2000; Huizinga, Loeber, & Thronberry, 1995; Reed & Roundtree,

1997; ONDCP, 2009; Ellickson, Hay, & Bell, 1992; Golub & Johnson, 2001; Kandel, 1984, 2002; Lynskey, Coffey, Carline, & Patton, 2003; Lynskey, Vink, Boomsma, 2006; Green and Ensminger, 2006; Brook, Gordon, Brook, & Brook, 1989a; Donovan, 1996; Wagner & Anthony 2002; Wilcox, Wagner & Anthony, 2002; Brook, Whiteman, Finch, & Coen, 1996; Greenwood, 1992; Sealock, Gottfredson, & Gallagher, 1997). Studies have linked drug use behaviors to failure in academic achievements, such that students who engage in substance use have had bad school performance and lowered achievement motivation and school persistence (Barns, Welte, & Hoffman, 2002; Jeynes, 2002). In a study examining the relationship between substance use and youth delinquency, Barnes and his colleagues (2002) found the link between youth's alcohol use and other illicit drug use and later delinquency from a sample of New York high school students. Initial alcohol use in early age is correlated with developing problematic drinking habits and poor coping mechanisms (Warner & White, 2003). Adolescents who are at high risk of committing serious crime and incarceration in juvenile facilities have a high level of propensity to alcohol and drug abuse problems in their childhood (Hawkins et al, 2000; Guo, Elder, Cai & Hamilton, 2008).

Alerted to these detrimental impacts of illicit and licit drug use among adolescents, American society exerted great effort to curb early substance use. Consequently, general substance and illicit drug use among adolescents began to decline in the 1980s, and after a period of little change or some increase has declined again since 2002 in the United States (Johnston, O'Malley, Bachman, & Schulenberg, 2008a). However, the overall proportion of adolescent who use substances such as alcohol, tobacco and illicit drugs is still alarming (Ritt-Olson, Unger, Valente, Nezami, Chou, & Trinidad, D, 2005; Johnston, O'Malley, Bachman, & Schulenberg, 2008b).

For example, alcohol use is still prevalent among U.S adolescents (Cleark & Loheac, 2007). The trend in alcohol use is parallel with that of illegal drug use in the U.S (Johnston et

al., 2007). Alcohol and tobacco are the most widely used substance among adolescents than any other drugs, is continuously consumed among adolescents. According to a 2007 national survey, the proportion of any alcohol and tobacco use among 12th graders in their life time are 72.3 percent and the proportion of tobacco use among 12th graders is 43.6 percent respectively (Johnston, et al., 2008a).

The prevalence and entwined problems of youth's substance and drug use are not limited to the United States. Substance use among adolescents has also been considered as a critical social issue in South Korea for decades and the trends of substance use among South Korean adolescents shows somewhat similar trends to those in the United States. First, many South Korean youths use substances as much as American adolescents do. Especially, legal substances, such as alcohol and tobacco use, as well as the abuse of pharmaceutical such as stimulants and depressants are serious problems. Second, substance use among adolescents, particularly, is considered as one of the major probable causes that are linked to various types of deviant behaviors for South Korean youths (National Youth Commission, 2004; Son, Kim, & Chun, 2002). Therefore, the Korean society, in general, is also dealing with adolescents' illicit and licit drug use seriously. The South Korean government also spends large sums of money each year on substance use control policy for adolescents, such as education and prevention programs in schools and anti-substance use advertisement thorough mass-media.

Despite such tremendous efforts made by the South Korean government and society, the prevalence of substance use among South Korean youths is still high. Furthermore, similar to the declining trends of adolescent alcohol, tobacco and other illicit drug use in the United States, the recent trends of adolescents substance use in South Korea is getting lower but the magnitude of substance use, particularly, alcohol use, among adolescents is as high as the statistics in Western nations (National Youth Commission, 2004; Son, et al., 2002; Park, Kim, Kim, & Sung, 2007; Je, He, Kim, & Lee, 2004). In 2004, The National Youth

Commission, a government funded research institution, in South Korea interviewed 2,990 South Korean youths aged 12 to 18 to investigate the prevalence of alcohol use among South Korean adolescents. The National Youth Commission (NYC) reports that approximately 74.4 percents of youths aged 12 to 18 reported that they have experienced alcohol in their lifetime. Alcohol use among youths has increased from 60.2 percent in 1999, and 70.4 percent in 2002 survey. Also, the proportion of binge drinking during the past month among youths is 70.1 percent for high school students attending industrial schools and 55.4 percent for students attending liberal high schools, according to the 2004 NYC report. Notably, the prevalence of alcohol use among female students' alcohol use is at a significant level. The proportion of female high school students' lifetime alcohol use is greater than that of male students and the frequency of binge drinking among female high school students is slightly higher than the frequency of male students. The age of onset of alcohol use is significantly reduced.

Smoking is also a common trend seen in adolescence in South Korea. Particularly, it was prevalent among youth in the early 2000s. Recently, the proportion of smoking adolescents is getting lower; yet, the overall prevalence of cigarettes smoking is still high. In 2007, National Youth Commission investigated the tobacco use among adolescents and found that 32 percent of high school students who attend industrial school and, 11.2 percent of high school students who attend liberal school reported that they had smoke during the last year. Furthermore, the age of beginning smoking is getting younger and the prevalence of female students' smoking is on the rise (National Youth Commission, 2007; National Health Institution, 2006).

Contrary to the high prevalence of alcohol and tobacco use, the general trends of illicit drugs use among adolescents have been substantially deceased in South Korea. For example, adolescents' marijuana use deceased from 28.5 percent in 1987 to 2.8 percent in 2002, according to the South Korean Supreme Court report in 2002. However, some licit and illicit

drugs are also a serious threat for South Korean youths. For instance, inhalant use by adolescents constituted about 80 percent of the total inhalant users in South Korea; it has decreased somewhat, but it is still high (South Korean Supreme Court Drug Report, 2002). Furthermore, about 20 percent of adolescents reported that they have been involved in licit drug abuse, such as depressants use (Choi, 2003). Studies suggest that the decreased illicit drugs use among adolescents is partially due to the difficult accessibility of illicit drugs such as marijuana and cocaine (Choi, 2003; Sakai, Hall, Muijlich-Gulbertson, & Crowley, 2004). However, other over the counter drugs, such as depressants can be obtained from many drug stores without prescriptions just like other commercial products. Since the depressants are cheap and readily available (often in the home) and legal to buy and possess, they are commonly preferred by young adolescents. As a result, depressants are particularly preferred by those teens experiencing significantly more abuse and neglect (South Korean Supreme Court Drug Report, 2002; Choi, 2003). Such depressant abuse should not be taken lightly. That is because studies found that most drugs have a strong impact on adolescence behavior and their brain activity and may result in impaired perception and thought process, and even damaging and killing brain cells (Santrock, 2007).

As such, adolescents' substance use became a great concern for the communities in South Korea. Just as in the United States research on the causes and correlates of adolescent use is needed to inform public policy to control, prevent, or treat adolescent substance use and abuse in Korea. However, until today, only little research has been conducted to examine surrounding factors influencing adolescents' substance use in South Korea. Moreover, the limited number of studies investigating substance use among Korean youth has focused mainly on the trends and the prevalence of substance use. Just a few of these studies attempt to explain what factors or variables may be involved in the causes of the adolescents' behavior (Choi, 2003; National Youth Commission, 2004; Son, et al., 2002; Je, et al., 2004;

Hwang & Akers, 2006; Kim, Kwak, & Yun, 2010). But, generally, studies attempting to reveal the important correlates of South Korean adolescents' initiation and maintain substance use are still largely limited in explaining what mechanism and factors might influence youths' substance use behaviors.

In the United States, on the contrary, researchers from various disciplines have actively conducted research to address the causes and correlates of adolescent substance use. Interdisciplinary studies investigating predictors of adolescent illicit and licit drug use consistently have shown that various factors, such as peer influence (i.e., peer use and delinquent peer association), family (i.e., parental substance use and ineffective parenting), and individual personality traits (i.e., low conventionality, and other individual level correlates, are associated with adolescents' drug and substance use (Barnes, Barnes, & Patton, 2005; Newcomb & Bentler, 1988; Swadi, 1999; Warr, 1993a; 1993b).

Gaps in the Research

In addition to the contribution from numerous studies, which extended current knowledge about the etiology of adolescent substance use, there is a small body of studies that attempts to extend the focus to include both individual-level factors and the role and impact of neighborhood on adolescent drug (Jang & Johnson, 2001; Sunder, Grady, & Wu, 2007; Winstanley, Steinwachs, Ensminger, Latkin, Stizer, & Olsen, 2008). These attempts may reflect recent recognitions among scholars that the predictors of substance use must be measured not only at the individual level, but also at the community level. The neighborhood provides the context in which individual behavior occurs. Therefore, it is reasonable to assume that this context may change the way in which individual protective and risk factors operate (Browing, 2008). However, a recent review of these previous studies examining community influence on adolescents' substance and drug use sometimes found inconsistent findings for some relationship. For example, while some studies found that the higher level of

neighborhood affluence is positively related with the increased adolescents' substance and illicit use, other studies found that the greater level of neighborhood poverty is positively associated with increased adolescence substance and illicit drug use. (Allison, et. al, 1999; Ennett, Flewelling, Lindrooth, & Norton, 1997; Luthar & Cushing, 1999; Ford & Beveridge, 2006; Saxe, Kadushin, Beveridge, Livery, Tighe, Rindskopf, Ford, & Brodsky, 2001; Sunder et al., 2007; Wright, Bobashev, & Folsom, 2007; Winstanley et al., 2008). Saxe et al. (2001) tested the relationship between substance use and neighborhood disadvantages and found that people in poorer neighborhoods only slightly used more substance than those residing in better neighborhoods. In a study using the same data, Ford et al, (2006) reported that neighborhood disadvantage, minority composition and density do not explain residents' drug use, but instead merely addresses the more overt or visible drug problems (e.g., drug dealing). This was contradicted by Winstanley et al., (2008), who reported that neighborhood disadvantages and social capital were significantly associated with adolescent drug and alcohol use and dependence, even after controlling for individual and family variables.

Furthermore, there are some other social structural factors believed to have disruptive impact on children and youth's substance and drug use. Along with neighborhood poverty, neighborhood level of residential mobility and population density are key pieces of these social structural factors. These neighborhood characteristics have been identified as possible risk factors by social disorganization theory not only for adolescents substance and drug use but also for crime and delinquency (Ennett, et al., 1997, p.56). However, studies found mixed evidence regarding the positive relationships between the effects of residential mobility and population density and adolescents' drug and substance use. In terms of residential mobility, as it is well known, social disorganization theory and some studies testing its contention found that higher level of residential mobility, as one neighborhood characteristic, is associated with higher level of adolescent substance use (Brook, Whiteman, Gordon, A.S.,

Nomura, & Brook, 1986; Clark & Loheac, 2007; Dewit, 1998; Ennett, et al., 1997; Hwakins, Catalano, & Miller, 1992; Sampson & Groves, 1989). Clark and Loheac (2007) found that adolescents who move frequently are more likely to be susceptible to peer group pressure for using drug and substance use such as marijuana and cocaine use. DeWit (1998) found that higher level of residential mobility is positively associated with adolescents' frequency of alcohol and drug use. Generally, studies found that residential mobility negatively affects adolescents' drug and substance use. However, Ennett and her colleges (1997) found that residential mobility has significant and negative impact on adolescents' lifetime alcohol use, the opposite relationship posited by the social disorganization theory literature. Moreover, they found that population mobility and density are partially mediated by some school characteristics, such as substance use norms in schools.

Studies examining the effects of higher levels of population density also generated conflicting findings in terms of the relationship with individual's substance and drug use. Some studies found positive relationships between population density and individual substances and drug use. Sundquist and Frank (2004) examined if the level of urbanization is associated with hospital admissions for alcohol and drug abuse with a sample drawn from Sweden. They defined the level of urbanization by population density. They found that both women and men who live in the most densely populated communities had significantly greater levels of increased risk of being hospitalized for alcohol and drug abuse compared to women and men living in the least populated communities. The positive relationship between population density and hospital admission rates for alcohol and drug abuse is significant even after controlling for demographic characteristics, such as marital status, education, age, and immigrant status. However, Ennett et al (1997) found that high population density is significantly and negatively associated with adolescents' life time alcohol and cigarette use. The rates of lifetime alcohol use and cigarette use are higher in schools in low-density

neighborhoods. Also, O'Malley et al (1988) analyzed Monitoring the Future data and found that adolescents' marijuana and cocaine use, but not alcohol and tobacco use, were positively associated with population density.

Overall, this review of previous studies examining the impact of neighborhood characteristics on adolescents' substance use reveals that there are a number of apparent differences in the relationships between neighborhood characteristics and adolescent substance use. Also, some studies found that many of the findings are not predicted by social disorganization theory. These contradicting findings among studies must be interpreted carefully, however. Perhaps, these differences could be explained by the different outcome operationalizations examined in different studies (different types of substance and substance use vs. including other risk behaviors) or the difference in age of populations in studies. More fundamentally, it might be possible to assume that such differences from these neighborhood context studies are due to the lack of comprehensive and integrated theories to develop appropriate analysis models. Therefore, although there is an increased interest in examining the relationship and interactions between structural level factors and individual level factors in influencing adolescents' substance use, the complexity of the causes and consequences of substance use is still a challenge in both theoretical conceptualization of neighborhood effects and developing appropriate methodological models. Consequently, to date, there is still a limited number of studies that have actually considered the mechanisms or processes by which neighborhood or community factors influence adolescent behavioral outcomes in what way (Akers, 1998; Crane 1991; Elliott, Wilson, Huizinga, Sampson, Elliott, & Rankin, 1996; Dembo, Blount, Schmeidler, & Burgos, 1986; Jang & Johnson, 2001). Therefore, there are still many gaps in the knowledge of relating neighborhood contexts to adolescents substance and drug use and this gap suggests the need for further investigation.

CHAPTER 2 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Social Learning Theory

Akers's social learning theory (1973, 1985, 1998; Akers, Krohn, Lanza-Kaduce & Radosevich, 1979) is a reformulation of Sutherland's classic differential association theory in 1947 (Sutherland, 1939; Akers, 1998; Sutherland & Cressey, 1966). Sutherland first proposed his theory, in his book titled *Principles of Criminology* in 1939. Later, he revised his first version of differential association theory in 1947 and proposed nine statement explanations referring to the process by which a particular person comes to engage in criminal behavior. Most of all, his theory's key proposition is that both criminal and conforming behaviors are learned through the process of social interaction in intimate groups or networks which supply favorable and unfavorable definition of crime.

Recognizing the omission of the specified mechanism of learning, Burgess and Akers (1966) took an initiative to address the task of specifying the learning process left implicit by Sutherland (1947). This revision of differential association theory by Burgess and Akers was called "differential association-reinforcement" theory (Akers, 1998; Burgess & Akers, 1966, p.146). In "differential association-reinforcement" theory, Burgess and Akers merge differential association with Skinner's operant reinforcement mechanism.

Akers' Social Learning Theory

Later, Akers (Akers, 1973, 1985, 1998) further elaborated and enhanced the conceptualization and presentation of the theory which he came more and more to refer to as "social learning" theory. Akers' revision (1973, 1985, 1998) postulates a general theory that focuses on four major distinctive concepts: differential association, differential reinforcement, definition and imitation (Akers, 1998, p.50; Akers, et al., 1979). In his most

recent statement of the theory, he describes the central proposition of the social learning theory of criminal and deviant behavior as follows;

The probability that persons will engage in criminal and deviant behavior is increased and the probability of their conforming to the norm is decreased when they differentially associate with other who commit criminal behavior and espouse definitions favorable to it, are relatively more exposed in-person or symbolically to salient criminal/deviant models, define it as desirable or justified in a situation discriminative for the behavior, and have received in the past and anticipate in the current or future situation relatively greater reward than punishment for the behavior. (Akers 1998, p.50)

As such, it proposes that individual conformity and deviant behavior are products of a learning process, operating in a context of social structure, interactions with significant others, and situation. The difference between conformity and deviance is the direction of the process in which these mechanisms operate. These learning mechanisms have balance in influencing an individual's behavior, functioning as four key mechanisms: differential association, definitions, differential reinforcement, and imitation.

Differential association refers to exposure to significant other's attitude, values and behaviors through direct and indirect, verbal, and nonverbal communication, interaction, and identification with others. These significant others can be both conforming and deviating others who are in their primary (or secondary, reference or symbolic) groups (i.e., family, peers, school, church groups and co-workers). These persons can contain the individual's major sources of reinforcement, behavioral models, and effective definitions which has a powerful effect on one's behaviors (Akers, 1998, pp.52-53). The composition of the groups also varies over the life course; family is the most salient group in childhood; the importance of peers and school are peak in adolescence; and spouse and colleagues are the most significant others in adulthood (Akers, 1998, pp. 60-66). The influence of differential association varies depends on the modalities of association: frequency, duration, priority, and intensity of association with those significant others and groups. Therefore, it can be expected

that conforming or deviating behaviors are more likely, when associations occur earlier (priority), last longer and occupy more of one's time (duration), take place most often (frequency), and involve others with whom one has the more important or closer relationship (intensity) (Akers & Sellers, 2009, p.90)

Differential reinforcement refers to the net balance of the past, present, and anticipated future costs and rewards, which relates to a given behavior, conformity and crime and delinquency. Reinforcers can be positive (i.e., obtaining approval, money or pleasant feelings) or negative (i.e., avoid or escape aversive or unpleasant events) and punishers can be direct (i.e., painful, unpleasant consequences) or indirect (i.e., reward or pleasant consequences) in the way influencing individuals' behaviors. Furthermore, reinforcement can be non-social (i.e., positive or negative effects of psychological and physical stimuli) and social (i.e., positive and negative social consequences including reactions and relationship with parents and friends) which influence on individual behaviors contingent on previously learned experiences of that person (Akers & Sellers, 2009, p.92). Social reinforcement is described as "involving not just the direct reactions of others present while an act is performed, but also the whole range of tangible and intangible rewards valued in society and its subgroups" (Akers, 1998, p.71). Akers (1998) also suggests that it also varies by modalities and the most significant rewards are social (most of reward and punishment are social). However, recent studies reveal that psychological and neurological effects of intrinsic reinforcers that are influenced by social expectations (e.g., past experience, influence by definition) also affect social reinforces, while interacting with individual characteristics (i.e., seeking thrills, impulsivity) (Akers, 1998; Brenzina & Piquero, 2003; Wood, Gove, & Cochran, 1994; Wood, Cochran, & Pfefferbaum, 1995).

Definitions refers to an individual's learned values and attitudes favorable and unfavorable toward deviant and conforming behavior. The concepts of definitions are both

general and specific. General beliefs mean that religious, moral and other conventional values and norms that are favorable to conforming behaviors are also generally unfavorable to deviant behavior. Specific definitions related to specific acts (Akers, 1998, p.78). Definitions then are positive, neutralizing and negative (Akers, 1998, pp.77-87). Definitions can generally or specifically favor deviance, oppose deviance or justify or excuse deviancy under certain conditions (Verill, 2008, p.39). Definitions serve as cues that make one more willing to commit an act given anticipated reinforcement or punishment for certain behavior. The dimensions of the concept of definitions include beliefs, attitude, and rationalization/neutralization (Akers, 1998).

Imitation is described as “committing behavior modeled on, and following the observation of, similar behavior in others” (Akers, 1998, p.65). In other words, it means that by observing others’ behaviors and their consequences, individuals are able to infer probable outcomes from adopting the behavior. Whether an individual will imitate the observed behavior or not is depends on the characteristics of the models (e.g., admired or not) the behavior observed, and the observed consequences (i.e., rewarded or punished) (Akers, 1998, p.65). Imitation is more likely to have an effect in initiation of delinquent and criminal behaviors (Akers, 1998). In sum, with those four concepts, social learning theory proposed separate testable hypothesis that when an individual is more likely to be engaged in deviant or criminal acts:

1. He or she differentially associated with others who commit, model, and support violations of social and legal norms.
2. The violative behavior is differentially reinforced over behavior in conformity to the norm.
3. He or she is more exposed to and observes more deviant than conforming models.
4. His or her own learned definitions are favorable toward committing the deviant acts. (Akers, 1998, p.51).

Social learning theory posits that the social learning process involves reciprocal and sequential processes and operates in one's past learning history and immediate situation in which an opportunity for a crime is present (Akers & Sellers, 2009, p.93). These social learning concepts are applicable to initiation, repetition, maintenance, and desistance (1998, p.59). Akers's social learning theory is a general theory which claims that it can explain all types of crime and deviance.

Empirical Validity of Social Learning Theory

Social learning theory has consistently received positive empirical support (strong to moderate) by a large body of empirical research (for a review see, Akers, 2006; Agnew 1991a, 1993, 1994, ; Akers, 1985; 1998; Akers & Lee, 1996; Akers & Sellers, 2009; Bahr et al., 2005; Burkett & Jensen, 1975; Burkett & Warren, 1987; Cao, 2004; Conger, 1976; Conger & Simons, 1995; Dabney, 1995; Dembo et al., 1986; Elliott, Huizinga, Suzanne, & Ageton, 1985; Hwang & Akers, 2006; Inciardi, Horwitz, & Potttigger, 1993; Jensoen, 1972, 2003; Johnson, Marcos, & Bahr,1987; Kandel & Davies, 1991; Krohn, et al., 1985; LaGrange & White, 1985; Matsueda & Heimer 1987; Meier, Burkett, & Hickman, 1984; Patterson & Dishion, 1985; Pratt, Cullen, Sellers, Winfree, Madenson, Diago, Fearn, & Gau, 2009;Orcutt, 1987; Reed & Rountree, 1997; Sellers et al., 2005; Warr, 1993a; 1993b; 1996; Warr & Stafford, 1991; White, Pandina, & LaGrange,1987; Winfree & Griffiths, 1983; Winfree, Sellers, & Clason, 1993; Wood, Cohran, & Pfefferbaum, 1995). Sometimes, social learning theory is tested in comparison with other theories or as integrated or combined models with other variables from other theories and social learning concepts usually have the strongest net effects on the dependent variables than concepts from other theories (Akers & Sellers, 2009; Benda, DiBlasio, 1991; Burton, Gullen, Evans, & Dunaway, 1994; Catalnon et al., 1996; Elliott, Huizinga, & Ageton, 1985; Huang et al., 2001; Hwang & Akes, 2003; 2006; Jang, 2002; Kaplan, Jonson & Barley, 1987; Kaplan, 1996; McGee, 1992; Neff & Waite,

2007; Rebellon, 2002; Thonberry, Lizotte, Krohn, Franworth, & Jang, 1994; White, Johnson, & Horowitz, 1986). Agnew (1991a, 1993, 1994, 200). Agnew (1991a, 1993) acknowledges the empirical validity of the social learning theory through his own reviews on empirical testing on the major concepts and notes that “social learning theory has much support”. Therefore, he concludes that social learning theory is a “leading” explanation of delinquency and substance use behaviors. Particularly, studies testing the effects of the four measures of social learning theory on individuals’ substance abuse and minor forms of deviance, Warr (2002) states that “the evidence for social learning theory is extensive and impressive” (p. 78). Kubrin and his colleges (2009) also state that the accumulated research evidences from the numerous empirical studies conducted on the theory are “consistent with this approach” that the social learning theory proposed. And they conclude that “social learning theories have earned an important place among individual explanations of crime” (p. 164).

Recently, Pratt et al (2009) conducted a meta-analysis, a standard approach in review of empirical studies that can examine the absolute and relative influence of theoretical components of on outcome behaviors. This meta-analysis approach can reduce investigator’s bias and specify the criteria for review (Pratt, et al, 2009, p.8; Rosenthal & DiMatteo, 2001). In their analysis they reviewed about 133 studies that tested the social learning theory directly and studies using social learning theory concepts. In particular, the sample studies that they used for their meta-analysis were collected in a systematic way; they used studies which included social learning variables that were published in the leading criminal justice/criminology journals from 1974 to 2003 (p. 9). In the analysis, they found that measure of peers’ behavior is very important across studies. Their findings indicates that the index of differential association (i.e., peer’s behavior, parents’ behavior, and peers attitude, etc) is the measure that have strongest overall effect size ($Mz = .225, p < .001$). Among the index, peer’s behavior has the strongest effect on dependent variables across studies ($Mz =$

.406, $p < .001$). Specifically, the peer's attitude is strong in studies that assessed substance and alcohol abuse, which have the range of effect size of 0.361 and 0.338 ($M_z = .361$ and $.338$, respectively, $p < .05$). Also, the index of definition variable has great influence for general population sample's behaviors as a moderator ($M_z = .658$, $p < .001$) (p.23). Overall, they found consistent supportive evidence from those studies. In conclusion, they stated that the empirical validity of social learning theory has been well supported by the meta-analysis. "In short, the variables specified by social learning theory tend to be strong, yet not invariant, predictors of criminal and deviant behavior" (p.24). However, this meta-analysis was incomplete in that it did not include findings on differential reinforcement and imitation.

Prior to the meta-analysis of Pratt et al (2009) other meta-analysis have been conducted (Andrews & Bonta, 2006; Gendreau, Goggin, & Law, 1997; Gendreau, Little, & Goggin, 1996; Lipsey & Derzon, 1998). Andrews and Bonta (2006) conducted a meta-analysis for risk and need predictors of criminal recidivism. Particularly, the major risk and/or criminogenic need factors that used in their meta-analysis are measures of "social learning and/or cognitive-behavioral influence strategies are readily identified within general personality and social learning perspectives on criminal behavior" (Andrews & Bonta, 2006, p.10). Their findings reveal consistent findings to the propositions of social learning theory. That is, beliefs favorable for law violations and delinquent peer association significantly predict recidivism.

Other evaluation research on correction and rehabilitation programs with criminal offenders are another source for supporting the empirical validity of social learning theory (Pratt et al., 2009). That is because correctional or school based prevention programs are based on underlying criminological theories of crime which select certain risk factors that are believed to cause certain criminal behaviors for change of offenders conduct. Therefore, the reduction of risk factors and misbehaviors can be seen as supporting evidence for the selected

theory (Pratt et al., 2006). In this context, although program evaluation does not provide direct empirical evidence on a theory, experimental and quasi-experimental studies can provide evidence regarding the validity of criminological theories (Cullen, Wright, Gendreau, & Andrews, 2003). Recently, evaluation studies on treatment and prevention programs, especially cognitive-behavioral interventions-consistently found that the major propositions and the four major concepts of social learning theory are the most effective factors in changing and reducing offenders' risky behaviors and recidivism (Andrews & Bonta, 2006; Cullen et al., 2003; Lipsey, Chapman, & Landenberger, 2001; MacKenzie, 2006). Therefore, these findings provide experimental and quasi-experimental evidence consistent with social learning theory (Cullen et al., 2003; Pratt et al., 2009).

Social learning theory is a general theory that claims to explain various types of deviant behaviors and offending. While research has focused more on delinquency and adolescent deviance, social learning research provides support for the claim of application to a wide range of behavior, from serious to minor form of behaviors (see Akers & Sellers, 2009; Warr & Stafford, 1991), including adolescent and elderly substance use (Akers et al., 1979, Akers et al., 1989; Akers & La Greca 1991; Akers, 1992; Akers & Lee, 1996; Hwang & Akers, 2003, 2006; Sellers, Cochran, & Branch, 2005; Spear & Akers, 1988), and gang membership and activities (see Akers, 1998, pp. 110-117; Battin, Hill, Abbott, Catalano, & Hawkins, 1998; Currey, Decker, & Egley 2002; Esbensen & Deschenes, 1998; Winfree, Mays, & Vigil-Backstrom, 1994b; Winfree, Vigil-Backstrom, Mays, 1994a). Social learning principles have also been tested on other forms of criminal and deviant behaviors, including computer crime (Skinner & Fream, 1997), premarital sex (DiBlasio & Benda, 1990), courtship violence (Sellers, Cochran, & Winfree, 2003), sexual coercion among fraternity men (Boeringer, Shehan, & Akers, 1991), college students cheating (Lanza-Kaduce & Klug, 1986), felony offending of both gender (Alarid, Burton, & Cullen, 2000), terrorist violence (Akers &

Silverman, 2004), homicide rates of various societies (Batton & Ogle, 2003; Jenson & Akers, 2003). The principles have also been found to be operative in evaluation of more successful correctional rehabilitation programs (Cullen & Gendreau, 2000; Cullen, Wright, Gendreau, & Andrews, 2003). While still more studies assessing serious types of criminal behaviors, such as homicide and violent criminal behaviors, are necessary, those recent empirical efforts expanded the scope of the theory and have supported the generalizability of social learning theory (Sellers et al., 2003).

Studies conducted by Akers and his colleagues have employed measures of the four main constructs proposed by the theory (Akers, 1992; Akers, LaGreca, Cochran & Sellers, 1989; Akers & Lee, 1996; Akers et al., 1979; Boeringer, Shehan & Akers, 1991; Hwang & Akers, 2003, 2006; Krohn, Skinner, Massey & Akers, 1985) and have included cross-sectional and longitudinal data (Krohn et al., 1985; Akers & Lee, 1996). Those studies used all of the four major concepts proposed by social learning theory to test its propositions in cross-sectional and in longitudinal ways (Krohn et al., 1985; Akers & Lee, 1996). Some of studies also compared the theory's validity with other theories (e.g., social bonding, self-control theory, and general strain theory) (Akers & Cochran, 1985; Hwang & Akers, 2003). Also, some of the studies used samples drawn from different cultures to examine the theory's cross-cultural generalizability (Hwang & Akers, 2006). Using an adolescent sample of approximately 3,000 in grades 7 through 12 in eight communities in Midwest, Akers and his colleagues (1979) conducted the first empirical test on youth's substance abuse and drug use. This data set has been called Boys Town data. In this study, they found that the model with measures of each of four concepts is moderately to strongly associated with substance use in the expected direction. These variables accounted for 55 % of the variance in alcohol use and 68 % of the variance in marijuana use of the sample. Generally, the power of explanation of the social learning variables was very high compared to variables from other theories (e.g.,

social bonding). Other subsequent studies that tested social learning theory with this data set garnered moderate to strong empirical supports for the theory (Krohn et al., 1982, 1985; Lanza-Kaduce et al., 1984; Akers & Cocran, 1985; Akers, 1992). Krohn et al. (1985) conducted a longitudinal analysis to examine the influence of social learning variables on initiation and maintenance of adolescents smoking. They used a five year longitudinal data of smoking among junior and senior high school students in Muscatine, Iowa. This study provided some support and structured a causal map describing a process of initiation and maintenance of smoking behaviors. They found that imitation and definition has importance in the initiation while differential association and differential reinforcement (including both peer and nonsocial reinforcement) are important in maintenance of smoking behaviors. Subsequent studies using the same dataset found supportive evidence of the theory's propositions (Lauer, Akers, Massey, & Clarke, 1982 Akers, Skinner, Krohn, & Lauer, 1987; Spear & Akers, 1988). In the Iowa smoking study, Spear and Akers (1988) conducted tests from the first year survey. They found that each of the four social learning variables is moderately to strongly correlated with smoking frequency of the participants. All of the social learning variables combined explain 54% of smoking behaviors among adolescent. Furthermore, Akers and Lee (1996) used longitudinal data from the same study, five year's of data from a panel of 454 adolescents in Iowa, and examined the causality of the process posited by the theory. They found some support for its reciprocal and feedback effects among variables over time with greater effects of social learning variables on smoking than the effects of smoking on the social learning variables.

Social learning theory also provides a sound theoretical framework for elder alcohol use. Akers and his colleges (1989; Akers & LaGreca, 1991; Akers, 1992) studied the influence of social learning variables on elderly alcohol use with a sample of 1,410 adults aged sixty and over from four communities in Florida and New Jersey. Akers and his

colleges' found that the social learning variables (differential association, definitions, and differential reinforcement) explained 59 % of the variance in the frequency of the elders' drinking behaviors in the past year and 52% of the variance in the quantity of drinking of the participants.

Although all of social learning concepts received substantial empirical support for their validity, the effects of the four concepts on outcome behaviors are not equal. The existing research, including studies fully or partially (e.g., used one or two social learning variables) testing social learning concepts, suggests that the strongest predictor of criminal involvement typically is differential association. In particular, social learning variables operative in peer association has received abundant evidence to demonstrate the significant impact on delinquency and crime of learning, especially during adolescence (Akers, 1998). Also, it is the mostly commonly used variable in research. Specifically, Warr (2002) claimed that “no individual factor in criminology is better than delinquent friends” measured by “number of delinquent peers” as the strongest predictor of criminal and delinquent behaviors (for a review see, Akers & Sellers, 2009; also see Warr, 2002:40). A recent study by Haynie (2002) focused on influence of contextual factors on the relationship between friendship networks and delinquency. She found that the proportion of delinquent peer associations (that is differential peer association) is the most important factor in peer networks in explaining delinquency. Furthermore, Sellers et al. (2003) found that peer association is also the strongest predictor of aggression and dating violence even when peers are typically absent during the commission of the aggressive act. Furthermore, empirical studies present evidence supporting the social learning argument that the learning process operating in the family setting is a strong predictor for either conforming or deviant behavior. Family, a key primary group provides conforming and deviant modeling, definition and reinforcement through child-parent interactions (Akers & Sellers, 2009; Patterson, 1995).

With regard to the validity of the other social learning concepts, empirical studies have also generated significant supports for differential reinforcement and definition, while imitation has received relatively less support. Akers argues that imitation is an important concept in “the initial acquisition and performance of novel behavior” as well as “to continue to have some facilitative effect in maintaining or changing behavior” (Akers, 1998, p.75; Akers et al., 1979; Krohn et al., 1985).

Specifically, differential reinforcement can be considered as the central causal mechanism in the social learning model, since research evidence suggest that differential association, definitions, and imitation/modeling all affect one’s probability of committing deviance in relation to a process of differential reinforcement. Triplett & Payne (2004) examined the influence of social and nonsocial reinforcement on youth’s drug use by using 1,725 youths from the National Youth Survey data. This study employed three social learning measures, imitation, differential association, and differential reinforcement for analysis. In particular, they employed two types of reinforcement measures that are specified social (i.e., reactions from peers) and nonsocial reinforcement measures (i.e., drug use as problem solving) separately. Their findings provide supportive evidence for the propositions of social leaning theory. They found that the three measures were significant for adolescents in their sample, in particular, for frequent drug users. Also, they found that reinforcement measures mediate the relationship between differential association and drug use. Further, their study revealed that youths tended to use drug as a way to solve problems and confirmed the effects of nonsocial reinforcement on adolescent drug use as social learning theory predicted. Wood and his colleges (1995) also found some evidence of psychological or emotional arousal (e.g., internal sensations of excitement or thrill) while committing or anticipating deviant behaviors can be played as intrinsic rewards to an individual. Their findings suggest that some types of deviant and criminal behaviors can be intrinsically rewarding in that, “voluntary risk-taking

and thrill seeking behavior provide sensory or physiological stimulation which is highly rewarding to the individual” (Wood et al., 1995, p.174). In terms of social reinforcement, research found that it is a very important variable in cessation/continuation of substance and drug use. Studies found that social reinforcement contributing significantly to the amount of variance explained by the model. For example, friends and family were important in determining individuals’ perceptions of a drug as having negative or positive consequences (Akers et al, 1979; Krohn et al, 1985; Winfree, Sellers, & Clason, 1993).

In spite of years of theoretical specification, the importance of all of social learning concepts and several examples provided by Akers himself, researchers still rarely include good measures of differential reinforcement and imitation. Therefore, it is necessary to develop more sophisticated measures to examine the differential reinforcement process, such as the role of nonsocial reinforcers. In terms of the imitation concept, in fact, research has revealed a relationship between exposure to deviance and violence on television and other media outlets and behavior problems in early childhood (Akers, 1998, p.77; Comstock & Rubinstein, 1972; Murray et al., 1972; Pearl et al., 1982; Donnerstein & Linz, 1995). Also, imitative effects on pro-social behaviors have been reported as well (Rushton, 1980, 1982).

Cross-Cultural Applicability of Social Learning Theory

The applicability of social learning theory is not limited only to American samples, but also to sample from various countries confirmed the generalizability of the theory. As Akers clearly states, the social learning theory is not a culture-bounded or society specific explanation of deviance. Accordingly, cross-cultural studies have been conducted in South Korea, Sweden, New Zealand, Israel, Ireland, Europe, Taiwan, & China (Fergusson, Swain-Campbell, & Horwood, 2002; Fergusson & Horwood, 1999; Hwang & Akers, 2003, 2006; Kandel & Adler, 1982; Lee, 1989; Junger-Tas, 1992; Bruinsma, 1992; Miller, Jennings, Alvarez-Rivera, & Miller, 2008; Bezinović & Malatestinić, 2009; Rumpold, et al., 2006;

Zhang & Messner, 1995). Rumpold et al. (2006) used a sample of Austrian adolescents to examine the effects of various predictors on adolescent substance and drug use. They conducted multivariate structural equation model analyses and found that peer group influence is particularly strong predictors associated with adolescent substance and drug use behaviors compared to other risk variables for adolescents' substance use, such as negative family atmosphere and school difficulties, including other individual level risk factors.

Fergusson and his colleagues (2002) examined the deviant peer influence on adolescents' substance use as well as deviant behaviors among New Zealand adolescents. They used twenty-one years of longitudinal data in a birth cohort of 1,265 children who were born in Christchurch, urban area, in New Zealand in mid-1977. The cohort has been followed by Christchurch health and Development Study program at birth, 4 month, 1 year and at annual interval to age 16, 18 and 21 years old. With such a carefully designed study, they found significant influence of deviant peers on adolescents' deviant behaviors, such as violent crime, property crime, alcohol and other drug abuse. On the basis of their findings, researchers concluded that deviant peer associations are correlated with increased rates of a range of problem behaviors in adolescence and young adulthood, and the influence of deviant peer association is the most influential at younger age. Miller et al. (2008) also specifically assessed the cross-cultural efficacy of social learning theory with a sample of Puerto Rican high school adolescents, who are attending private and public schools. This study focused on comparison of the relative influences of personal and peer definitions (differential association) on substance use (tobacco, alcohol, and marijuana use). They found statistical differences between public and private school students across all three substance use behaviors and the two aspects of social learning theory, definitions and differential association. In this study, peer definitions are the strongest predictors on adolescents' substance use after controlling for demographic factors, age, and gender. That is, students

who perceive more peer approval of substance use are at greater risk to be involved in lifetime tobacco, alcohol, and marijuana use than students who perceive less peer approval of substance use, regardless of their own personal definitions of these substance use behavior.

South Korean Adolescents and Social Learning Theory

These findings are consistent with the results of studies that have used South Korean samples and studies conducted in South Korea context. First, Hwang (Hwang, 2000; Hwang & Akers 2003; 2006) extended testing social learning theory to in a sample of South Korean youths. He collected data from a cross-sectional sample of 1,012 high school students in a metropolitan city, Busan (formerly Pusan), in South Korea. In their study, specifically, all of four social learning concepts are employed. The findings of the study reveal that the concept of differential peer association, which was measured by association with friends using substances and drugs, has the strongest direct effects on adolescents' substance and drug use. That is, the more students reported that they are associated with substance using friends, the more likely it was that they used substances and drugs. Besides differential association with peers definitions, differential reinforcement, and imitation were also significant predictors for South Korean youths' substances and drugs use. A recent study conducted by Kim et al (2010) used a national sample of 3,188 junior high school students drawn from South Korea to examine comparative predictability and generalizability between social learning theory and social bonding theory. This study compared the relative importance between peer influence drawn from social learning theory and parental influence reflecting social bonding attachment measure on adolescent drinking and smoking behaviors. This study found support for both social learning theory and social bonding theory, suggesting substantial peer and parental for influence in predicting the risks of adolescent substance use.

Other studies conducted by South Korean researchers also support the social learning propositions in explaining adolescents substance and drug use behaviors. National Youth

Commission (2005) conducted research investigating patterns of alcohol abuse among South Korean youths by using a self-reported data from randomly selected sample across South Korea. Researchers in this project collected a national representative sample of 1,615 adolescents which is composed with 361 elementary school students (22.4%), 469 junior high school students (29%) and 785 high school students (48.5%). Specifically, the high school participants consist of 395 students attending liberal school and 390 students attending industrial schools. Although they used randomized data collected nationwide, the researchers only conducted descriptive analysis, cross-tab analysis and t-test for comparing means between groups, and correlation analysis, including some narrative analysis with several interview data. Therefore, although they attempt to collect data and conduct empirical analysis their efforts are limited in understanding correlations between risk and protective factors and participants' alcohol use behavior.

However, this study provides the overall patterns of alcohol use among adolescents in South Korea and general information regarding important factors influencing on their alcohol use behavior. They found that approximately 65 percent of participants have ever used alcohol. Although the overall proportion using alcohol among adolescents has decreased slightly from the proportion of the previous years, 74percent, the pattern of alcohol use among youths is still high and comparative to the rates of western countries. Also, the proportion of binge drinking among students increased from 44.9 percent in 2004 to 56.9 percent in 2005. In addition, this study found that there is no significant gender difference in the life time alcohol use (lifetime alcohol use for male students is 63.4% versus for female students is 62. 2%). Furthermore, the proportion of alcohol use during the past year is greater for female students than male students (40.3% for males and 43.0% for females respectively), indicating increased trends of alcohol and other substance use among female students in South Korea.

They also found some differences in the frequency of alcohol use per month among students by type of schools they attend. For students attending industrial schools, the mean frequency of alcohol use per month is 3.45 times per month, while the average alcohol use frequency for students attending industrial schools is 2.03 times per months. In terms of binge drinking among youths, students attending industrial schools reported that they drunk three times per month on average, while students attending industrial schools reported that they have been involved in binge drinking less than five times per year. That indicates students attending industrial schools more frequently use alcohol per month and were at greater risk of binge drinking than students attending liberal type of schools. This study explicitly employed predictors for adolescents alcohol use drawn from social learning, social bonding and strain theory. They found that peer association is the best predictor of students' alcohol use. In particular, the influence of friends using alcohol has great impact on both the initiation and maintaining of alcohol use behavior among the participants. The correlation coefficient of the peer variable is 0.20 which is the greatest one among variables used in this study. Again, the variables measured by the proportion of close friends who use alcohol and their frequency of alcohol use, which are also other explicit peer association measures, had the second greatest impact on adolescents' alcohol use. Participants responded that they wanted to maintain good relationship with friends who using alcohol and that is one of the main reasons they initiate and continue to use alcohol while they associate with friends. Interestingly, approximately 21 percent of student who ever used alcohol reported that they used alcohol because other adults encouraged drinking. This suggests that differential association with other adults who use alcohol has an impact on students' use of alcohol.

Parental alcohol use was an important predictor for students' alcohol use. Students who have alcohol abuse problems are more likely to report their father's alcohol use problems compared to the students who did not have binge drinking problems. The difference is

statistically significant between the two groups and indicates that father's problematic alcohol use has significant influence on their children's alcohol use behavior. There are also some differences between the two groups in terms of mother's alcohol use behaviors. The greater mother's use alcohol and binge drinking, the higher risk that their child report binge drinking problem. Students' definition favorable to use of alcohol is also highly correlated with alcohol use. Imitation through exposure to alcohol using advertisement appeared to have some impact on adolescents' alcohol use. In terms of social bonding variable, parental supervision and parental attachment are also significantly associated with the participants' substance use.

Yun and her colleges (1999) used differential reinforcement measures from social learning theory in their study examining adolescents' substance use. In their study, they used a list of index of 21 questions asking students about their expectance from alcohol use. In analysis they found that question items reflecting good or bad effects of substance use, which indicate both social and non-social reinforcement measures, are significantly and strongly associated with students' alcohol and substance abuse behaviors. This study concluded that students who have greater expectation of substance use on the basis of measures of the effects of substance use, such as rewards and costs of substance use, are more likely to use substance. This finding supports the concept of differential reinforcement in social learning theory.

Choi (2003) investigated correlates associated with drugs use among a sample of incarcerated delinquents in six juvenile confinement facilities in South Korea. In her final sample, she surveyed 508 delinquents which is 27.9 percent out of the total juvenile delinquents incarcerated in any confinement facilities in South Korea (n=1,822, a nationwide sample) in 2003. She also studied the trends of substance and drug use among non-delinquent and delinquents in confinement facilities from 1987 to 2003 by using data from other studies

of adolescents and delinquents substance and drug use (Kim, Chio, & Chin, 1990; National Youth Commission, 2002). In her analysis, first she found that illicit drug use among non-delinquent adolescents subsequently decreased compared to a decade earlier. Choi noted two important predictors for substance and illicit drug use among non-delinquents and delinquents are 1) the availability of illicit and substances and 2) peer influences. Although this study does not explicitly use social learning theory as the theoretical framework for analysis, the findings support the proposition of peer influences in the theory. However, this study did not utilize rigorous statistical methods; rather it used simple descriptive, content and narrative analyses.

Studies investigating smoking behaviors among South Korean adolescents also support major concepts of social learning theory. Specifically, peer and parental influences were found to be strong predictors for adolescents' smoking behaviors. National Health Control Institution (2006) conducted a survey to examine adolescents' health behaviors in 2006 and found that the most important causal factor for initiation of cigarette use is peer influences, particularly for female adolescents. Kang and Kim (2005) investigated factors associated with male students' cigarette use. They found that the number one predictor for smoking among male students is also peer influence. Particularly, the variable measuring proportion of close friends using cigarette, a standard variable reflecting the differential peer association concept of social learning theory, was the strongest predictor in his study. Another study by Kim and Park (2009) found parental influence is the second important risk factor on adolescents' smoking behaviors followed by the differential peer association with smoking friends.

In summary, studies conducted in South Korea generally support the propositions and the core concepts of social learning theory. Although these studies provide valuable information regarding patterns and behaviors of adolescent substance and drug use, only a few of the studies employed rigorous statistical methods and variables from major

criminological theories (Hwang & Akers, 2003, 2006; Kim, Kwak, & Yun, 2010). Therefore, there are still great knowledge gaps in explaining and investigating the predictors related with the process of South Korean youths' substance and drug use. Most of all, unlike the studies conducted in the United States and other Western countries, none of the studies, which used samples of South Korean, have systematically used neighborhood or community level factors, which are considered as important predictors in understanding adolescents' substance and drug use behaviors.

Akers' Social Structure Social Learning Theory (SSSL)

Akers' (1998) Social Structure Social Learning Theory (SSSL) is a cross-level integrated theory or "theoretical elaboration" of social learning theory that specifies the process and mechanism by which structural level variables affect individual deviant and criminal behaviors (Akers, 1998, p.330). The key proposition of the SSSL theory is that, the social learning process mediates social structural influences on individual criminal and deviant behaviors that make up the macro-level rate of crime and deviance. More specifically, the cognitive/behavioral process specified in social learning theory process is hypothesized to be the primary mechanism linking social structural variables (meso- or macro-level structural factors) to individual behaviors (Akers, 1998, p.329). Therefore, differences in social structures such as "distal macro-level and meso-level causes of crime" across various "structure, context, and environments" will have an effect because they generate difference in the operation of social learning variables (Akers, 1998, p.322). Akers expects that empirical research findings "typically are that the net effects of social learning variables remain in these models while the net effects of socio-demographic variables are reduced, typically to statistical non-significance" (Akers & Jenson, 2006, p.54). In his book, *Social Learning and Social Structure*, he commented about the SSSL theory that,

Its basic assumption is that social learning is the primary process linking social structure to individual behaviors. Its main proposition is that variations in the social structure, culture, and locations of individuals and groups in the social system explain variations in crime rates, principally through their influence on differences among individuals on the social learning variables-mainly, differential association, differential reinforcement, imitation, and definitions favorable and unfavorable and other discriminative stimuli for crime. The social structural variables are indicators of the primary distal macro-level and meso-level causes of crime, while the social learning variables reflect the primary proximate causes of criminal behavior by individuals that mediate the relationship between social structure and crime rates (Akers, 1998, p.322).

In SSSL, Akers maintains that four main dimensions (differential association, differential reinforcement, definitions, and imitation) of the social learning process are the key mechanisms that mediate the effects of structural conditions. Akers identifies four major dimensions of social structure that provide the various contexts within which the social learning process is assumed to operate: differential social organization (society, community culture), differential location in social structure (age, gender, class, race), meso-level of social location (primary, secondary, and reference groups), and theoretically defined structural variables (social disorganization). Figure 2-1 illustrates the conceptual model of the SSSL theory.

The first structural dimension is “*social structural correlates: differential social organization*” (p.332). This concept refers to known causative aggregate-level characteristics of cultural, societal and geographical differences in crime rates. Akers has little emphasis on this concept because “the empirical variation in rates of crime and delinquency can be established, with or without specification of the causative structural or cultural characteristics of these systems. From this point of view, it makes little difference what the specific theoretical explanations of the variations are. But the measure could be tapping some unspecified combination of the features of the social organization, culture, or social backgrounds of the people who from the community or society” (p.332). Indicators of this concept include empirical correlates that have been used as statistical controls in prior macro-

level studies, such as population size, density and other regional, geographic or economic social system (Akers & Sellers, 2009; Lee et al., 2004).

The second concept of the SSSL model is “*socio-demographic/socioeconomic correlates: differential location in the social structure*” (p.333). It reflects “social demographic” or “social economic correlates” that socially define or place people in macro-level social organization or larger groupings and other dimensions of differentiations in societies and communities (p.333). This concept is commonly conceptualized as direct individual crime causal factors, but it is defined as “socio-cultural categories” or “collectivities”, which indicate various categories of individuals in the social structure (p.333). These indicators are gender, race, marital status, occupation, religion, age, class and socioeconomic status and other individual characteristics that characterize groups in society. In empirical studies, these variables can be used in analysis of models of crime and deviance either by measuring the characteristics for individuals or by aggregating these measures into proportions of individuals with these characteristics. For example, a measure of race and gender proportions of the population in a community can be incorporated into an empirical model as an indicator of differential location in the social structure.

Third, “*theoretically defined structural causes*” refers to crime causative structural constructs identified and drawn from “the well known structural theories of crime and deviance that propose elevated rates in those societies, or segments of societies, that are hypothesized to have higher levels of some abstractly defined condition like anomie, conflict, social disorganization, patriarchy, or class oppression” (p.333). Some structural correlates of crime such as inequality, social class, poverty, population instability or others may be taken as indicators of these theoretical constructs or other measures taken at the group or individual level may be defined as indicators of the theoretical constructs. According to Akers, the most

relevant explanatory concepts are theoretical variables drawn from social disorganization theory and anomie theory (Akers, 1998, pp. 330-334).

The fourth structural dimension in the SSSL theory is “*differential social location in primary, secondary, and reference groups*” (p.334). It refers to the meso-level or - more immediate social context than to more macro-level and distal contexts. These consist of primary or secondary groups and individual networks such as family, work groups, peer groups, church groups, reference groups and others to which one is affiliated or belongs (p.335).

The four dimensions of the social structure affect an individual’s past or future exposure to different levels of the social learning variables. In turn, this different level of exposure to the social learning variables will determine the individual’s initiation, maintenance, and cessation of criminal and deviant behaviors, and ultimately crime rates among a population in which the crimes of these individuals are counted (p.335). The expected relationships between social structural dimensions and social learning variables and social learning variables and individual criminal and deviant behaviors are as follows:

The strongest expectation is that the variations and stabilities in the behavioral and cognitive variables in the social learning process account for all variations and stabilities in criminal behavior and thereby mediate all of the significant relationship between the structural variables and crime. The more realistic statement is that variations and stabilities in the behavioral and cognitive variables specified in the social learning process account for a substantial portion of individual variations and stabilities in crime and deviance and mediate a substantial portion of the relationship between most of the structural variables in the model and crime. A weak statement of the theory is that the social learning process accounts for some portion of the variation and stability in criminal behavior and mediate some portion of the relationship between the correlates and crime (Akers, 1998, p.340).

Specifically, Akers claims that the SSSL model rests on the expectation that the social learning variables will “substantially” mediate structural effects. The purpose of this SSSL theory is not to explain why there are social structural variations in social disorganization,

anomalies, as well as age and gender structures. Rather, he is more interested in explaining how social structural differences generate the difference in individual criminal behaviors through the effects on the social learning process and thus to the differences in crime rates (p.336).

Previous Studies Testing the Social Structure and Social Learning Theory

Although Akers proposed the social structure and social learning theory and invited empirical research for this model more than a decade ago, complete research testing the SSSL model which incorporates all four of social structural concepts, as well as the four major social learning concepts, is still rare. However, even the limited number of studies that have been conducted, generally have found supportive evidence for the major proposition of the theory, the mediating role of social learning measures between structural conditions and various deviant outcome behaviors (i.e., delinquency, crime and substance and drug use) (Akers & Lee, 1999; Bellair, Roscigon & McNulty, 2003; Gibson, Poles, & Akers, 2010; Haynie, Silver, & Teasdale, 2006; Holland-Davis, 2006; Jensen, 2003; Krohn, Lanza-Kaduce & Akers, 1984; Lanza-Kaduce & Capece, 2003; Lonza-Kaduce, Capece, & Alden, 2006; Lee, Akers, & Borg, 2004; Page, 1998; Verrill, 2008; Wu, Eschbach, & Gardy, 2008).

Lee et al (2004) tested the propositions of SSSL model with Boys Town data to examine whether social learning variables substantially mediate structural variables on adolescent alcohol and marijuana use behaviors. The study used three social structural variables; differential locations in social structure (gender, class, and age), differential social location in primary and secondary groups (family structure), and differential social organization (community size) as well as all four social learning variables, differential association, imitation, reinforcement, and definition favorable and unfavorable to substance use.

Utilizing structural equation modeling, they found supportive evidence of the model: Three social learning variables mediated substantial amounts and sometimes virtually all of

the effects of gender, socio-economic status, age, family structure, and community size on the adolescents alcohol drinking and marijuana smoking behaviors. Notably, the net effects of gender, although substantially reduced, remained statistically significant in the models. Although this study did not include “theoretically defined” structural measures in the models, they concluded that the findings generally support the SSSL model and that “it is a useful and empirically supported set of concepts and principles for understanding how social environmental factors have an impact on behaviors” (p.29).

Bellair et al. (2003)’ also tested whether social learning variables mediate the influences of social structural measures, particularly, predictors that garnered substantial empirical supports, such as labor market opportunity, and concentrated community disadvantage measures, on adolescents’ serious types of criminal behaviors, violence (fighting). They used multilevel data from a longitudinal survey data of 25,000 middle school students and various type of structural characteristics drawn from U.S. census data. The structural variables used in this study included poverty, unemployed, percent of urbanization, percent of professional occupation, percent of service job, and family headed household etc. Also, this study utilized various types of individual sociodemographic variables measured at the individual level such as race, employment, sports involvement, school attachment, exposure to violence, family mobility during the past two years, etc.

However, this study used less ideal social learning variables in testing the SSSL theory. What they expected in their analysis is that the employment structure of community may influence social learning processes as well as family well-being in the community directly. (p.199). Using hierarchical linear models analysis, they found significant effects of structural variables on the dependent variable and when social learning variables are entered in the models, the effects of social structural variables, particularly concentrated disadvantage, on adolescent violence were substantially reduced. Additionally, they also found that family

processes partially mediate the structural measures. On the basis of the findings, they concluded that local labor market context matters on adolescents' violent behaviors and their study provided partial support for the SSSL model.

Lanza-Kaduce and Capece (2003) conducted a partial test of the SSSL theory examining if social learning process mediates the influences of social structural variables on college students' binge drinking. They used a sample of 2,783 college students in eight different universities, which is drawn from the Core Alcohol and Drug Survey which conducted survey among various types of colleges in the United States. The final sample only includes college students who are full time, not married, and of traditional college age from 17 to 23 years old to avoid extra-social structural influence beyond the social structural measures included in the model. In their SSSL model, they utilized all four social structural measures: differential social organization (diverse university), differential location in social structure (gender and race), differential social location in meso-level groups (Greek organization extracurricular involvement), and the two structural theoretical variables, one is integration into academics (B or better grade point average) and the other is "the larger cultural climates surrounding alcohol on the campus" (if alcohol is central to each of groups: male students, female students, faculty/staff, alumni, and athletes). With regard to social learning measures, their study include two major concepts, differential reinforcement (anticipated rewards of alcohol use and anticipated punishments by friends for binge drinking) and definitions, while neither peer association nor imitation measures are included. They found that the coefficients of most of the structural variables (Greek Participation, gender, race, and campus climate regarding alcohol use) are substantially attenuated as social learning variables are included in the model. Therefore, they suggest that their study is supportive of the SSSL theory in that, social learning processes mediates *substantial proportion* of the relationship between *most* social structural factors and college students'

alcohol use (p.194). However, they note that studies including the better operationlized social structural variables are more likely to increase the mediation effects of social learning variables that the SSSL model predicted (p.194).

Later, Lanza-Kaduce, Capece, and Alden (2006) explored the effects of gender on college students' drinking behaviors before sexual intercourse within the SSSL framework and within the feminist theory perspective. That is, this study examined if the social learning variables may substantially mediate the effects of structural variables, such as gender, rather than modulate or moderate them. Second, it also examined feminist theory arguments that not all group dynamics, particularly gender, to be mediated by social psychological processes (Morash, 1999). Ultimately, the authors test whether gender, as a structural indicator, would hold in predicting drinking behaviors as suggested by feminist theory or whether the effect of gender would be mediated by social learning. Using a sample of 688 White single college students (18 years of age or older) from Core Alcohol and Drug Survey data in the U.S., they developed research models by including three structural variables (gender, campus Greek-system involvement, and grades) and two social learning variables from one differential reinforcement concept (anticipated risk of harm and anticipated positive consequences). In the analysis, the authors created a grade and gender interaction term (Grade×Gender) in the SSSL model to test if the social learning variables mediate the interactions between structural variables. In their research, they found that “the Akers position and feminist theory both received partial support” (p.138). Their results suggested that social learning variables did mediate the direct effect of gender; however, a significant statistical interaction between gender and grades was not mediated by social learning. They interpreted this finding after interaction between gender and other structural components that may act independently the social learning variables do not mediate. Particularly, the authors suggest that gender may interact with other structural variables independently of the mediation of social learning

process. However, as the authors noted, there was no differential association variable which “Akers et al (1979) expect that differential association to be correlated with the other leading variables, some mediation would have been expected. Without a differential association measures, conclusions about mediation need to remain tentative” (p.138). For the further research, this study concluded that the findings are still tentative and additional research testing the SSSL model is necessary to identify “which structural relationships are substantially mediated, which are not mediated, which interact and which are population specific” (p.139).

Holland-Davis’ (2006) offered a complete test of the SSSL model using macro and micro level data and developing appropriate multilevel analysis models. In this dissertation, she tested the mediation effects of social learning variables on structural variables for adolescents’ drug and substance use (alcohol, marijuana, and other illicit drug use). This study used individual self-report survey data from the Boys Town study and structural variables from the U.S census data. Utilizing Hierarchical Linear Modeling, this study includes all four social structural dimensions (age, SES, sex, population density, poverty, ethnic heterogeneity, residential mobility, and religiosity) and all four social learning variables (differential association, definition, differential reinforcement, and imitation) in the analysis models. This study provides strong support for the SSSL mediation propositions for marijuana and illicit drugs use and moderate support for alcohol use among adolescents. Overall, the findings revealed that most of the social structural influences are substantially mediated by each of the four social learning processes, with a few exceptions. Most of the social structure indicators (e.g., population density, residential mobility, poverty, age, and SES) became insignificant and their coefficients reduced toward zero when the social learning variables are entered into the each of the three substance and drug use models. Among the social learning variables, differential association, definitions, and differential

reinforcement, are strongest predictors and mediators on drug use behaviors in some social contexts than others. Notably, however, this study found that to some extent social structure moderates the social learning influence on adolescents' substance use behavior.

The coefficients of gender in each drug and substance model were reduced, but remained significant on alcohol, and marijuana and while not initially significant became significant for illicit drug use once social learning variables were included in the models. Her findings were consistent with the previous tests for the mediation effects of the social learning process, which mediated but did not make gender effects insignificant in the SSSL models (Lanza-Kaduce & Capece, 2003; Lanza-Kaduce, et al. 2006; Lee et al., 2004). The researcher, however, interpreted this gender effects as not completely inconsistent with the SSSL predictions because it suggests that the social learning variables interact in different ways to influence boys and girls differently (p.111). Also, this study found that the effects of poverty on alcohol use, which had no significant direct effects, increased and became significant when social learning variables included in the model. The researcher suggests that this interaction effect of social learning variables on poverty may also imply the moderating effects of social context on social learning process.

Another recent empirical study by Verill (2008) specifically tested the idea of mediation versus moderation effects of the social learning process on the relationship between social structural influences and delinquent behavior. Jumping to the conclusion, Verill reported that social learning variables more likely moderates the social structural effects on delinquency because his study found some moderated mediation effects of the social learning process on adolescents' delinquency involvement. Verill criticized some aspects of the previous studies testing the SSSL theory and Akers' theoretical proposition of the SSSL model. First, he stated that Akers' conceptual integration of the social learning theory with structural concepts does not specify the linking proposition clearly, accordingly

with Sampson 's(1999) and Krohn's (1999) criticism. Further, he noted that Akers loosely defined "mediation criteria" of the social learning process, substantial mediation, rather than complete mediation (p.129). Therefore, he argues that empirical studies need to test the theory with more scrutiny to rule out moderation effects to verify mediation effects of the social learning process than the previous studies afforded.

He used a survey data of 1,674 Largo, Florida high school and middle school students with 1998 U.S. census data. This study utilized various types of social structural measures (population density, race, sex, age, near poverty, racial composition, family disruption, poverty, residential mobility, socioeconomical status, and ethnic heterogeneity) that reflecting the differential social organization and theoretically defined structural concepts of social structural in the SSSL theory. He also used three elements of social learning variables (differential association, definition, & differential reinforcement. First, he tested moderation effects of the social learning process, by running twelve sets of different Ordinal Least Square models which included interaction terms of each social learning variables and each social structural variables. He found some evidence of moderation effects of social learning variables. For example, "differential association moderate rather than mediate the effects of population density, age composition, and sex on log delinquency; definitions moderate rather than mediate the effects of population density, individual sex, socioeconomical status, and log ethnic heterogeneity on the delinquency measures; and costs moderate rather than mediate the effects of log race composition and individual sex on log delinquency" (pp.132-133).

In a set of Structural Equation Models (SEM) estimating the mediation effects of the social learning process between three structural influences on log delinquency, he reported that the findings do not support Akers' mediation proposition. He concluded that the findings suggest that " the social learning process may moderate social structural variables that

represent the differential social organization and theoretically defined structural cause dimensions in such a way that combined effects reduce rather than increase delinquency” (p.142). However, he suggests that this finding of moderation effects does not invalidate the SSSL theory’s validity in that the findings also revealed that social learning variables are related to the social structural variables and their impact on delinquency. Furthermore, he noted that in a series of analyses examining moderation effects, some social learning variables were correlated with social structural variables as well as outcome variables. This correlation invalidates the moderation interpretation of the relationship (Baron & Kenny, 1986). Furthermore, “none of the interaction models found that a dimension indicator across all social learning variables, nor did one social learning variable statistically interact with all macro-social measures.” In conclusion, he suggested modification of the model to indicate social learning as both a moderator and a mediator of social structural variables (p.143). Further he interpreted the findings of moderated mediation in his study as follows: “Rather than social learning mediating the social structural effects on delinquency, distal macro-social correlates of crime may influence criminal behavior through their interaction with the social learning process, whereas more proximate meso-level crime correlates may provide the context social learning mediates. This explanation accounts for both the moderation effects observed in the present research and for the mediation effects noted in the literature” (p.144).

However, his study has several limitations: it does not include social structural dimensions of differential locations in the social structure and the differential social location in primary, secondary groups, representing more meso-level structures. Also, the sample used in this study was collected from only one high school and middle school in Florida. Further, as the author reported, there is possibility of some misinterpretations of the study findings by using strict model fit criteria of structural equation models. Since the study utilized a sample drawn from only one school area, the strict criteria accepting supportive evidence of the

mediation effects models might be rejected with errors. In addition, the author was concerned that the non-normality issues of data which might have generated error in the moderation analysis. These limitations critically limit the study's generalizability.

One of the most recent study by Gibson et al. (2010) provides a partial test of the SSSL theoretical model by examining whether the social learning process mediates social structural factors, such as theoretically defined variable (i.e., social disorganization), differential location in the social structure on children and adolescents' delinquent behaviors. This study used longitudinal data from the 9, 12 and 15 years old cohorts from Project on Human Development in Chicago Neighborhoods (PHDCN) data (n=1,214) and 1990 U.S. census data (343 neighborhood clusters). This study used two social structural dimensions of the SSSL theory, theoretically defined constructs (concentrated disadvantage as an indicator of social disorganization), and differential location in the social structure (age, race, gender, and socioeconomic status), and one social learning variable, differential association with delinquent peers. Particularly, concentrated disadvantage measure represents the structural conditions of neighborhoods in social disorganization theory and was operationalized by six items drawn from 1990 U.S. census data; percentage of people below the poverty line, percentage of people on welfare, percentage of female-headed households, percentage unemployed, percentage less than 18 years of age, and percentage Black (p.141).

They hypothesized that if the SSSL proposition is correct, 1) children and adolescents reside in more disadvantaged neighborhood will have more delinquent peers, 2) children and adolescents reside in more disadvantaged neighborhood will engage in delinquent behaviors; and 3) delinquent peer association will have a direct impact on children and adolescents' delinquency and will mediate substantially the impact of concentrated disadvantage on children and adolescents' delinquency. They found supportive evidence for their hypothesis. Children and adolescents residing in highly disadvantaged neighborhoods associated with

more delinquent peers and are more likely to engage in delinquency. Specifically, as anticipated by the SSSL model, the impact of concentrated disadvantage has been substantially reduced once the differential peer association is entered into the model while differential peer association has direct impact on children and adolescents' delinquency. But neighborhood concentrated disadvantage measures remained statistically significant and became insignificant only after differential location in the social structure variables were included in the model (age, race, gender, and socioeconomic status). Also, most of the effects of differential location in the social structure, such as age, race, gender, and socioeconomic status, have been also substantially reduced after differential association with delinquent peers is taken into account. On the basis of the findings, the researchers conclude that the effects of social disorganization and demographic characteristics are partially mediated by differential association with delinquent peers and the SSSL model is partially supported by the results from their study. It indicates that the differential association in fact shows moderate effects at best and did not fully explain the effect of neighborhood disadvantage on children and adolescents' involvement in delinquency, although the SSSL model never does state that full mediation effects are expected (p.146). Although this study utilized many neighborhoods in combination with individual data on children and adolescents and used a good theoretically defined measure (i.e., concentrated disadvantage), this study still has a major limitation in that it includes only one social learning measure. Although differential association is the most empirically influential elements of social learning theory, the lack of the other key social learning constructs may affect the results of this study.

There are some studies that did not explicitly claim that they are testing the mediation proposition of the SSSL, but they found partial support for the theory (Haynie et al., 2006; Wu, et al, 2008). Haynie and colleges (2006) examined whether delinquent peer exposure mediates the neighborhood characteristics on adolescents' involvement in violence. Although

this study is not an explicit test of the SSSL theoretical proposition, it provides partial support for the mediation effects of the differential peer association. Using the national longitudinal study of Adolescent Health (Add Health) data, and 1990 U.S census data, they developed Hierarchical Linear regression models for analysis. The findings reveals that adolescents reside in more socioeconomically disadvantage neighborhoods are more likely to engage in violence net of individual demographic and family characteristics and neighborhood selection measures. Importantly, once the peer network measure is taken into account in the model, they substantially reduced the effect of neighborhood disadvantage and other structural level factors toward zero and the two factors became insignificant. In addition, neighborhood disadvantage is associated with exposure to violent peers, and peer exposure mediates part of the neighborhood disadvantage and violence association. The authors concluded that the findings suggest that neighborhood disadvantage influences adolescent violence indirectly by increasing opportunities for youth to become involved in violent peer networks and that this association is in part mediated by exposure to violent and academically unmotivated peers (p.163).

Wu and Eschbach (2008)'s study does not explicitly mention that it follows guidance of or tests the SSSL model, but this study also provides partial test of the SSSL model. They examined contextual risk for marijuana and other hard drugs of young women and found that socially and economically disadvantaged neighborhoods influence their drug use, which is mediated by personal networks. The measures used for personal network variable include number of close friends or number of friends invited to their home, and respondents' perception of their friends' illicit drug use (p. 137) which reflects social learning measures.

Overall, previous studies testing the mediation proposition of social learning process posited by the SSSL model provide at least partial support. However, there are still some limitations regarding the previous studies. First, a complete test of the SSSL theory is still

rarely conducted (one exception is Holland-Davis). Instead, most of previous research built up hypotheses drawn from one or two of primary propositions of the SSSL model; differential association or definitions mediate structural variables on crime and delinquency or used less than ideal social structural measures and social learning variables. Also, the analytical models frequently failed to address measurement errors when using nested data in geographical units or groups. Since the SSSL theory is a macro- and micro-level theory, testing its theoretical proposition requires developing multi-level models. Yet, some of previous studies utilized traditional Ordinary Least Square (OLS) regression models that are not appropriate for examining multi-level data.

Moreover, some of previous studies reported not only mediation, but also some moderation effects of social learning variables. That is, social structural concepts may interact with the social learning process to increase or to decrease individual deviant or criminal acts. Therefore, more studies are necessary to test the mediation proposition of the SSSL model to investigate whether the social learning process intervenes in the relationship between social structure and outcome behaviors by mediation only or both mediation or moderation simultaneously.

Furthermore, in terms of the study evidence suggesting some moderation effects of the social learning process, some (for example, Sampson, 1999) may say that there are perhaps other linking process between the impact of social structural conditions and individual behaviors, instead of or in addition to the social learning process proposed by Akers (1998) , such as family-wellbeing (Bellaire et al., 2003), informal social control process (Gibson et al., 2010) and other social psychological processes (Lee et al., 2004). Although the findings of moderation effects of social learning process do not invalidate the SSSL model, this unexpected finding needs to be addressed and further tested by rigorous empirical studies

with diverse data sets to suggest modification of the SSSL model, if any modification is necessary.

Consequently, identifying alternative processes linking structural influences and individual deviant and criminal acts is also a critical consideration in testing the SSSL model. That is, researchers need to investigate whether alternative or other social psychological variables, besides social learning variables, may mediate the impacts of social structural variables on individuals' criminal and deviant behaviors. Particularly, contemporary research aimed to test the SSSL model must consider including variables drawn from major social control theories such as social bonding and self-control theory. In fact, Akers (Akers & Lee, 1999; Lee, et al., 2004) emphasizes several times the importance of examining mediation effects of other social psychological theories, such as social bonding and self-control theory, in testing of the SSSL model along with the social learning variables. For example, in a study that examined the relationship of crime and deviance to age with social learning and social bonding theories, Akers and Lee (1999) suggests that they basically agree with the statement by Tittle and Ward (1993) that "the explanation of age effects lies in variations in the magnitude or value of the causative variables by age" (p.2). They suggest that the causes of crime and deviance are principally the social psychological causative variables specified in social learning theory as well as social bonding theory. They clearly mention that Hirschi himself did not state it explicitly, but it is at least implicit in social bonding theory. Therefore, they hypothesized that both social learning and social bonding elements mediate the age effects on adolescents marijuana use and found supportive evidence of mediation for both theories.

A similar study had earlier been conducted by Krohn, Lanza-Kaduce and Akers (1984) and tested relative mediation effects of social learning and social bonding variables on the relationship between community contexts (rural or urban) and drugs use. For both of the

previous studies, social learning found stronger mediation effects compared to the social bonding theory. More recently, Akers and his colleagues (Lee et al., 2004) clearly state that “future studies should test models that include, besides social learning variables, good measures of other potential mediating processual or micro-level variables. The most obvious of these would be “social bonding (Hirschi, 1969), self-control (Gottfredson & Hirschi, 1990), or other social psychological or personality variables (Andrews & Bonta, 1994)” (p.31).

Moreover, it has been known that many scholars noted that there are a lot of similarity between social learning theory and social bonding theory. More specifically, Akers and Cochran (1985) (and Akers, 1997, 1998) suggested that social learning and social bonding theory has the greatest compatibility. In their arguments about conceptual integration between social bonding and social learning theory, they said that “... we conclude with a discussion of the conceptual overlap between social learning and social bonding theories to illustrate the direction a conceptual integration would take” (p.339). For example, Akers and Cochran (1985) pointed out that there is considerable conceptual overlap of the belief concept in bonding theory and the definitions concept in social learning theory. Further, they argued that the concept of definitions in social learning is broader because it “includes positive, neutral, negative and neutralizing attitudes and verbalizations which are both general and specific” (p.339). When beliefs are measured as the proximal beliefs specific to smoking or drug use, they are empirically the same as definitions favorable and unfavorable. Later, Akers (1998) distinguished between the two concepts when comparing “belief” to “definition” in empirical research: He allocated studies that used more generalized beliefs as studies testing bonding theory while studies used more specific beliefs to delinquency and substance use as research testing learning theory (p.339). Therefore, although the belief terminology comes directly from social bonding theory it does not need to be seen as separate from and can be integrated into the general overall concept of definitions. However, in empirical studies, researchers did

not make the connection or distinction between the two concepts, proximal beliefs of social bonding theory and definitions in social learning theory.

With regard to the other conceptual overlaps between social bonding and social leaning theory, Akers and Cochran (1985) argue that social bonding variables are subsumable under some concepts of social learning variables; the rational components in conformity, the cost of deviant behavior, of social bonding theory is subsumable under one side of the concept of differential reinforcement, negative punishment; the concept of attachment overlaps with the intensity of differential associations or other social leaning variables such as the concept of definitions, self-reinforcement in and imitation social learning theory (pp.339-340). This is another reason for emphasizing the importance of including other social psychological theories, such as social bonding and self-control variables to compare the relative mediation effects of the three theories.

Despite the importance of comparing and considering other social psychological variables such as social bonding and self-control variables, none of the studies has fully included other social psychological variables in models testing the SSSL theory, except the limited efforts made by Akers and Lee (1999) and Krohn, Lanza-Kaduce and Akers (1984). Therefore, by considering the importance of comparing and examining other social psychological variables with social learning variables, this study makes a contribution to the existing literature and development of the SSSL model. Other contributions are that this study is a complete test of the SSSL model that utilizes the full set of social structural dimensions as well as the four major concepts of social learning variables, as well as including all of the major concepts of social bonding and self-control variable. Also, using HLM and HGLM analysis models on three different substance use dependent variables, this study attempts to estimate not only mediation effects of the social learning variables but also attempts to find

moderation effects, if there is any. Finally, by using a sample drawn from Korea, this study attempts to extend the generalizability of the SSSL theory into another social cultural context.

Social Bonding Theory and Self-control Theory

Hirschi's Social Bonding Theory

Hirschi's (1969)'s social bonding theory as well as his and Gottfredson's self-control are now considered to be the major control theory within criminology and have received tremendous research interests and are endorsed by a high proportion of criminologists (Akers & Sellers, 2009). Hirschi's social bonding theory has several merits for empirical tests in that its major concepts are easy to measure and this theory is "an internally consistent, logically coherent, and parsimonious theory that is applicable to any type of criminal or deviant behavior, not only delinquency" (Akers & Sellers, 2009, p.129) Social bonding theory effectively incorporates key elements from all previous control theories and provides new insights to explain delinquent behaviors and drug and substance use.

In his book, *Causes of Delinquency*, Hirschi (1969) posits that delinquency and substance and drug use is the results of one's breakdown and weakened social bonds to society (1969, p.16). In other words, the more closely an adolescent bonds to his or her family, school, and friends, the less likely he or she is to act in deviant ways.

Hirschi identified four major elements referring to social bonding to society. The four main concepts in social bonding theory include attachment, commitment, involvement, and belief. According to Hirschi (1969), the four major elements are highly intercorrelated each other, indicating that the weakening or strengthening of one element will be accompanied by the weakening or strengthening of another element. First, Hirschi argues that *attachment* to others, regardless of whom they are, will make a person to be constrained from committing deviant behavior to make the person adhere to conventional societal rule and standard. That is, the more one has close emotional ties to others, admire and honor them and the person

cares about their expectations the less likely he or she is to be involved in delinquency and substance use.

Second, *commitment* refers to a “stake in conformity” that can be lost if one is engaging in law breaking behaviors or an investment of time or energy for conventional activities, such as academic achievement or occupational aspiration (Akers & Seller, p.130). It suggests that if one has greater commitment, the more the individual risks jeopardizing what he or she has by committing delinquent and substance use behaviors.

Third, the concept of *involvement* refers to an individual’s “engrossment in conventional activities”, such as studying, spending time with friends and family, and participation in extra-curricular activities. It assumes that if a person is heavily engaged in conventional activities, this person becomes too busy or too pre-occupied to engage in delinquency and substance use.

Fourth, with regard to the concept of involvement, some researchers have continuously argued that there is conceptual and empirical overlap between involvement and commitment (Akers & Cochran, 1985; Conger, 1976; Hwakins & Weis, 1985; Krohn & Massey, 1980). Therefore, measuring time spent in conventional activities is perhaps a better measure for the concept of commitment as the temporal dimension of commitment (Hwang, 2000).

Finally, the fourth element is belief. Hirschi defined the concept of *belief* as one’s belief in the general conventional values and norms, and endorsement of moral validity of societal rules and laws that keeps the individual from violating those rules and law. It assumes that if an individual believes he or she should obey the rules and laws, the more likely he or she is to act in a manner consistent with these rules and laws (Akers & Sellers, 2009, p.131). Although Hirschi described the concept of belief as generalized beliefs, research on adolescent alcohol and cigarette smoking has used primarily specific positive and negative beliefs about substance use behaviors (Krosnick & Judd, 1982). Furthermore, some

studies found that these more “proximal” beliefs are better predictors for adolescents’ smoking initiation while general beliefs are important only to the extent that they impact more proximal beliefs (Hwang, 2000, p.32; Fishbein & Ajzen, 1975; Chassin et al., 1981).

Therefore, the social bonding theory predicts that adolescents are more likely to refrain from deviant and substance use behaviors: 1) if they are more strongly attached to others (attachment); 2) if they have greater stakes in conformity (commitment); 3) if the majority of their time is spent involved in conventional activities (involvement), and 4) if they accept conventional moral law and conventional beliefs (belief).

Empirical Validity of Social Bonding Theory

Previous studies generally have supported the contentions of social bonding theory and the major concepts, except for the concept of involvement. The strength of the support from empirical studies is weak to moderate (Akers, & Sellers, 2009). Among the social bonding concepts, attachment seems to be the strongest predictor for delinquency (Lackey & Williams, 1995; Nagin & Paternoster, 1994; Wiatrowski, Griswold, & Roberts, 1981; Mak, 1991; Junger & Marshall, 1997) and for substance and drug use (Jessor & Jessor, 1975; Brook, Whiteman, Gordon, & Brook, 1981; Burkett, 1977; Jessor, Chase, & Donovan, 1980; Krohn, Massey, Skinner, & Lauer, 1983; Flewelling & Bauman, 1990; Farrell, Barnes, & Banerjee, 1995; Jang, 2002). Parental influence, attachment to teachers, and attachment to peers, are associated with adolescent deviance and substance use. Parenting style and parental control (as indicators of attachment) are also important determinates of delinquency (Coombs & Landsverk, 1988; Messner & Krohn, 1990). Lack of attachment to parents, regardless of whether an individual comes from a broken or intact family, was a strong predictor of adolescents’ smoking, alcohol, marijuana and other drugs (Brook, Whiteman, Gordon, & Brook, 1984; White, Pandina, & La Grange, 1987). White et al.’s (1987) longitudinal study used a sample of 882 adolescents who took part in an initial survey when they were 12-, 15-,

and 18- year old, and followed by the researchers three years later again to collect data. This study found that greater proportion of adolescents who reported a lower level of perceived parental affection and love were involved in the most serious levels of alcohol and other drug use than adolescents who reported greater levels of perceived parental attraction.

In some studies, however, the relationship between attachment and substance use were rather weak (Agnew 1991a; Bahr, Macos, & Maughan, 1995; Krohn et al., 1983). A longitudinal study conducted by Krohn, et al., (1983) found that belief and commitment are associated with smoking abstinence among adolescents, but attachment to friends and commitment to work are positively associated with adolescents' smoking behavior contrary to the theory prediction. Agnew (1991a) also conducted a longitudinal study and found that attachment did not predict adolescents' involvement in delinquent behaviors and the other three social bonding variables are weakly related with delinquency. Bahr et al (1995) found that family bonding measures is moderately associated with adolescents' drug use behaviors, but these measures operated through peer association. That is, adolescents who have strong bonds to family are less likely to associate with friends using drugs.

Studies also found some support, but weak, for the predictions of the effects of commitment, involvement and belief on delinquency and drug use behaviors (Bahr, et al., 1995; Brownfield & Sorenson, 1993; Hagan, 1991; Jang & Jonshon, 2001; Lyerly & Skipper, 1981). Using a sample of 1,505 adolescents from the 1977 National Youth Survey data, Jang and Johnson (2001) found that adolescents who were more committed to both school and educational work used drugs less than those who are less committed to these conventional works.

Bahr, et al., (1995) also found that commitment was negatively associated with adolescents' alcohol drinking behavior. The findings revealed that adolescents who are highly committed to educational work tend to drink less frequently and to drink less when they do

drink than those adolescents who are less committed to education. As such, some studies found some support for the concept of commitment to grades, educational and occupational expectations on delinquency, substance and drug use, but the overall relationship was weak (Agnew, 1985; Kandel, Kessler, & Margulies, 1978; Paternoster & Iovanni, 1986; Liska & Reed, 1985). Sometimes there are findings opposite to expectations from the social bonding theory (Krohn, et al., 1983).

The belief concept received some mixed support ranging from moderate to weak impact on adolescents' involvement in delinquency and drug use (Agnew, 1985; Akers & Cochran, 1985; Krohn & Massey, 1980; Kaplan, Martin, & Robbins, 1982; Krohn et al., 1983; Paternoster & Iovanni, 1986). In a longitudinal study, Krohn et al (1983) found that belief and commitment are the strongest predictors among social bonding variables in predicting adolescents' smoking behaviors. Kaplan et al (1982) also found some supportive evidence that adolescents who endorse conventional and normative beliefs less are more likely to use drugs. Akers and Cochran (1985) found that all of the four major concepts of social bonding theory were significantly associated with adolescents' marijuana use. Among the four factors, commitment and belief were the strongest predictors for youth's marijuana use. Contrary to the theory prediction, however, some findings contradicted to the social bonding theory. For example, Burton et al. (1995) found evidence non-supportive of the belief concept in a study of 263 high school students. They found a significant and positive, rather than a negative, relationship between belief and adolescents' drug use.

With regard to the concept of involvement, previous studies generally found that involvement is generally not related to adolescents' involvement in delinquency, and substance use behaviors (Agnew, 1991b; Ginsberg & Greenly, 1978; Jenkins, 1997; Wiatrowski & Anderson, 1987). For example, Ginsberg and Greenly (1978) used a sample of

319 college students and found that students' lack of involvement in conventional activities was not associated with students' marijuana use.

Overall, previous research testing social bonding theory found that bonding factors have significant influence on adolescents' delinquency and substance use. Yet, researchers frequently reported that social bonding measures had weaker effects if social learning measures were included in their models. While some studies reported greater support for social bonding theory when it is used as a single theoretical model, the effects of bonding disappear in studies including some measure of social learning variables while social learning variables retain their strength.

Gottfredson and Hirschi's Self-Control Theory

In their book, *A General Theory of Crime*, Gottfredson and Hirschi (1990) claim that this theory is suited to explaining all types of crime and deviance, at all times and places, all age, regardless of social class, gender, and race, etc., focusing on one unidimensional trait; low self-control. Accordingly, many scholars call this theory "Self-Control Theory." Gottfredson and Hirschi (1990) posit that "individual differences in involvement in criminal and analogous behavior are due largely to individual differences in the personality trait they call low self-control" (Ameklev, Grasmick, Tittle, & Bursik, 1993, p.225). That is, the propensity to engage in criminal and delinquent behavior is caused by low self-control (Akers & Sellers, 2009). Low self-control is formulated as the outcome of ineffective parental socialization when parents do not closely monitor their children's behaviors and fail to recognize and correct or punish the children's problematic behaviors when it occurs (Gottfredson & Hirschi, 1990, p.97). Gottfredson and Hirschi contended that one's level of self-control, once established in early childhood between aged 8 to 10 years old, remains stable over the life course and are relatively unaffected by other factors (1990, pp.107-108). That is, those individuals with low self-control will be substantially more likely to engage in criminal acts

at all periods of life while people with high self-control are less likely to commit crime, according to self-control theory (Akers, 1997, p.91). Also, individuals with low self-control will have a greater and stable tendency to commit crime and deviance across all social circumstances (e.g., school, work, and marriage) at all stage of life after childhood (Akers, 1997, p.93).

Although Gottfredson and Hirschi do not explicitly spell out the elements of the low self-control concept, they suggest the attributes that characterize people as constituting low self-control in their original work (Arnekeev et al., 1993; Grasmick, Tittle, & Bursik, 1993). According to the theory, individuals with low self-control tend to be “impulsive, insensitive, physical (as opposed to mental), risk-taking, shortsighted, and nonverbal” (Gottfredson & Hirschi, 1990, p.90). These individuals are characterized by a “here and now” orientation and a desire for immediate and simple gratification while people with high self-control are able to defer gratification and recognize that involvement in crime and delinquency provide only “few or meager long-term benefits” (impulsivity) (Gottfredson & Hirschi, 1990).

Also, individuals who have low self-control tend to be adventuresome and engage in risky and exciting activities rather than be cautious (risk-seeking) (1990, p. 89). These people with low self-control also are deemed to be self-centered, indifferent, and insensitive to the sufferings of others (self-centered) (1990, p.89).

The other characteristic of individuals with low self control includes a tendency to be less “diligent, tenacious, or persistent in the course of action.” That is these people prefer “easy or simple gratification of desire” and while trying to avoid complex tasks (simple tasks) (1990, p.89). Also, these low self-control people tend to be more physical and less verbal, rather than “cognitive” or “mental” (physical activities) (1990, p. 89).

Lastly, low self-control characterized by a temper, which refers to tendency to have low level of tolerance for frustration and little ability to respond to conflict through verbal rather

than physical means” (temper) (1990, p. 90). These elements are what Gottfredson and Hirschi believe to comprise self-control: impulsivity, preference for simple tasks, risk seeking, physical activity, self-centeredness, and temper (Grasmick et al., 1993). Therefore, Gottfredson and Hirschi (1990) propose that individuals possessing low self-control, who are impulsive and self-centered, and oriented to simple task, risk-seeking, physical activity, and have low-tolerance for frustration are more likely to engaged in crime and deviant behaviors, including analogous acts (Hwang, 2000, p.37).

With regard to the empirical validity of self-control theory, it has received moderate support by a number of studies on criminal behaviors among adults (Tittle, Ward, & Grasmick, 2003), adolescents (Cauffman, Steinberg, & Piquero, 2005), adolescents in various Western and non-Western countries (Vazonyi et al., 2001, 2004), inmates or offenders (Piquero, MacDonald, Dobrin, Daigle, & Cullen, 2005), street kids (Baron, 2003), and university students (Higgins, 2004). Also, it has received moderate support in explaining adolescent delinquent behaviors as well as drug and substance use behavior (Akers & Sellers, 2009; Arneklev et al., 1993, 1999; Brownfield & Sorenson, 1993; Burton, Cullen, Evans, & Dunaway, 1994; Costello, 2000; Deng & Roosa, 2007; Evans et al., 1997; Gibbs & Giever, 1995; Grasmick et al, 1993; Keane, Maxim, & Teevan, 1993; Nagin & Paternoster, 1993; Pratt & Cullen, 2000; Vazony et al, 2001, 2004; Wood et al., 1993). Pratt and Cullen (2000) conducted a meta-analysis with 21 cross sectional and longitudinal studies directly examining the relationship between low self-control and crime, delinquency and substance use to examine the empirical power of self-control measure. In their analysis, they found that self-control is a significant and strong predictor of crime, delinquency and drug use among various groups. They state that “the meta-analysis reported here furnishes fairly impressive empirical support for Gottfredson and Hirschi’s theory” (Pratt & Cullen, 2000, p.952). Burton et al. (1998) tested the proposition of self control theory on imprudent and criminal behaviors

using self-reported survey data. They found supportive evidence for the self-control theory and conclude that “self control holds promise in explaining both male and female offending behaviors” (p.134). Gibbs and Giever (1995) found strong relationship between low self-control and alcohol use and a minor type of misbehavior, class cutting. Unnever, Cullen, and Pratt (2003) stated that “its relationship to delinquent involvement is a fact which extant theories must take into account” (p.483). Cochran et al (1998) observed the relationship between self-control and academic dishonesty. College students with lower levels of self-control were significantly more prone to cheat on an exam. Evans et al. (1997) examined a significant positive relationship between low self-control and criminal behaviors, as well as behaviors analogous to crime. They found that self-control was a more significant predictor of crime and delinquency than were measures of social control. Furthermore, they found that low self control was also associated with various social outcomes such as quality of marriage and employment. The findings indicate that persons with low self-control make decisions in their lives that lead to negative social consequences, including crime or delinquency.

However some studies found mixed support for the self-control theory (Arneklev et al., 1993; Brownfield & Sorenson, 1993; Perrone, Sullivan, Pratt, & Margaryan, 2004; Wood et al., 1993). Contrary to the theory expectation, however, Wood et al (1993) found that some demographic factors, such as age and gender had significant effects on self-control. Their findings reveal that males have a greater likelihood to engage in illegal substance abuse, and vandalism compared to that of women. Arneklev et al. (1993) also examined the relationship between low self-control and adolescents’ smoking, drinking and gambling behaviors. In analysis, they found some mixed effects of low self-control on such misbehaviors. While the low self control scale predicts drinking and gambling behaviors, it does not explain smoking behaviors. Grasmick et al. (1993) also found mixed results for the low self-control and crime relationship. While low self control had a strong positive effect on fraud, it had no significant

effects on force. Moreover, they found significant interactive effects between low self-control and opportunity on offending (both fraud and force). Patternoster and Brame (1998) presented another study with mixed support for the theory. They found significant positive low self control effects on criminal and analogues behaviors among children. Yet, the correlation between criminal behaviors and analogous behaviors remained high after holding self-control constant, suggesting other possible forces might be operating on the relationship between criminal behaviors and behaviors analogous to crime. This finding contradicts Gottfredosn and Hirschi's arguments that self-control has direct effects on crime and deviance, while they do not consider any mediation effects between self-control and criminal behavior.

In sum, vast amount of previous research testing self-control theory found that low self control has significant influence on various adolescents' criminal and deviant behaviors, including substance and drug use. However, there is still a tautology issue in testing the low self-control theory because much empirical research assumes low self-control from the commission of certain acts, behavior measures (i.e., drinking and driving). Therefore there is still a lack of research "directly" testing self-control. In sum, therefore, over the past two decades, a large body of studies tested the theory, but evidence suggesting that the theory is empirically valid and error free have yet surfaced. Additionally, there are studies that discredits the theory's ambitious contention of a general theory of crime to explain "all crime, at all times" (Gottfredosn & Hirschi,1990:117) (see, Beaver, Wright, & Delisi, 2007; Burt, Simons, & Simons, 2006; Grasmick et al., 1993; Hay & Forest, 2006; Wright et al., 1999; Pratt & Cullen, 2000; Patternoster & Brame, 1998; Perrone, Sullivan, Pratt, & Margaryan, 2004).

Cross-cultural testing of social bonding and self-control theories

Relationship between social bonding theory and self-control theory

Although the social bonding and self-control theory have been frequently tested individually and these two theories once have been considered as different theory, now the two theories are considered as theories that share the same core elements of explanatory variables. As it is well known, Hirschi is the author of social bonding theory (1969) as well as the coauthor of self-control theory (1999) along with Gottfredson. Although he is the author of the two theories, the propositions of these two theories appeared to contradict each other and the relationship between the two theories was not specified by the authors until recently. In fact, when Hirschi first posited social bonding theory, he criticized earlier control theorists' concept of inner control or self-control. Hirschi suggested that attachment is a better concept than self-control, because it avoids the tautology problem in measures of self-control and because self-control can be subsumed under the concept of attachment (Akers & Sellers, 2009). However, Gottfredson and Hirschi's self-control theory (1990) later emphasized the causal significance of self-control, while keeping silent on the key elements of social bonding theory, including attachment. This is was a rather abrupt and surprising theoretical transition without much clarifying explanations (Akers & Sellers, 2009). In the 1990 self-control theory, Hirschi and Gottfredson refrained from detailing precisely how the two perspectives (social control and self-control) converged and diverged. That indicates that Hirschi once thought that social bonds were the main determinant of crime. Later, however, he (and Gottfredson) came to believe that self-control is the sole individual level causal factor in criminal involvement.

In 2004, Hirschi (2004) made a more concerted effort to clarify the relationship between social control theory and self-control theory. Low self control and the propensity to crime were defined in the same way. Gottfredson and Hirsch (1990) asserted that the

propensity of crime was viewed as the tendency to be impulsive, insensitive, physical, risk-taking, short-sighted, and nonverbal. Also, Gottfredson and Hirschi argued that it could be best measured by the very criminal and deviant behavior it was supposed to explain. This of course presented both a conceptual and a measurement tautology issue (Gottfredson & Hirschi, 1990).

In the newer concept, Hirschi (2004) redefined self-control as “the tendency to consider the full range of potential costs of a particular act that moves the focus from the long-term implications of the act to its broader and often contemporaneous implications” (p.534) and asserted that social control and self-control are the same thing. Interestingly, this new concept seemed to be exactly opposite from his original social bonding theory suggested in 1969 (Hirschi, 1969). As noted above, once he (1969) subsumed self-control under the concept of attachment. However, he (2004) now equates all elements of the social bond with, and perhaps subsumes them under, a new concept of self-control (Akers, 2005). In other words, according to Hirschi’s new notion, social bonding theory is now merged under the umbrella concept of self-control. These measures of the four elements of social bonds (attachment, commitment, involvement, and belief) now become measures of self-control concept (Akers, 2005).

Akers (2005) pointed out this theoretical transition of Hirschi’s resolved the tautological problem in the 1990 original version of self-control theory, because the new concept of self-control is not synonymous with criminal propensity or criminal behavior and the new measures of it suggested by Hirschi are not indicators of the dependent variable converted to measures of the independent variable. Followed by Hirsch’s modification of self-control theory, only one empirical study testing Hirschi’s redefined self-control concept presented by Piquero and Bouffard (2007). They collected data from college students to measure the newly defined and reconceptualized self-control concept and to compare its

predictability to Grasmick et al (1993)'s attitudinal measure of self-control, which is the most commonly used to measure the self-control concept. The study found that Hirschi's redefined self-control was significantly related with criminal outcome measures, while the effects of Grasmick et al's attitudinal measure of self-control reduced to insignificant. They concluded with the suggestion that the new self-control concept may be "considered as a situational characteristic, one that may not necessarily be stable within persons, over time, and across opportunities" (Piquero & Piquero, 2010, p. 304).

Such research finding indicates that redefined self-control concept ensures further empirical research. However, Hirschi has not proposed any new measure of self-control concept by himself in his modification. Rather, on the basis of his newly equated self-control and major elements of social bonding concepts, he simply used the same measures that had been used in the past (Hirschi, 1969) for measuring social bonding concepts. This current study, therefore, attempts to follow Hirschi's guideline to examine the reconceptualized self-control measure by using both social bonding variables as well as Grasmick et al's attitudinal measures that captures the six dimensions of the self-control concept that Gottfredson and Hirschi originally proposed in 1990.

Previous Studies Comparing Social Learning, Social Bonding and Self-Control Theory

Social leaning, social bonding theory, self-control theory have been most frequently used in explaining adolescents' substance use and delinquency not only individually but also in combined models. In general, these three theories have received substantial empirical supports, individually and together. Also, sometimes the three theories have been compared with each other as competing theories in explaining crime, delinquency and substance use. When research compares social leaning to social bonding and/or self-control theories, it provides more support for the propositions of social learning perspectives, as well as the relative greater importance of peer association and delinquent peer influence than variables

from social bonding theory and self-control theory (Akers & Cochran, 1985; Bahr, et al., 2005; Brown, et al, 1993; Cooper, May, Soderstrom, & Jarjoura, 2009; Dillon, et al., 2008; Dishion et al., 1991; Erikckson, et. al., 2000; Ghanizadeh 2005; Hoffman, 1993; Hwang & Akers, 2003, 2006; Krohn et al., 1984; Neff & Waite, 2007; Triplett & Payne, 2004; Warr, 1993b; Zhang & Messner, 1995).

Krohn et al (1984) found social learning variables accounted more than social bonding variables for community variances in adolescent substance use. Akers and Cochran (1985) compared social learning, social bodings and strain/anomie theory in predicting adolescents' marijuana use. They found that social leaning theory is strongly supported while social bonding theory is moderately supported by the research. The social bonding variables such as attachment, commitment, and beliefs are significantly related to marijuana use, but the effects of those variables are much weaker than peer association, reinforcement and attitudes toward marijuana smoking.

McGee (1992) examined the relative importance of parental versus peer influences on adolescents illicit drug use. The study used data extracted from the Monitoring the Future data in 1985. Using measures from social bonding, strain and social learning theories, the study found that the strongest effect from peer influence, on adolescents' drug use. On the other hand, the effect of parental influence measure based on social bonding theory does not have significant impact on adolescents drug use.

Cooper et al (2009) compared multiple criminological theories to examine their respective strength in predicating substance use behaviors among incarcerated juvenile delinquents' substance use behaviors. Using a sample of approximately 800 delinquents drawn from incarcerated population in Midwestern states, they examined the relationship between the participants' attitude toward substance and drug use and the actual use of drugs. In analysis, they used nonsocial reinforcement theory, social learning theory, social control

theory, and strain theory. Their findings suggest that nonsocial reinforcement and social learning theory demonstrate greater predictability for both preference for and use of illegal substances among juvenile delinquents compared to social control and strain theory.

Finally, although Pratt and Cullen (2000)'s meta-analysis reported that low self control is a significant and strong predictor of offending, they also noted that variables drawn from social learning theory, in particular, peer factors remained as consistently strong and significant predictors of crime, even after controlling self-control constant.

Cross-Cultural Studies Comparing Social Learning, Social Bonding and Self-Control Theory

The relatively greater importance and significance of social learning variables over social bonding variables and self-control measures were consistently found among studies conducted in cross-cultural settings. First, studies conducted in a South Korean context strongly supported the greater importance of social learning variables in explaining deviance and crime than social bonding and self-control theories (Hwang & Akers, 2003, 2006). Hwang and Akers (2006) found that peer association has a direct positive effect on substance use and that peer effects were greater than that of parental influence. They concluded that the findings were compatible with the previous research in the United States that supported social learning theory. Hwang and Akers' (2003) also compared the empirical validity of social learning, social bonding, and self-control theory by using a sample from South Korean youths. They reported that social learning variables' explanatory power for adolescents' substance use ranged from 58 percent to 67 percent explained variance while social bonding variables accounted for less than 20 percent and self-control theory less than 12 percent of the variance. They concluded that the variables from social learning theory had greater significance and power than that of social bonding and self-control theory in explaining the variance of South Korean youths' alcohol and tobacco use.

Other studies using samples from Asian countries also revealed social learning theory has greater predictability in examining delinquency and crime than social bonding and self-control theory. Zhang and Messner (1995) compared social learning and social bonding theories by examining the influence of family harshness and deviance on adolescent delinquency in China where relatively strong emphasis on family values remains. They hypothesized diminishing peer effects on youths' deviance due to the prominent role of family in China. Contrary to their prediction, the peer variables turned out to be the key predictors of delinquency in China.

Cheung and Cheung (2008) tested self-control theory against social variables including social bonding variables, differential associations, and strain variables with data from Hong Kong. They found that self-control was significantly correlated to social bonds and differential associations, and when entered into the model with these variables, self-control became insignificant.

In sum, what limited literature exists on delinquent youth prediction using data collected from Far Eastern countries seems to support most of the findings from American studies. The research indicates that differential peer associations were a strong predictor of delinquency, as were family and school attachments, and familial strains.

Studies conducted in various other social cultures, such as Western Europe, South America, and Iran, found that the social learning variables explain adolescents; drug use and delinquency relatively better than social bonding and self-control variables. Hartjen and Priyadarsini (2003) compared social bonding and social learning theory with a national sample of 387 French female and male college students on various types of delinquent behaviors. They utilized the four social learning measures (i.e., attitude toward deviance, exposure to delinquent peers, and an index of exposure to delinquent peers) as well as social bonding measures (involvement with family, and school). The findings revealed that all of

social learning measures were significant and reliable predictors for the French college students' delinquency, while none of social bonding measures were significantly associated with their delinquent behaviors. Particularly, they found that social learning theory explains both females and males' delinquency "in the same way to remarkably similar extent" (p.402). Consequently, they conclude that social learning theory is credited as "a universal explanation of youth crime and delinquency" (p.402).

Another study conducted in Sweden, Europe by Svensson (2003) who compared social learning theory and social bonding theory in predicting adolescents' drug use behaviors. He conducted a cross-sectional study with a sample of 859 adolescent drawn from Sweden to examine whether parental monitoring (social bonding theory) and delinquent peer association (social learning theory) explain adolescents' drug use, particularly focusing on if those theories address the gender difference in drug use. This study found that when delinquent peer association measure was taken into account in the analysis model, gender became insignificant while parental monitoring failed to reduce the significance of gender. That indicates the social learning variable was a stronger predictor than the social bonding variable in explaining adolescents' drug use for both boys and girls. The study found that boys tended to have higher levels of contact with delinquent peers than girls, while females tended to receive higher levels of parental monitoring than boys. Also, using an interaction term (parental monitoring \times delinquent peers association), this study revealed that girls who receive less parental monitoring were at a greater risk of becoming associated with delinquent peers and, in turn, this association with delinquent peers led them to engage in drug use. However, he found no significant interaction effects for boys.

Ghanizadeh (2005) examined relative predictability of social learning variables and social control variables with a sample of 173 college students in one university, Shiraz, Iran. Researcher investigated participants' lifetime substance and drug use behaviors such as

cigarettes, cannabis, alcohol and opiate, heroin with variables of social learning theory (i.e., substance using peers) and social bonding theory (i.e., religious attachment). The findings found significant correlations between social learning variables and students' life time drug use across all types of substances and drugs. On the other hand, only some of social bonding variables are indirectly related with substance and drug use behaviors. Furthermore, the significant variable of social bonding theory is religious attachment which Hirschi (1969) had originally rejected as having relevance as one of the concept of social bonding. On the other hand, social learning theory consistently includes the religious variable either as differential location of social structure in SSSL model or one of differential association variables (i.e., association with church group members). Therefore, the significance found among social bonding theory can be interpreted, in fact, as an evidence for greater predictability of social learning theory than social bonding theory. These findings provide strong evidence supporting social learning theory as having better applicability in explaining substance and drugs use among Iranian college students than social bonding theory and accordingly as having greater generalizability.

Meneses (2009) examined cross-cultural applicability of the four major criminological theories on deviant and substance use behaviors among college students in South American societies. These four theoretical perspective used in this study include social learning, strain, self-control and social bonding theory that have been widely applied for explaining deviant and criminal behaviors as well as substance use behaviors in the United States. For analysis, he assessed the findings from a sample of Bolivian college students collected in two universities and compared the findings to the analysis results of a sample of American college students drawn from one large university in southeastern United States. Explanatory variables from the four theories utilized to explain the variances of five dependent variables (alcohol, cigarette, marijuana, other drugs use, hitting, and beating

someone). This study found that measures of social learning theory are strong and significant predictors of substance use (alcohol, cigarette, marijuana, and other drug use) and violent behavior (hitting and beating someone) not only the Bolivian sample but also the American sample. However, they found mixed support for social bonding, strain, and self-control theories. Interestingly, this study found some mediation effects of social learning process for the three variables effects on deviant and substance use behaviors. That is, when social learning variables are added in the same equation with the variables from the three theories, most of the effects of variables from these theories disappear and do not operate as similarly as social learning variables in both societies.

As such, several studies have compared the relative strength in explaining adolescents' substance and delinquent behaviors and the generalizability of the three theories in cross-cultural context. However, there are not many studies examining the mediation effects of the three theories, social learning, social bonding and self-control theory in one combined model. In fact, there are only two of these studies by Krohn et al (1984) and Akers and Lee (1999) assessed social bonding theory's mediation effects on structural (community) variations or age impact (differential social location) in adolescent substance use compared to mediation effects of the social learning theory. Therefore, again, it is important to assess if there are any mediation or moderation effects among social bonding and self-control variables that are comparable to the same effects of social learning variables to expand the propositions of the SSSL theory.

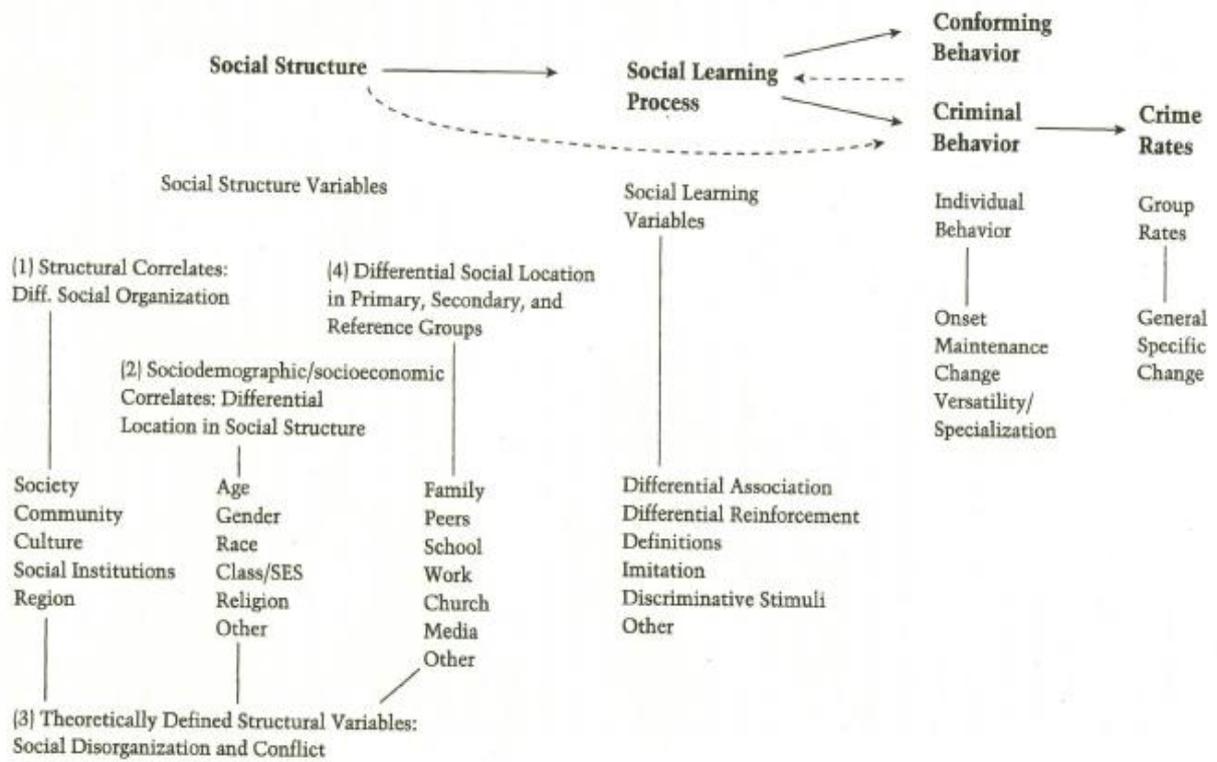


Figure 2-1. The Social Structure and Social Learning Model [Adopted from Akers, R.L. 1998. Social Learning and Social Structure (Page 331, Figure 12.2). Transaction Publisher, New Brunswick, New Jersey]

CHAPTER 3 METHODS

This dissertation analyzes secondary data on adolescence substance use among South Korean youths attending schools in Busan (Hwang, 2000) and adds an original data set comprised of structural-level variables constructed from census data collected by from the Korean National Statistical Office and Busan City government on the 15 districts of Busan. The school districts and the census districts are coterminous. The analysis uses micro- and macro-level data to test the SSSL model through hierarchical linear modeling.

Individual Level Data

The first set of multilevel data is individual level data, which is drawn from a self-report survey data from South Korean youths in Busan, South Korea, originally collected by Dr. Sunghuyn Hwang for his dissertation in 2000. The data were collected by using a two-staged stratified sampling method. In the first stage of the research, the key stratification criterion for the selection of schools was geographical location (district) and type of schools. Busan consists of fifteen different districts called “Gu” in Korean. Since each district in Busan exhibits different social characteristics, geographical dispersion is important for maximizing representativeness. Next, the type of school, “liberal” (high to middle quality), teaching college preparatory curricula, and “industrial” (middle to low quality), delivering vocational training curricula, was used as a criterion for selection of schools. On the basis of these criteria, students of 26 schools were initially selected as target population from the total of 136 high schools in Busan in 1999. There are 10 boys’ liberal high schools (38.5%), 6 boys’ industrial high schools (23.1%), 5 girls’ liberal high schools (19.2%), and 5 girls’ industrial high schools (19.2%) from fifteen districts in Busan. Twenty four of the high schools are in a small town outside the metropolitan Busan, while the rest of schools are within the metropolitan area.

In the second stage, classes were randomly selected and all of students in those selected classes became target sample. In general, the average class size in each high school classroom in Busan ranged from 40 to 45 students. The questionnaire was administrated to all of the students in the selected classes present at that day. The number of students present was 1,035 and all completed the survey. The typical number of absentees and the number of absentees on that day is not known. The final total number of students included in the study was 1,021 students because 23 students who took part in the survey were excluded due to the incompleteness of their survey questionnaires. Thus, the response rate from those present was 100% and of these 98% completed usable questionnaires.

The data from the survey includes measures of all core concepts of social learning, social bonding and self-control theories. The measures of social learning variables used by Hwang were adapted from the questionnaire from the Boys Town Study conducted by Akers and his associates (Akers et al., 1979; Hwang, 2000). The instrument therefore contains very good measures of social learning variables. Also, measures of social bonding variables were adapted from the Boys Town instrument and from the instrument used in the study conducted in a large metropolitan area of the Southwestern United States in 1980's by Marcos et al. (1986). Therefore there are also very good measures of social bonding concepts in the data. The self-control construct was measured by a set of survey questions used by Arnekev et al (1993)'s a 1991 survey of a large southwestern city and the 13th annual Oklahoma City survey conducted by Grasmick et al., (1993) in spring 1991. The questionnaires used in Hwang's dissertation had been carefully translated into Korean (and checked with back translation) by the original researcher. For more detailed information in terms of measurement and the survey questionnaire reliability, please refer to the dissertation of Hwang (2000, pp. 49-50).

Structural Level Data

The data collected by Hwang (2000) contains the school name and location imbedded within the respondent's identification number. This number allows identification of the schools which the respondents attended. The geographical location of the schools and the residential areas from which it draws students with census data are ideal because the Gu for the school district is exactly the same as the Gu for collection of census and other sociological data.

The structural level of data for the Gu is drawn from two different governmental resources in South Korea. First, census data, such as population density, residential mobility, and gender and age composition in each district in Busan, were downloaded from the Korean National Statistical Office (KNSO) to be used for this dissertation research. Second, several important social, economical, and cultural characteristics of districts in Busan (i.e., crime rates, composition of low-income single family in each district, etc.) were obtained from the Busan Statistical Yearbook (BSY) published by the Busan city government annually.

The Korea National Statistical Office (KNSO) which collects national census data across South Korea is a governmental organization which provides a primary service of annually collected national statistics. The KNSO offers services of overall planning and coordination of Korea national statistics, as well as the production and distribution of various economic and social statistics operating under the Statistics Acts of 1962 (and subsequent amendments) in South Korea. A total of 34 different government organizations take part in collection of national level census data (i.e., Korean National Police Agency, Ministry of Labor, and Korean Intelligence Service). Therefore, the data collected by the KNSO are the most reliable official statistics in South Korea. Fortunately, access to these statistical data is readily available online through the Korean Statistical Information System (KOSIS) (www.kosis.kr). The census data are considered to be open public data and are downloadable

from this site directly by theme and by regions (i.e., population density, gender and age composition of each region). Using the KOSIS, several structural data were downloaded by selecting social and cultural characteristics of each district in Busan. The data of population density and residential mobility in each district were downloaded. The downloaded data were originally collected in 1999 to correspond to the same year in which the self-report data were collected by Hwang. The selected structural level data were saved initially in excel file format before being merged with the other structural data set. To merge this data, a corresponding identification number, which reflected each district in Busan, was assigned (1 through 15).

Second, several important structural level data were also drawn from the Busan Statistical Yearbook (BSY) published by the Busan city government (<http://www.busan.go.kr/main>). The BSY is an annual official publication of statistics which has been publicly available since 1993 according to Article 18 of the Statistics Law. The BSY contains various statistics related with Busan city. The BST is available at National Assembly Library (NAL) in South Korea as PDF file format. The BST include statistics such as percent of residents on government welfare, crime rates (i.e., the number of crimes committed by youths, including the crime clearance rates), composition of foreigners and statistics regarding the number of low-income single parent's families in each district. The data from the BST were also originally collected in year 1999 by the Busan city government. Although several different types of structural variables were available through the BST, due to the lack of level-2 units (15 districts), only the percent of residents on government welfare was used in the analyses. The BST data of percent of residents on government welfare in 1999 was downloaded through the NAL online website directly (<http://www.nanet.go.kr/main.jsp>).

Those two set of structural level data were merged into one data set for analysis. Since the statistics from BSY are in table form, I entered the selected structural data into an excel

file to merge it with the census data obtained from the KNSO. To merge the two different data sets into one file, the Busan district names were used as an identifier. To develop an identifier, each district in Busan was assigned a unique number from 1 through 15. After the BST data were entered and coded into an excel file according to the district identification number (ID), it was merged with the census data, which has the same district ID. Next, the merged excel file was transferred into a SPSS data format in order to use it with the individual level self-report data in analysis. Because the original self-report data had been saved as in SPSS format, the structural data were saved in the same format. Therefore, I intentionally matched the two different level data sets into one type of statistical software format, SPSS. Before conducting multi-level analysis with the structural level data, the self-report data must have an identifier to match individual level data with structural level data. Since self-report data were collected by school, which are nested in the 15 administrative districts (Gus) in Busan, the district identification number, which was used to merge the two structural data sets, is the perfect identifier for multilevel analysis. Therefore, the self-report data were reentered according to the school identification number which indicated where the school was located in the districts in Busan.

Utilizing census data collected by South Korean government and Busan city government as structural level data will increase the reliability and validity of the structural level data. Using these data from South Korea to measure structural level variables has a great advantage in this dissertation research. As noted above, in South Korea, the census tract and each district level, “Gu”, is exactly the same geographical unit. In general, a student attends a school located in the same geographical district where the student has a current address, according to the education policy in South Korea. Therefore, the students who took part in the self-report survey in 1999 had their address in the same regions where the schools were located. The schools randomly selected by Dr. Hwang represent 15 different

geographical districts which is the same unit of census tracts in Busan, South Korea. Unlike the research using American samples and census data from the United States in multilevel analysis, this proposed dissertation will not have issues and problems using census data collected from different geographical units from where respondents reside. Additionally, using the existing data save tremendous amount of times, efforts, and money for the researcher.

Measures of Variables

Dependent variables: Alcohol, Tobacco, and Depressant Use

The original data set by Hwang (2000) includes measures of the frequency of adolescents' use of various types of licit and illicit substances. Those include alcohol, tobacco, depressants (geborin, sardon, penjal, sedaphin, nubain), stimulants (timing, night, esnanine, reglin), tranquilizers (atiban, barium, seconal, ruminal, barbital), inhalants (bond, sinna, butane-gas), marijuana, and other drugs (LSD, cocaine, and narcotics). The focus of the dissertation research, however, is limited to adolescents' use of three substances: alcohol and tobacco, and depressants. Consideration was given to including other types of substance use, but the use of the other illicit drugs among South Korean youths, as found in Hwang's study, is at very low frequency levels and the frequency distribution is too skewed to include in the analysis. According to Hwang's (2000) findings only 0.2 percent of the respondents in this study reported having used marijuana and none of the respondents reported use of serious types of illicit drugs (LSD, cocaine, and narcotics) in their life time. Therefore, in this study, the dependent variables are the frequency of use of alcohol, tobacco, and depressants (geborin, sardon, penjal, sedaphin, nubain). It is believed that the inclusion of the use of the three substances as dependent variables is sufficient to address the central goals of the dissertation to conduct tests of the relatively explanatory power and cross-cultural generalizability of three major theories of crime and deviance.

Each type of substance use (alcohol, depressants, and tobacco) was measured by responses to a single item: “For each of the substances listed below, please check the box which comes closest to how often have you ever used it in your lifetime?” Responses were measured on a 7-item Likert response scale: never (0), once or twice (1), several times (2), less than once a month (3), once or twice a month (4), at least once a week (5), but not every day, and every day or nearly every day (6).

Alcohol and depressant use were basically measured as ordinal level data. First, the dependent measure of lifetime alcohol use frequency is created. At the time of data collection, each of students responded to a question asking how often they used each of substances in their life time. The frequency is measured in a seven-Likert item scale (0=“never”, 1=“once or twice”, 2=“several times”, 3=“occasionally”, 4=“weekly”, 5=“monthly” and 6= “almost every day”). Participants are requested to choose only one of the seven categories reflecting the frequency of alcohol use for that student. Therefore, the response category indicates the student’s lifetime frequency of alcohol use. The responses of all of students were, then, collapsed into one outcome measure and became one single measure of frequency of alcohol use. In the same way, a single depressant use frequency measure was created.

The distribution of responses to the alcohol and depressant questions were approximately normal. However the distribution of responses to the tobacco question were essentially binomial and therefore The tobacco use as a dependent variable in this study was converted to a dichotomous variable (0=never use, 1=used one or more times). The problem with non-normality of the frequency of tobacco use distribution is that it does not allow use multiple Hierarchical Linear Models. To conduct multilevel analysis with a dichotomous dependent variable, Hierarchical Generalized Linear Models (HGLM) are developed for tobacco use.

Independent Variables: Individual Level

Social learning variables. The first set of individual level variables is intended to measure the four main concept of social leaning theory.

Differential association in the family and with peers is measured by differential association with substance using friends, father's use of each substance and mother's use of each substance. *Peer Association* indicates that differential association with substance using and abstaining friends which was measured by two questions. First, respondents' were asked to report how often their close friends used each type of substance (seven-point response scale ranged from "never used" (0) to "every day or nearly every day" (6)) and how many of the participants' close friends use each type of substance (four-point response scale: "none, or almost none"(0), "less than half" (1), "more than half"(2) and "almost all" (3)). A scale was created by summing the two variables specific to each substance. This summed scale is created because the two items are highly correlated each other, the two items cannot be used as a separate measure in one analysis model at the same time due to the possibility of multicollinearity. Further, it is one of the common ways to create a summed measure to capture the concept of peer association. The resulting scales ranged from no friends who use the substance (0) to all close friends who used every day or nearly every day (9). The reliability of the scale is Chronbach alpha (α) = 0.76 on alcohol, $\alpha=0.77$ on tobacco, and $\alpha=0.82$ on depressants, respectively. This scale of proportion and frequency of substance using friends and all of the individual level independent variables are changed into standardized Z-scores to facilitate comparison among the three sets of variables of their relative mediating effects. It is noteworthy that there are some methodological issues regarding the measures of concept of differential association with peers in testing social learning theory (Kurbin et al., 2009). One of the issues is that asking the individual to describe his or her perceptions of the attitudes or delinquency of his or her friends are not

direct measures of peer's delinquency and therefore not appropriate to examine the effects of peer approval or disapproval on delinquency (Kurbin et al., 2009; p.149). Although it is correct that the measure asking a person's perception of his or her friends' delinquency is not direct measure of the actual behavior of friends but rather it's the respondents' report of what they perceive to be the behavior of friends. Akers (1998) argues that while other direct measures of friends' behavior are valid indicators, it is the perceptual measure that is more appropriate in testing the concept of peer influence proposed in social learning (as well as the SSSL) theory. That is the individual's perceptions of friends' behavior will have an effect what the actual behaviors of his or her friends'. Therefore, the current measure is appropriate to test the SSSL model. Differential association in the family was measured by *father's use of each specific substance* and *mother's use of each specific substance* from "never use (0) to "use every day or nearly every day (6).

Definitions favorable and unfavorable to use of specific substance are measured by a asking participants' attitudes approving or disapproving each of the three different types of substances (alcohol, depressant and tobacco). For each the response scale was "approve" (1), "sometimes approve and sometimes disapprove, depending on circumstances" (2) and "disapprove" (3). The response scales were re-corded according to the SSSL theory's expectation: "disapprove" (1), "sometimes approve and sometimes disapprove, depending on circumstances" (2) and "approve" (3). Therefore, positive correlations with dependent variables of definitions indicate greater probability of engaging substance use among adolescents as the SSSL theory predicts.

Differential reinforcement is measured by *the reinforcement balance* of perceived rewards and costs that have resulted (if the respondent had ever used the substance) or which would result (if the respondent had never used the substance) from using the specific substance. This is a scale constructed by responses to two items: One asks the participants to

check all “good things” that had happened or would happen from using a specific substance on a seven-point response scale of “fit into groups better” (1), “relieve boredom” (2), “help me study better” (3), “a good high” (4), “relieve pain or sickness” (5), “relieve pressure of school”(6), and “no good things” (7)). The other item asks the participants to check all “bad things” that had happened or would happen from using a specific substances on a seven-point response scale of “feel guilty” (1), “drop in school grades” (2), “interfere with studying” (3), “loss of health” (4), “a habit” (5) “a bad high” (6), and “no bad things” (7)). The responses to the “bad things” list was subtracted from the responses to the “good things” list to get a score for this variable. Therefore, if the score is greater than 0, that indicates the participant perceived on balance that more rewards of using were greater than the costs for using the substance. If the value of this variable is less than 0, it means that the participant perceived more costs than rewards from the using the substance. Therefore, a positive correlation with a dependent variable indicates support for the social learning theory in the expected direction.

Differential reinforcement is also measured by one item asking about anticipated *friends’ reactions* and one item asking about anticipated *parents’ reactions* to the respondents use of the substance. Friends’ reactions were measured on a seven-point scale (from “become closer friends” (1) to “turn you into the authorities” (7)). These scales were redirected and, recorded measures ranged from very punishing or discouraging (“turn you into the authorities”) (1) to very rewarding or encouraging (“become closer friends”) (7). Parents’ reaction is measured on a five-point response scale ranging from turning into authorities (1) to encouraging use (5). That is, a higher score of these measures mean greater rewarding reactions and a lower score means greater punishing reactions. Therefore, positive correlations with a dependent variable are in the direction expected by the SSSL theory.

Imitation is an index created by summing four indicators measuring if participants’ observation of substance uses of a list of significant others or all the admired models have

influenced their substance behaviors (same age peers; parents or other adults whom the participants admire; admire models on TV and the movies or web sites; and advertisements). This variable is measured on a four-point scale ranging from “strongly agree” (1) to “strongly disagree” (4). Measures of imitation were also redirected and re-coded imitation measures ranged from “strongly disagree” (1) to “strongly agree” (4). Therefore, positive correlations with a dependent variable indicate greater exposure for substance use models which proposed to lead to higher level of substance use among adolescents. This scale is also standardized as a Z-score ($\alpha=0.95$).

Social bonding variables. The second set of individual level variables is intended to measure the four main concepts of social bonding theory. All four of the social bonding measures are standardized as Z-scores.

Attachment is operationalized by three items measuring parental attachment, peer attachment, and parental supervision. The response scale for each ranged from “strongly agree” (1) to “strongly disagree” (4) but redirected according to the social bonding prediction. That is negative relationships between attachment and adolescents’ substance use. Therefore, redirected measures ranged from “strongly disagree” (1) to “strongly agree” (4). The three items summed into one scale and standardized as like the social learning variables ($\alpha=0.60$).

Belief is measured by a single item asking if respondents believe that they have moral duty to obey the law (from “strongly agree” (1) to “strongly disagree” (4)). This single item is measured on a four-point response scale and redirected as the social bonding theory predicted (from “strongly disagree” (1) to “strongly agree” (4)).

Commitment to school and future employment are used to measure this concept. The participants responded on a four-point response scale for the two items (“strongly agree” (1) to “strongly disagree” (4)). Each of items were also redirected and the re-coded two items

ranged from “strongly disagree” (1) to “strongly agree” (4)). The two items asking the participants’ educational aspirations, and occupational aspirations were summed into one scale. ($\alpha=0.78$).

Involvement is measured by a single item asking the participants how much time they spent each day in studying after school. This item is measured on a six-point response scale from “none at all” (1) to “over four hours” (6).

Self-control variable: The concept of self-control variable is measured by 12 items reflecting six components of what Gottfredson and Hirsch considered core elements for the low self-control concept. The six components of low self-control include impulsivity, preference for simple tasks, risk seeking, preference for physical activities, self-centeredness, and volatile temper. Each of the 12 items asked the participants to judge themselves in terms of possessing low self-control. Each of the items is measured on a four-point response scale from “strongly agree” (1) to “strongly disagree” (4). All of the 12 items are summed as one scale indicating the overall low self-control. The summed self-control variable is also standardized as a Z-score ($\alpha=0.68$).

Independent Variables: Structural Level

Structural level variables include differential social organization, differential location in the social structure, theoretically defined social structural variables, and differential location in primary and secondary group. Although various types of structural variables are available, only limited number of structural level of predictors are used for this study. That is because of a small number of district units (15 Gus) in the data. To conduct multilevel model analysis (HLM and HGLM), it is required to have a substantial number of cases for every variable included in the analysis model. In fact, Raudenbush and Bryk (2002) recommend at least 10 cases for every independent variable to develop models. In this dissertation, the student sample includes more than 1,012 students. Therefore, the students’ level models are able to

accommodate a number of predictors. However, with just 15 Gu of district level units, the district-level model can be limited to approximately no more than 2 independent variables, according to Raudenbush and Bryk's recommendation. Consequently, this current study used a limited number of structural variables drawn from South Korean census data and the BST. Although it might be appropriate to include only two structural variables, in the final model, three structural variables are included according to the researcher's judgment. That is because the three variables are all important to examine the propositions of the SSSL model appropriately. Further, to assess mediation effects of social learning, social bonding and self-control variables, at least one or two structural level variables representing each dimensions of social structure described in the SSSL are necessary. Although percent of residents on public welfare is not a significant variable in the overall structural models, it must be included as an important criminogenic indicator of economic disadvantage of districts. Additionally, due to the lack of significant variance across districts of the other structural variables (i.e., percent of foreigners and percent of young males) from census data, the three have been selected as the most appropriate structural level variables in this study.

Differential Social Organization. *Population density* of the district is used as a measure differential social organization. Population density of each Gu, is operationalized by the number of population per area (Km²) of each Gu as reported in the census data.

Differential Location in the Social Structure. *Sex* (gender) is drawn from the self-report data (female=0, male=1). Akers' SSSL model characterizes social demographic variables (i.e., race, class, gender) as indicative of the individual's differential social location in social structure (Akers, 1988: p.333). Therefore, although sociodemographic variables such as gender are often used in research simply as control variables and are social characteristics of individuals, they are viewed in the SSSL model as indicators of the

hierarchical and horizontal location of individuals and groups in the overall social structure (Lanza-Kaduce et al., 2006, p.129).

Theoretically Defined Structural Variable. Residential Mobility and Percent of Residents on Public Welfare. These two variables are similar to measures that have been included in the literature on social disorganization, the first as an indicator of population instability and the second as an indicator of relative economic disadvantage (level of poverty) of the community or neighborhood. These are not direct measures of social disorganization but rather indirect indicators that are commonly found in the literature. That is they are seen as antecedent conditions of social disorganization as the breakdown in social control and social cohesion (Sampson et al., 1997). They will be considered in this dissertation research as measuring relative social disorganization among the Gu of Busan. *Percent on public welfare* is a variable reflecting economical disadvantage in Busan, South Korea drawn from the BSY. It measures the proportion of residents who were on public welfare in each Gu in 1999. *Residential mobility* is measured by the percent of residents who move into and out of each Gu during the previous year. This measure was drawn from the South Korea census data.

Differential Location in Primary and Secondary Groups. Type of School and Religiosity. Two variables drawn from the self-report data will be used to measure the immediate social context of location in different groups in society. *Type of school* is measured by two qualitatively different characteristics of the schools where the participants attended -- either “Liberal type” (0) or “Industrial type” (1) high school. *Religiosity* is measured by a single item questioning how often the respondents participated in religious service. The response scale is a four-point scale ranged from “never” (1) to “about once a week or more” (4).

Each of these structural variables is considered as likely to have an effect on deviant behavior based on prior criminological research as reviewed in literature review. Whether they will have an effect on adolescent substance use in this study remains to be seen. The SSSL model (Akers, 1998) proposes that if a structural variable is related to the deviant behavior of individuals then that relationship will be substantially mediated by social learning processes, but if there is no relationship, there is nothing to mediate and the model proposes that the structural variable also will not be related to the social learning variables.

Hypotheses

The major purpose of this dissertation is to test the Akers' SSSL model with adolescent substance use in Korea as the dependent variable. The central proposition of SSSL that is tested here is that the effects of social structural variables on the dependent variables will be substantially mediated by the social learning variables. The second major purpose is to extend the test of the SSSL model by testing the proposition that the relationships between the structural variables and adolescent substance use will be mediated substantially more by social learning variables than by social psychological variables taken from control theory, both social bonding and self-control variables. On the basis of these two main purposes and proposition, there are several sub- hypotheses developed as follows:

Between District (Gu) Differences in Adolescent Substance Use –Structural Level

Hypothesis 1: Alcohol, depressant and tobacco use will significantly vary across districts (Gus).

SSSL Measures -Structural Level

Hypothesis 2a: Social structural variables such as population density, residential mobility and percent of residents on public welfare will be associated with adolescents' substance (alcohol, depressant, and tobacco) use.

Hypothesis 2b: Male adolescents, students attending industrial type of school, and students with low level of religiosity (social structural variables) will be more likely to use alcohol, depressants and tobacco.

Social Learning, Social Bonding, and Self-Control Measures– Individual Level

Hypothesis 3: Social learning, social bonding and self-control variables will be associated with adolescents' substance (alcohol, depressant and tobacco) use in the direction predicted by each of the theories.

Mediation Hypothesis

Hypothesis 4: The relationships between substance use and all of the social structural variables will be partially and substantially mediated by social learning variables, social bonding variables, and self-control variables.

Comparison Hypothesis

Hypothesis 5: Social structural effects on substance use will be more substantially mediated by social learning variables than by social bonding and self-control variables.

Analysis Plan

First, descriptive statistics from the observed measures are estimated (Table 4-1 and Table 4-2). A set of bivariate correlations among dependent variables (alcohol use, depressant use, and tobacco use) and independent variables (structural variables, social learning variables, social bonding variables, and self-control variable) are run to examine main effects of each independent variable on each dependent variable used to demonstrate the bivariate relationship between those measures (see Table 4-3).

Second, multiple multilevel models are utilized for testing the hypotheses from the SSSL model with data nested in districts (Raudenbush, & Bryk, 2002). Specifically, Hierarchical Linear Modeling (HLM) is utilized to examine the association between the structural-level factors and students' alcohol and depressant use taking into account the

impact of individual characteristics. Although the available dependent variables have been measured with 7-items Likert scales (0=“never”, 1=“once or twice”, 2=“several times”, 3=“occasionally”, 4=“weekly”, 5= “monthly” and 6= “almost every day”), these measures are not grouped into separate categories but summed as one dependent variable. Therefore, it still reflects a continuous measure, the frequency of alcohol and depressant use of adolescents in their lifetime. In this case, if dependent variables are measured more than 7-or 8-item scales and the dependent variable is summed as one variable, HLM is still applicable for this type of dependent variable.

With regard to the tobacco use models, Hierarchical Generalized Linear Modeling (HGLM) is utilized due to the distribution of the frequency of tobacco use (outcome variable) in this sample. Although the distribution of alcohol use and depressant use appear to be relatively normally distributed, the distribution of tobacco use is skewed toward “0” (never used) and “6” (use almost every day), essentially a binomial distribution. That is, the majority of participants in this sample consists of either those who have never used tobacco or those who use almost every day. Such a distribution of responses on the dependent variable violates the assumption of normality in HLM. Therefore, to obtain unbiased estimations for tobacco use, the response of tobacco use, which was measured with 7-item Likert scales was summed into two categories (0 or 1), a dichotomous variable. After summing the variable as a binary outcome variable, for which 0 indicates “never used” and 1 indicates “ever used” one or more times, HGLM is the most appropriate form of statistical analysis. HGLM is quite similar to the linear hierarchical models (HLM) but differs in the distribution of the dependent variable and the use of the link function. The link functions transform the values of the dependent variables so that they adhere to linear model assumptions and the outcome is still values of the dependent variable (e.g., a HGLM model with a dichotomous outcome can only have a predicted value of 0 or 1).

Using this multilevel analytical strategy of HLM (and HGLM) has benefits for this dissertation because the data collected by Dr. Hwang (2000) are nested within 26 different schools which are also nested in 15 different districts (Gus). It has been shown that if we use OLS regression with nested data, it entails two major problems (Raudenbush & Bryk, 2002). First, multilevel analysis using regression modeling risks violation of two regression assumptions, namely, the independence of error terms and homoscedasticity. When higher level variables are disaggregated to individual characteristics, individuals nested within groups will no longer represent independent observations because they share many of the same characteristics. This results in correlated error terms and biased estimate of standard errors. In addition, when the regression equation error terms are compared for individual and group effects the results between groups will be independent, but the results within groups will be perfectly correlated. Yet, HLM (and HGLM) is an enhancement to traditional regression techniques for analyzing nested or multilevel data by taking structural- level data into account and allows for variations within and across group level units. In other words, it corrects for these violations by including random components at all levels of the analysis.

In addition, the binary correlation matrix presented here are two-tailed tests which examined significance at 0.05 level or lower. However, all multilevel models analyzed in this dissertation were run on the basis of one-tailed test which uses significance levels of 0.10, or lower. Although it seems to be inconsistent in using significance test level for different set of analyses, using a significance level of 0.10 for multilevel models in this dissertation is justifiable. That is because it has been frequently shown that the majority of variations in dependent variables are from individual level independent variables, while community level influences have little or minor variances in dependent variables in multilevel analysis. Since in multi-level analysis, finding significance community level influences is very important , it is not unusual to adopt one-tail significance test which using a significance level of 0.1

instead of 0.05 previous studies using cross-level data and examining multilevel models (Ennett et al., 1997). Moreover, since the major purpose of this current dissertation is to examine mediation effects of the social learning process on the relationship between social structural influences and individual substance use behavior, it is justifiable to use a significance level of 0.1 for multi-level models. In fact, it is consistent with previous studies because some of previous studies testing the SSSL model (Holland-Davis, 2006; Verill, 2008) have adopted a significance level of 0.1 for their multilevel analyses.

The current dissertation developed two-level models consists of level-2 units (districts or Gus) in which the level-1 units (individuals) are nested. The units of observation in the first level are students that are grouped within the second level units, districts (Gus).

Generally, a simple two-level model equation begins with an equation at level-1:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(X_{ij}) + \gamma_{ij} \tag{1a}$$

In equation (1a), i represents each individual and j represents each structural level unit. The error γ_{ij} is the level-1 random effect. This equation produces the fixed effects estimates which has similar interpretation to the results of OLS regression analysis.

In addition to these individual level fixed effects, this two-level modeling allows both the intercept and slope to vary across social units producing random effects estimates. The example of random effects equations at level-2 is:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + u_{0j} \tag{1b}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}W_j + u_{1j} \tag{1c}$$

Finally, the equation (1d) represents the combined model of level-1 and level-2 model:

$$Y_{ij} = \gamma_{00} + \gamma_{01}W_j + \gamma_{10}X_{ij} + \gamma_{11}W_jX_{ij} + u_{0j} + u_{1j}X_{ij} + \gamma_{ij} \tag{1d}$$

The error γ_{ij} is the level-1 random effect and the error u_{0j} and $u_{1j}X_{ij}$ are level-2 random effects.

The β s parameters in the level-1 model are level-1 coefficients and the γ s are the level-2 coefficients (Raudenbush & Byrk, 2002:pp.19-23).

Modeling

The procedures of HLM and HGLM consist of five stages of modeling: 1) specifying unconditional models at the level-2; 2) level-2 conditional models with structural level of predictors only; 3) level-1 conditional models with individual level of predictors included without consideration of structural level of predictors; 4) the fully conditional level-1 and level-2 model; and finally, 5) the full comparison model including all level-1 and level-2 variables to compare the relative mediation effects among the three different set of social/psychological variables. The statistical significance of the effects of predictors on outcome variables as well as the between-Gu variances are tested at each phase of analysis before proceeding to the next phase.

To use multilevel modeling, it is necessary to consider how variables are centered. Centering subtracts the mean value of a variable from the value of each individual observation (Porter & Umbach, 2001). There are two centering methods, grand-mean centering and group-mean centering. First, grand-mean centering subtracts the mean value of a independent variable for the entire sample from that variable's value for each individual observation. On the other hand, group-mean centering estimates the mean of a variable for all observations within the specific group or unit and subtracts it from that the value of the variable for each observation. For this dissertation, grand-mean centering is used for all variables the all multi-level analyses. Centering variables in the analyses facilitates the interpretation of the intercept in the model (Raudenbush & Bryk, 2002). Therefore, independent variables are centered around a grand mean by subtracting each students' value on the independent variable from the mean of that variable across the mean of all other students in the sample. When grand-mean centering is used, the intercepts in HLM equations represent the predicted score of an individual whose value for that independent variable is equal to the grand mean. Also, by using grand-mean centering, the intercepts in HGLM

equations represent the likelihood of use of an individual whose value for that independent variable is equal to the grand mean.

Using the HLM 6.02 software package, this dissertation develops three separate sets of models for each of the dependent variables, alcohol use, depressant use and tobacco use (Bryk, Raudenbush, & Congdon, 1996). The symbolic representation of models will be presented to help understand the overall steps of analyses and the models that are used in this analysis. However, it should be pointed out that the analysis can be done with any other multilevel or mixed model analysis software that has a capability of modeling multilevel analysis, such as multi-level analysis with STATA, GLLAMM program, SEM, MIXOR (Hedeker & Gibbons, 1996), MLWin (Goldstein et al., 1998), and SAS (Kamata, 2002;p.30).

HLM Models

Unconditional (Random ANOVA) Models

The first model of the analysis will be developed to estimate the amount of variation in average adolescent alcohol and depressant use among 15 different districts. This unconditional one-way random ANOVA model provides preliminary information about how much variation in the frequency of alcohol and depressant use within and between districts (Gus) and if the reliability of each districts' sample mean is reliable as an estimate of its true population mean.

In this unconditional model, reliability is a function of sample size in each of the districts and intraclass correlation is the proportion of the total variance, which is between districts relative to the amount that is within districts (Raudenbush & Bryk, 2002; Hwang, 2006).

Significant variation will be assessed by examining μ_{0j} the level-2 variance component. If there is no significant variation across the 15 districts found, it indicates that I will not need

to add structural level variables to the level 2 model. To assess the magnitude of variation among districts (Gus) in the absence of predictor variables, it is possible to denote this model as follows;

$$\text{Level-1 model: } Y_{ij} = \beta_{0j} + \gamma_{ij}. \quad (2a)$$

$$\text{Level-1 model: } \beta_{0j} = \gamma_{00} + u_{0j}. \quad (2b)$$

$$\text{The combined model: } Y_{ij} = \gamma_{00} + u_{0j} + \gamma_{ij}. \quad (2c)$$

At level-1, Y_{ij} is the frequency of alcohol or depressant use of student i in district j , and the intercept β_{0j} is the average of frequency of alcohol or depressant use of the j th Gus. At level-2, γ_{00} represents the grand mean of students' alcohol or depressant use across all Gus.

Structural Level Models

This model includes structural level variables only, while it does not contain any individual level variables such as social learning, social bonding and self-control variables. In this model, only three district-level variables (i.e., population density, percent on public welfare, and percent involved in residential mobility) are included because the small number of districts limit the number of district level variables may be included. Also, according to the arguments of the SSSL model, three variables, which were drawn from questionnaire data, sex and religiosity, and from the school level information on type of school which is coded as a school number for each individual respondent in each school, are used as structural level variables as explained above. Therefore, three structural predictors drawn from Busan census data (population density, percent of residents on public welfare, and percent population that have moved into or out of the district), and three structural variables are taken from Hwang's survey (sex, religiosity, and type of school) and can be modeled as follows:

$$\text{Level-1 model: } Y_{ij} = \beta_{0j} + \beta_{9j} (\text{Sex}) + \beta_{10j} (\text{Type of School}) + \beta_{11j} (\text{Religiosity}) + \gamma_{ij} \quad (3a)$$

$$\text{Level-2 model: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public$$

$$\text{Welfare})+\gamma_{03}(\text{Residential Mobility})+\mu_{0j} \quad (3b)$$

$$\beta_{9j} = \gamma_{90} + \mu_{9j} \quad (3c)$$

$$\beta_{10j} = \gamma_{100} + \mu_{10j} \quad (3d)$$

$$\beta_{11j} = \gamma_{110} + \mu_{11j} \quad (3e)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \gamma_{90}(\text{Sex}) + \gamma_{100}(\text{Type of School}) + \gamma_{110}(\text{Religiosity}) + \mu_{0j} + \mu_{9j} + \mu_{10j} + \mu_{11j} + \gamma_{ij} \quad (3f)$$

All predictors are grand-mean centered. In terms of the symbols in this model, β_{0j} indicates the mean of substance use for each Gu after addressing the effects of sex, type of school, and religiosity; β_{9j} is the change in substance use for being a male; β_{10j} is the change in alcohol and tobacco use for attending industrial schools; β_{11j} is the change in substance that is predicted by each unit of change in religiosity.

Finally, μ_{0j} , μ_{9j} , μ_{10j} and μ_{11j} indicate that the intercept and the slopes are treated as random coefficients. It examines if a Gu's population density, percent on public welfare, percent who are residentially mobile, impact each Gu's overall substance use behaviors. γ_{00} is the mean substance use for Gus at the grand-mean for population density, percent on public welfare, and percent residential mobility within one year. γ_{90} , γ_{100} , and γ_{110} are the mean of the Gu specific slopes between substance use and sex, type of school, and religiosity, respectively.

Random Coefficients Models: Individual Level Predictor Models

This is a random coefficient regression model in which level-1 predictors are entered into the model and allowed to vary across Gus. A random coefficient model examines the multivariate association between individual-level variables and substance use and shows whether any of the individual-level slopes vary significantly across Gus. This random coefficient regression model helps determine whether a slope is to be fixed within districts or

should be specified as random across districts depending on the significance of variance across districts (Hwang, 2006). If a district-level slope varies across districts, the slope can be estimated using district-level predictors (Rountree, Land, & Miethe, 1994). Social learning variables (eight variables), social bonding variables (four variables) and self-control variable (one variable which is a scale of several items), were included in this third stage of analysis respectively. However, in this model, no structural level predictor is included.

Social learning model

The first model is social learning only model. This model is written as;

$$\text{Level-1 model: } Y_{ij} = \beta_{0j} + \beta_{1j} (\text{Peer Association}) + \beta_{2j} (\text{Father's Use}) + \beta_{3j} (\text{Mother's Use}) + \beta_{4j} (\text{Definitions}) + \beta_{5j} (\text{Reinforcement Balance}) + \beta_{6j} (\text{Parent's Reactions}) + \beta_{7j} (\text{Friend's Reactions}) + \beta_{8j} (\text{Imitation}) + \gamma_{ij} \quad (4a)$$

$$\text{Level-2 model: } \beta_{0j} = \gamma_{00} + \mu_{0j} \quad (4b)$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j} \quad (4c)$$

$$\beta_{2j} = \gamma_{20} + \mu_{2j} \quad (4d)$$

$$\beta_{3j} = \gamma_{30} + \mu_{3j} \quad (4e)$$

$$\beta_{4j} = \gamma_{40} + \mu_{4j} \quad (4f)$$

$$\beta_{5j} = \gamma_{50} + \mu_{5j} \quad (4g)$$

$$\beta_{6j} = \gamma_{60} + \mu_{6j} \quad (4h)$$

$$\beta_{7j} = \gamma_{70} + \mu_{7j} \quad (4i)$$

$$\beta_{8j} = \gamma_{80} + \mu_{8j} \quad (4j)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{10} (\text{Peer Association}) + \gamma_{20} (\text{Father's Use}) + \gamma_{30} (\text{Mother's Use}) + \gamma_{40} (\text{Definitions}) + \gamma_{50} (\text{Reinforcement Balance}) + \gamma_{60} (\text{Parent's Reactions}) + \gamma_{70} (\text{Friend's Reactions}) + \gamma_{80} (\text{Imitation}) + \mu_{0j} + \mu_{1j} + \mu_{2j} + \mu_{3j} + \mu_{4j} + \mu_{5j} + \mu_{6j} + \mu_{7j} + \mu_{8j} + \gamma_{ij} \quad (4k)$$

All district and individual-level variables are grand-mean centered. β_{0j} represent the mean of substance use when the eight individual-level social leaning variables equal to their respective grand means. $\beta_{1j}, \beta_{2j}, \beta_{3j}, \beta_{4j}, \beta_{5j}, \beta_{6j}, \beta_{7j}$ and β_{8j} indicate the change in substance use predicted by each social learning variable, differential association with friends, father's use, mother's use, definition, differential reinforcement balance of substance use, parents' reaction, friends' reaction from, and imitation, change by one unit.

γ_{00} is the grand mean substance use, and $\gamma_{10}, \gamma_{20}, \gamma_{30}, \gamma_{40}, \gamma_{50}, \gamma_{60}, \gamma_{70}$ and γ_{80} are the mean of the Gu specific slopes between alcohol or depressant use and differential association with friends, father use, mother use, definition, differential reinforcement of substance use, reactions from parents, reactions from friends, and imitation, respectively. The same procedure is applicable for both the social bonding only model and the self-control only model.

Social bonding model

The second model is social bonding only model. This model is basically in the same structure with social learning model, but the variables used in this model are social bonding variables only. This model is written as;

$$\text{Level-1 model: } Y_{ij} = \beta_{0j} + \beta_{12j} (\text{Attachment}) + \beta_{13j} (\text{Belief}) + \beta_{14j} (\text{Commitment}) + \beta_{15j} (\text{Involvement}) + \gamma_{ij} \quad (5a)$$

$$\text{Level-2 model: } \beta_{0j} = \gamma_{00} + \mu_{0j} \quad (5b)$$

$$\beta_{12j} = \gamma_{10} + \mu_{12j} \quad (5c)$$

$$\beta_{13j} = \gamma_{130} + \mu_{13j} \quad (5d)$$

$$\beta_{14j} = \gamma_{140} + \mu_{14j} \quad (5e)$$

$$\beta_{15j} = \gamma_{150} + \mu_{15j} \quad (5f)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{120} (\text{Attachment}) + \gamma_{130} (\text{Belief}) + \gamma_{140} (\text{Commitment}) + \gamma_{150} (\text{Involvement}) + \mu_{0j} + \mu_{12j} + \mu_{13j} + \mu_{14j} + \mu_{15j} + \gamma_{ij} \quad (5g)$$

Self-control model

The third model is self-control only model. This model is basically in the same structure with social learning and social bonding model, but the variables used in this model is self-control variable only. This model is written as;

$$\text{Level-1 model: } Y_{ij} = \beta_{0j} + \beta_{16j} (\text{Self-Control}) + \gamma_{ij} \quad (6a)$$

$$\text{Level-2 model: } \beta_{0j} = \gamma_{00} + \mu_{0j} \quad (6b)$$

$$\beta_{16j} = \gamma_{160} + \mu_{16j} \quad (6c)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{160} (\text{Self-Control}) + \mu_{0j} + \mu_{16j} + \gamma_{ij} \quad (6d)$$

Full Models

The SSSL model

The full SSSL model includes both the individual-level (social learning variables) and the structural-level variables can be denoted as follows;

$$\text{Level-1 model: } Y_{ij} = \beta_{0j} + \beta_{1j} (\text{Peer Association}) + \beta_{2j} (\text{Father's Use}) + \beta_{3j} (\text{Mother's Use}) + \beta_{4j} (\text{Definitions}) + \beta_{5j} (\text{Reinforcement Balance}) + \beta_{6j} (\text{Parent's Reactions}) + \beta_{7j} (\text{Friend's Reactions}) + \beta_{8j} (\text{Imitation}) + \beta_{9j} (\text{Sex}) + \beta_{10j} (\text{Type of School}) + \beta_{11j} (\text{Religiosity}) + \gamma_{ij} \quad (7a)$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j} \quad (7b)$$

$$\beta_{2j} = \gamma_{20} + \mu_{2j} \quad (7c)$$

$$\beta_{3j} = \gamma_{30} + \mu_{3j} \quad (7d)$$

$$\beta_{4j} = \gamma_{40} + \mu_{4j} \quad (7e)$$

$$\beta_{5j} = \gamma_{50} + \mu_{5j} \quad (7f)$$

$$\beta_{6j} = \gamma_{60} + \mu_{6j} \quad (7g)$$

$$\beta_{7j} = \gamma_{70} + \mu_{7j} \quad (7h)$$

$$\beta_{8j} = \gamma_{80} + \mu_{8j} \quad (7i)$$

$$\text{Level-2 model: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \mu_{0j} \quad (7j)$$

$$\beta_{9j} = \gamma_{90} + \mu_{9j} \quad (7k)$$

$$\beta_{10j} = \gamma_{100} + \mu_{10j} \quad (7l)$$

$$\beta_{11j} = \gamma_{110} + \mu_{11j} \quad (7m)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \gamma_{10}(\text{Peer Association}) + \gamma_{20}(\text{Father's Use}) + \gamma_{30}(\text{Mother's Use}) + \gamma_{40}(\text{Definitions}) + \gamma_{50}(\text{Reinforcement Balance}) + \gamma_{60}(\text{Parent's Reactions}) + \gamma_{70}(\text{Friend's Reactions}) + \gamma_{80}(\text{Imitation}) + \gamma_{90}(\text{Sex}) + \gamma_{100}(\text{Type of School}) + \gamma_{110}(\text{Religiosity}) + \mu_{0j} + \mu_{1j} + \mu_{2j} + \mu_{3j} + \mu_{4j} + \mu_{5j} + \mu_{6j} + \mu_{7j} + \mu_{8j} + \mu_{9j} + \mu_{10j} + \mu_{11j} + \gamma_{ij} \quad (7n)$$

Social structure and social bonding model

The social structure and social bonding model includes both the individual-level (social bonding variables) and the structural-level variables can be denoted as follows;

$$\text{Level-1 model: } Y_{ij} = \beta_{0j} + \beta_{9j}(\text{Sex}) + \beta_{10j}(\text{Type of School}) + \beta_{11j}(\text{Religiosity}) + \beta_{12j}(\text{Attachment}) + \beta_{13j}(\text{Belief}) + \beta_{14j}(\text{Commitment}) + \beta_{15j}(\text{Involvement}) + \gamma_{ij} \quad (8a)$$

$$\beta_{12j} = \gamma_{120} + \mu_{12j} \quad (8b)$$

$$\beta_{13j} = \gamma_{130} + \mu_{13j} \quad (8c)$$

$$\beta_{14j} = \gamma_{140} + \mu_{14j} \quad (8d)$$

$$\beta_{15j} = \gamma_{160} + \mu_{16j} \quad (8e)$$

$$\text{Level-2 model: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \mu_{0j} \quad (8f)$$

$$\beta_{9j} = \gamma_{90} + \mu_{9j} \quad (8g)$$

$$\beta_{10j} = \gamma_{100} + \mu_{10j} \quad (8h)$$

$$\beta_{11j} = \gamma_{110} + \mu_{11j} \quad (8i)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \gamma_{90}(\text{Sex}) + \gamma_{100}(\text{Type of School}) + \gamma_{110}(\text{Religiosity}) + \mu_{0j} + \mu_{9j} + \mu_{10j} + \mu_{11j} + \mu_{12j} + \mu_{13j} + \mu_{14j} + \mu_{15j} + \gamma_{ij} \quad (8j)$$

Social structure and self-control model

The social structure and self-control model contains both the individual-level (self-control variable) and the structural-level variables can be denoted as follows;

$$\text{Level-1 model: } Y_{ij} = \beta_{0j} + \beta_{9j}(\text{Sex}) + \beta_{10j}(\text{Type of School}) + \beta_{11j}(\text{Religiosity}) + \beta_{16j}(\text{Self-Control}) + \gamma_{ij} \quad (9a)$$

$$\beta_{16j} = \gamma_{160} + \mu_{16j} \quad (9b)$$

$$\text{Level-2 model: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \mu_{0j} \quad (9c)$$

$$\beta_{9j} = \gamma_{90} + \mu_{9j} \quad (9d)$$

$$\beta_{10j} = \gamma_{100} + \mu_{10j} \quad (9e)$$

$$\beta_{11j} = \gamma_{110} + \mu_{11j} \quad (9f)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \gamma_{90}(\text{Sex}) + \gamma_{100}(\text{Type of School}) + \gamma_{110}(\text{Religiosity}) + \mu_{0j} + \mu_{9j} + \mu_{10j} + \mu_{11j} + \mu_{16j} + \gamma_{ij} \quad (9g)$$

Comparison Models

This full comparison model for alcohol and depressant use includes all of the social structural variables as well as social learning, social bonding and self-control variables. This model intends to examine relative mediation impact of these individual-level variables from

the three different theories of the social structural variables on alcohol and depressant use. It is expected that variables with relatively stronger mediation effect would remain significant with greater regression coefficients compared to variables having weaker mediation effects.

The model can be written as follows:

$$\text{Level-1 model: } Y_{ij} = \beta_{0j} + \beta_{1j}(\text{Peer Association}) + \beta_{2j}(\text{Father's Use}) + \beta_{3j}(\text{Mother's Use}) + \beta_{4j}(\text{Definitions}) + \beta_{5j}(\text{Reinforcement Balance}) + \beta_{6j}(\text{Parent's Reactions}) + \beta_{7j}(\text{Friend's Reactions}) + \beta_{8j}(\text{Imitation}) + \beta_{9j}(\text{Sex}) + \beta_{10j}(\text{Type of School}) + \beta_{11j}(\text{Religiosity}) + \beta_{12j}(\text{Attachment}) + \beta_{13j}(\text{Belief}) + \beta_{14j}(\text{Commitment}) + \beta_{15j}(\text{Involvement}) + \beta_{16j}(\text{Self-Control}) + \gamma_{ij} \quad (10a)$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j} \quad (10b)$$

$$\beta_{2j} = \gamma_{20} + \mu_{2j} \quad (10c)$$

$$\beta_{3j} = \gamma_{30} + \mu_{3j} \quad (10d)$$

$$\beta_{4j} = \gamma_{40} + \mu_{4j} \quad (10e)$$

$$\beta_{5j} = \gamma_{50} + \mu_{5j} \quad (10f)$$

$$\beta_{6j} = \gamma_{60} + \mu_{6j} \quad (10g)$$

$$\beta_{7j} = \gamma_{70} + \mu_{7j} \quad (10h)$$

$$\beta_{8j} = \gamma_{80} + \mu_{8j} \quad (10i)$$

$$\beta_{12j} = \gamma_{120} + \mu_{12j} \quad (10j)$$

$$\beta_{13j} = \gamma_{130} + \mu_{13j} \quad (10k)$$

$$\beta_{14j} = \gamma_{140} + \mu_{14j} \quad (10l)$$

$$\beta_{15j} = \gamma_{150} + \mu_{15j} \quad (10m)$$

$$\beta_{16j} = \gamma_{160} + \mu_{16j} \quad (10n)$$

$$\text{Level-2 model: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \mu_{0j} \quad (10o)$$

$$\beta_{9j} = \gamma_{90} + \mu_{9j} \quad (10p)$$

$$\beta_{10j} = \gamma_{100} + \mu_{10j} \quad (10q)$$

$$\beta_{11j} = \gamma_{110} + \mu_{11j} \quad (10r)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \gamma_{10}(\text{Peer Association}) + \gamma_{20}(\text{Father's Use}) + \gamma_{30}(\text{Mother's Use}) + \gamma_{40}(\text{Definitions}) + \gamma_{50}(\text{Reinforcement Balance}) + \gamma_{60}(\text{Parent's Reactions}) + \gamma_{70}(\text{Friend's Reactions}) + \gamma_{80}(\text{Imitation}) + \gamma_{90}(\text{Sex}) + \gamma_{100}(\text{Type of School}) + \gamma_{110}(\text{Religiosity}) + \gamma_{120}(\text{Attachment}) + \gamma_{130}(\text{Belief}) + \gamma_{140}(\text{Commitment}) + \gamma_{150}(\text{Involvement}) + \gamma_{160}(\text{Self-Control}) + \mu_{0j} + \mu_{1j} + \mu_{2j} + \mu_{3j} + \mu_{4j} + \mu_{5j} + \mu_{6j} + \mu_{7j} + \mu_{8j} + \mu_{9j} + \mu_{10j} + \mu_{11j} + \mu_{12j} + \mu_{13j} + \mu_{14j} + \mu_{15j} + \mu_{16j} + \gamma_{ij} \quad (10s)$$

HGLM Models

While a standard HLM model uses a normally distributed dependent variable and an identity link function, the binary outcome model uses a binomial sampling model and a logit link (Raudenbush & Bryk, 2002; p.295). In this dissertation, the sampling model of HGLM is Bernoulli. It is a binary model used if the outcome is only measured once and the predicted value is the probability of success. For example, it estimates if a student use tobacco or not in their life time and there is only one outcome per individual. As explained earlier in this chapter, the distribution of the frequency of tobacco use is such that it requires making it into a dichotomously measured variable. The participants who responded never used tobacco remained as a “never user” (0), and those who responded have ever used tobacco more than once are scored as “ever user” (1).

Also, the link function of the HGLM model is a logit link function. That is,

$$Y_{ij} = \log \left(\frac{\varphi_{ij}}{1 - \varphi_{ij}} \right) \quad (11a)$$

where η_{ij} is the log of the odds of success. If the probability of success is φ_{ij} the odds of success is $\varphi_{ij}/(1 - \varphi_{ij}) = 0.5/0.5 = 1.0$ and the log-odds or “logit” is $\log(1) = 0$. When the

probability of success is less than 0.5, the odds are less than 1.0 and the logit is negative. When the probability is greater than 0.5, the odds are greater than 1.0 and the logit is positive. The structural model of HGLM predicting β , which is a predicted log-odds. The log odds can be converted to an odds by taking the $\exp(Y_{ij})$. Also, the predicted log-odds can be converted to a predicted probability (Raudenbush & Bryk, 2002; p.295). The equation converting predicted logs-odds to predicted probability is $\varphi_{ij} = 1/[1 + \exp(-Y_{ij})]$.

The procedure of HGLM modeling is similar to the HLM models explained above. Also, all independent variable are grand-mean centered. Therefore, the five stages of modeling for the tobacco use models are discussed briefly.

Unconditional (Random ANOVA) Model

To justify the use of HGLM model, tobacco use must vary across districts (Gus). In this case, districts must vary in the estimated average likelihood of students' tobacco use. To estimate if the average likelihood of tobacco use vary across Gus, the first HGLM model is the random unconditional which include no predictors at either level. Given the Beroulli sampling model and a logit link function, the level-1 model is as following,

$$\text{Level-1 model: Prob } (Y_{ij} = 1 \mid \beta_{ij}) = \varphi_{ij}$$

$$\text{Log } [\varphi_{ij}/(1 - \varphi_{ij})] = \beta_{0j} \quad (12a)$$

$$\text{Level-1 model: } \beta_{0j} = \gamma_{00} + u_{0j} \quad (12b)$$

$$\text{The combined model: } Y_{ij} = \gamma_{00} + u_{0j} + \gamma_{ij} \quad (12c)$$

At level-1, Y_{ij} is the log-odds of tobacco use of student i in district j , and the intercept β_{0j} is the expected average log-odds of tobacco use of the j th Gus. At level-2, γ_{00} represents the average log-odds of students' tobacco use across all Gus. In terms of the leve-2 variance, the interclass correlation for linear models does not applicable for nonlinear models due to the heteroscedastic nature of level-1 variance.

Structural Level Model

As like the HLM structural level model, this model includes structural level variables only (population density, poverty, and mobility), while it does not contain any individual level variables. However, sex, type of school, and religiosity are treated as structural level predictors as suggested in the SSSL theory. The structural HGLM model is as follows:

Level-1 model: $\text{Prob}(Y_{ij} = 1 | \beta_{ij}) = \varphi_{ij}$

$$\text{Log} [\varphi_{ij}/(1 - \varphi_{ij})] = \beta_{0j} + \beta_{9j} (\text{Sex}) + \beta_{10j} (\text{Type of School}) + \beta_{11j} (\text{Religiosity}) + \gamma_{ij} \quad (13a)$$

$$\text{Level-2 model: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \mu_{0j} \quad (13b)$$

$$\beta_{9j} = \gamma_{90} + \mu_{9j} \quad (13c)$$

$$\beta_{10j} = \gamma_{100} + \mu_{10j} \quad (13d)$$

$$\beta_{11j} = \gamma_{110} + \mu_{11j} \quad (13e)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \gamma_{90}(\text{Sex}) + \gamma_{100}(\text{Type of School}) + \gamma_{110} (\text{Religiosity}) + \mu_{0j} + \mu_{9j} + \mu_{10j} + \mu_{11j} + \gamma_{ij} \quad (13f)$$

All of predictors were grand-mean centered. The parameter in these equations describes the expected log-odds of tobacco use at Gu j for the various structural independent variables. β_{0j} indicates the students' average likelihood of using tobacco for each Gu addressing the effects of sex, type of school, and religiosity. In this model, not only intercept but also all independent variables are allowed to vary across Gus. Each β_s refer to the log-odds of each predictor on the likelihood of students' tobacco use. These β_s will be converted to odds ratio in order to improve interpretability. In this dissertation, odds-ratios designate the change in the odds of students' tobacco use, relative to not their using tobacco, associated with a one-unit change in a certain independent variable when holding constant other variable in the model (Hedeker & Gibbons, 1996). Odds-ratios greater than one indicate an increase in

students' tobacco use, while values less than one indicate a reduction in their likelihood of using tobacco (Hedeker & Gibbons, 1996). Finally, μ_{0j} , μ_{4j} , μ_{5j} and μ_{6j} indicate that the intercept and the slopes are treated as random coefficients.

Random Coefficients Models: Individual Level Predictor Models

It includes level-1 predictors only and allows these variables to be varied across Gus. As like the three HLM conditional models which contain separate groups of individual-level predictors only, there are three HGLM conditional models at level-1. This example model includes the social learning variables only can be written as;

$$\text{Level-1 model: Prob } (Y_{ij} = 1 \mid \beta_{ij}) = \varphi_{ij}$$

$$\begin{aligned} \text{Log } [\varphi_{ij}/(1 - \varphi_{ij})] = & \beta_{0j} + \beta_{1j}(\text{Peer Association}) + \beta_{2j}(\text{Father's Use}) + \beta_{3j}(\text{Mother's Use}) + \\ & \beta_{4j}(\text{Definitions}) + \beta_{5j}(\text{Reinforcement Balance}) + \beta_{6j}(\text{Parent's Reactions}) + \beta_{7j}(\text{Friend's Reactions}) \\ & + \beta_{8j}(\text{Imitation}) + \gamma_{ij} \end{aligned} \quad (14a)$$

$$\text{Level-2 model: } \beta_{0j} = \gamma_{00} + \mu_{0j} \quad (14b)$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j} \quad (14c)$$

$$\beta_{2j} = \gamma_{20} + \mu_{2j} \quad (14d)$$

$$\beta_{3j} = \gamma_{30} + \mu_{3j} \quad (14e)$$

$$\beta_{4j} = \gamma_{40} + \mu_{4j} \quad (14f)$$

$$\beta_{5j} = \gamma_{50} + \mu_{5j} \quad (14g)$$

$$\beta_{6j} = \gamma_{60} + \mu_{6j} \quad (14h)$$

$$\beta_{7j} = \gamma_{70} + \mu_{7j} \quad (14i)$$

$$\beta_{8j} = \gamma_{80} + \mu_{8j} \quad (14j)$$

The combined model:

$$\begin{aligned} Y_{ij} = & \gamma_{00} + \gamma_{10}(\text{Peer Association}) + \gamma_{20}(\text{Father's Use}) + \gamma_{30}(\text{Mother's Use}) + \gamma_{40}(\text{Definitions}) \\ & + \gamma_{50}(\text{Reinforcement Balance}) + \gamma_{60}(\text{Parent's Reactions}) + \gamma_{70}(\text{Friend's Reactions}) + \end{aligned}$$

$$\gamma_{80} (\text{Imitation}) + \mu_{0j} + \mu_{1j} + \mu_{2j} + \mu_{3j} + \mu_{4j} + \mu_{5j} + \mu_{6j} + \mu_{7j} + \mu_{8j} + \gamma_{ij} \quad (14k)$$

All individual-level variables are grand mean centered and β_{0j} represent the average likelihood of tobacco use for each Gu, after controlling each set of individual level social leaning variables. γ_{00} is the average likelihood of using tobacco, while γ_{10} , γ_{20} , γ_{30} , γ_{40} , γ_{50} , γ_{60} , γ_{70} and γ_{80} represent the mean of the Gu specific slopes between tobacco use and each independent variables at level-1. The same procedure is applicable for social bonding model and self-control model. The structure of the social bonding and self-control models are consistent with the social learning model described above, but the variables used in the each of the models. For the social bonding model, social bonding variables are only used and for the self-control model, the only variable used in the model is self-control variable. Therefore, the two models' structures were not included in this chapter.

Full Models

The full model includes both the individual-level and the structural-level variables. The following model is an example of the SSSL model with the social learning variables. The model can be described as follows;

$$\text{Level-1 model: Prob } (Y_{ij} = 1 \mid \beta_{ij}) = \phi_{ij}$$

$$\begin{aligned} \text{Log } [\phi_{ij}/(1 - \phi_{ij})] = & \beta_{0j} + \beta_{1j} (\text{Peer Association}) + \beta_{2j} (\text{Father's Use}) + \beta_{3j} (\text{Mother's Use}) + \\ & \beta_{4j} (\text{Definitions}) + \beta_{5j} (\text{Reinforcement Balance}) + \beta_{6j} (\text{Parent's Reactions}) + \beta_{7j} (\text{Friend's Reactions}) \\ & + \beta_{8j} (\text{Imitation}) + \beta_{9j} (\text{Sex}) + \beta_{10j} (\text{Type of School}) + \beta_{11j} (\text{Religiosity}) + \gamma_{ij} \end{aligned} \quad (15a)$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j} \quad (15b)$$

$$\beta_{2j} = \gamma_{20} + \mu_{2j} \quad (15c)$$

$$\beta_{3j} = \gamma_{30} + \mu_{3j} \quad (15d)$$

$$\beta_{4j} = \gamma_{40} + \mu_{4j} \quad (15e)$$

$$\beta_{5j} = \gamma_{50} + \mu_{5j} \quad (15f)$$

$$\beta_{6j} = \gamma_{60} + \mu_{6j} \quad (15g)$$

$$\beta_{7j} = \gamma_{70} + \mu_{7j} \quad (15h)$$

$$\beta_{8j} = \gamma_{80} + \mu_{8j} \quad (15i)$$

Level-2 model: $\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \mu_{0j}$ (15i)

$$\beta_{9j} = \gamma_{90} + \mu_{9j} \quad (15k)$$

$$\beta_{10j} = \gamma_{100} + \mu_{10j} \quad (15l)$$

$$\beta_{11j} = \gamma_{110} + \mu_{11j} \quad (15m)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \gamma_{10}(\text{Peer Association}) + \gamma_{20}(\text{Father's Use}) + \gamma_{30}(\text{Mother's Use}) + \gamma_{40}(\text{Definitions}) + \gamma_{50}(\text{Reinforcement Balance}) + \gamma_{60}(\text{Parent's Reactions}) + \gamma_{70}(\text{Friend's Reactions}) + \gamma_{80}(\text{Imitation}) + \gamma_{90}(\text{Sex}) + \gamma_{100}(\text{Type of School}) + \gamma_{110}(\text{Religiosity}) + \mu_{0j} + \mu_{1j} + \mu_{2j} + \mu_{3j} + \mu_{4j} + \mu_{5j} + \mu_{6j} + \mu_{7j} + \mu_{8j} + \mu_{9j} + \mu_{10j} + \mu_{11j} + \gamma_{ij} \quad (15n)$$

Comparison Model

As like the HLM full comparison model, the final HGLM comparison model also includes all of structural-level predictors and individual-level predictors. The model intended to compare the relative mediation effects of the three different set of individual-level variables. The model can be denoted as follows:

$$\text{Level-1 model: } \text{Prob}(Y_{ij} = 1 | \beta_{ij}) = \varphi_{ij}$$

$$\text{Log} [\varphi_{ij}/(1 - \varphi_{ij})] = \beta_{0j} + \beta_{1j}(\text{Peer Association}) + \beta_{2j}(\text{Father's Use}) + \beta_{3j}(\text{Mother's Use}) + \beta_{4j}(\text{Definitions}) + \beta_{5j}(\text{Reinforcement Balance}) + \beta_{6j}(\text{Parent's Reactions}) + \beta_{7j}(\text{Friend's Reactions}) + \beta_{8j}(\text{Imitation}) + \beta_{9j}(\text{Sex}) + \beta_{10j}(\text{Type of School}) + \beta_{11j}(\text{Religiosity}) + \beta_{12j}(\text{Attachment}) + \beta_{13j}(\text{Belief}) + \beta_{14j}(\text{Commitment}) + \beta_{15j}(\text{Involvement}) + \beta_{16j}(\text{Self-Control}) + \gamma_{ij} \quad (16a)$$

$$\beta_{1j} = \gamma_{10} + \mu_{1j} \quad (16b)$$

$$\beta_{2j} = \gamma_{20} + \mu_{2j} \quad (16c)$$

$$\beta_{3j} = \gamma_{30} + \mu_{3j} \quad (16d)$$

$$\beta_{4j} = \gamma_{40} + \mu_{4j} \quad (16e)$$

$$\beta_{5j} = \gamma_{50} + \mu_{5j} \quad (16f)$$

$$\beta_{6j} = \gamma_{60} + \mu_{6j} \quad (16g)$$

$$\beta_{7j} = \gamma_{70} + \mu_{7j} \quad (16h)$$

$$\beta_{8j} = \gamma_{80} + \mu_{8j} \quad (16i)$$

$$\beta_{12j} = \gamma_{120} + \mu_{12j} \quad (16j)$$

$$\beta_{13j} = \gamma_{130} + \mu_{13j} \quad (16k)$$

$$\beta_{9j} = \gamma_{140} + \mu_{14j} \quad (16l)$$

$$\beta_{10j} = \gamma_{150} + \mu_{15j} \quad (16m)$$

$$\beta_{11j} = \gamma_{160} + \mu_{16j} \quad (16n)$$

Level-2 model: $\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \mu_{0j}$ (16o)

$$\beta_{9j} = \gamma_{90} + \mu_{9j} \quad (16p)$$

$$\beta_{10j} = \gamma_{100} + \mu_{10j} \quad (16q)$$

$$\beta_{11j} = \gamma_{110} + \mu_{11j} \quad (16r)$$

The combined model:

$$Y_{ij} = \gamma_{00} + \gamma_{01}(\text{Population Density}) + \gamma_{02}(\text{Percent on Public Welfare}) + \gamma_{03}(\text{Residential Mobility}) + \gamma_{10}(\text{Peer Association}) + \gamma_{20}(\text{Father's Use}) + \gamma_{30}(\text{Mother's Use}) + \gamma_{40}(\text{Definitions}) + \gamma_{50}(\text{Reinforcement Balance}) + \gamma_{60}(\text{Parent's Reactions}) + \gamma_{70}(\text{Friend's Reactions}) + \gamma_{80}(\text{Imitation}) + \gamma_{90}(\text{Sex}) + \gamma_{100}(\text{Type of School}) + \gamma_{110}(\text{Religiosity}) + \gamma_{120}(\text{Attachment}) + \gamma_{130}(\text{Belief}) + \gamma_{140}(\text{Commitment}) + \gamma_{150}(\text{Involvement}) + \gamma_{160}(\text{Self-Control})\mu_{0j} + \mu_{1j} + \mu_{2j} + \mu_{3j}$$

$$+ \mu_{4j} + \mu_{5j} + \mu_{6j} + \mu_{7j} + \mu_{8j} + \mu_{9j} + \mu_{10j} + \mu_{11j} + \mu_{12j} + \mu_{13j} + \mu_{14j} + \mu_{15j} + \mu_{16j} + \gamma_{ij} \quad (16s)$$

Data Limitations

The limitation of the study concern one issue: suitability of these data for testing multilevel hypotheses. Although the data used in this dissertation are ideally suited for testing social learning theory and are also well suited to test social bonding theory of substance use, they do not contain many of structural level of measures that will be used in estimating structural variation of substance and drug use among students. The individual level data contain a limited number of social structural measures, mainly the socio-demographic variables such as gender, family structure, SES, and age. The current study utilizes measures from census data in Busan, South Korea, and as noted these correspond exactly to the residential areas in which the students are located. However, the district level data set in Busan is limited in size (15 Gu) compared to the individual data set. Accordingly, the limited district sample size reduces the number of predictors of between school variation and random slope coefficients the level-2 model can support. Although the issue of suitability of the data set is important, it is neither an unusual limitation of data in utilizing level 1 and level 2 data sets in combined models, nor does it completely prohibit conducting multilevel of analysis. First, for example, Holland-Davis (2006) had the same issue in her dissertation. According to Holland-Davis (2006), her dissertation corrected this issue by including only one or two predictor for each structural dimension in the structural and full models (p.67). Therefore, this study used the same analytic strategy to overcome the data limitation.

Second, having 15 districts as level 2 sample sites is a feasible sample size to conduct multilevel of analysis as long as there is an appropriate number in the sample at the level 1 per site. There are several situational studies examining how to choose the optimal sample size at the macro- and at the micro-level to ensure a desired level of power given a relevant (hypothesized) effect size and a chosen significance level (Mass & Hox, 2004). With regard

to multilevel analysis, the primary concern is sample size at the level-2 because the sample size at the group or district-level is smaller than the sample size at the level-1. In general, therefore, it is well known that if the goal of a study is to maximize power in testing the average effect of treatment, then the larger the variation in the treatment impact across sites the more sites (level-2 sample) are needed to attain adequate power (Mass & Hox, 2004). However, other studies indicate that “in contrast, Brwone and Draper (2000) report that with as few as six to twelve groups, Restricted ML (RLM) estimation provides reasonable variance estimates and, with 48 groups, both RML and Full Information ML (FML) estimation produce reasonable variance estimates” (see, Mass & Hox, 2004, p. 128).

Furthermore, Raudenbush & Liu (2000) suggest that the temptation simply to maximize sample size at level-2 in designing a study must be tempered by the relative cost ratio, the cost of sampling sites relative to the cost of sampling participants within sites. Accordingly, Raudenbush and Liu (2000) introduce an equation used to choose optimal sample sizes at the level-1 and level-2 along with estimated power for varying values of the cost ratio and the variance of the treatment effect in designing a randomized study¹. In their simulation analysis, they found that if a study has 17 groups or primary site unit at level-2, its optional sample size per site is 20 at level-1, which would have an effect of site covariate ranging from 0.2 to 0.6 and power for site covariate effect ranged .109 to .561 (see Raudenbush & Liu, 2000, p. 209). Considering the moderate effect size of a study to detect average impact of a treatment across varied settings and moderating effect of a site

¹ The formula introduced by Raudenbush and Liu (2000) “parallels the well-known formula for the optimal cluster size in a two-stage cluster sample (Cochran, 1977) and the optimal sample size per cluster in a cluster randomized trial with no covariates” (p.208). This formula has been introduced in various simulation studies examining optimal sample size (cf. Allison et al., 1997; Overall & Dala, 1965; Waters & Chester, 1987; Raudenbush, 1997).

characteristic², this study has data from 15 Gus, with data from at least 40 individuals per district.

² Cohen viewed standard effect sizes of .2 and .5 and .8 as small, medium, and large, respectively. Raudenbush & Liu also suggest rules of thumbs for variances of the treatment effects of .05, .10, and .15 as small, medium and large variances (Raudenbush & Liu, 2000, pp.203-204).

CHAPTER 4 RESULTS OF ANALYSES

To begin, descriptive statistics for all explanatory and dependent variables are presented. Also, three bivariate correlation analyses between the explanatory variables and each type of substance use are done. Finally, multilevel analyses proceed with the estimation of a series of hierarchical linear models for alcohol and depressant use and hierarchical generalized linear models for tobacco use.

Descriptive Statistics

Table 4-1 presents the distribution of students' alcohol, depressant and tobacco use across Gu (district). The percent for each Gu indicates the proportion of students who have ever used each type of substance. In Table 4-1, Sa-Sang Gu shows the highest percentage of students who used alcohol. Among 39 respondents, 38 students reported that they ever used alcohol (97%). On the other hand, Saha Gu shows the lowest proportion of students' alcohol use (50%). With regard to depressant use, Sooyoung Gu has the highest proportion of depressant use (84%), while Seu Gu has the lowest proportion of students who had used depressant (25%). However, Seu Gu is the district where the highest proportion of students reported tobacco use (77%). Consistent with the alcohol use distributions, Saha Gu has the lowest proportion in students' tobacco use (8%). It is interesting to note that Saha Gu shows low proportions of students using alcohol and tobacco, but it has the third highest proportion of students' depressant use (74%). In contrast, Sa-Sang Gu has the highest proportion of students' alcohol use and the third highest proportion of students' tobacco use, but shows relatively low proportion of students' depressant use (38%). These findings may be related to the sample characteristics in each Gu. In Saha Gu, the sample consists of female students attending liberal school only, while there are only male respondents attending an industrial school in Sa-Sang Gu. Therefore, it indicates gender and type of school may influence

substance use differently. Overall, 84% of respondents reported alcohol use, 55% reported depressant use, and 46% reported tobacco use.

Table 4-2 presents descriptive statistics for the students and district characteristics (see also, Hwang 2006, p.137). In Table 4-2, all of the explanatory variables, individual-level and structural-level variables, as well as three dependent variables (i.e., the frequency of alcohol and depressant use and tobacco use (yes=1)) are included to demonstrate the variable characteristics. The mean level of alcohol use for the students is 2.17 on a seven-point scale of use which indicates the frequency of alcohol use by students in this sample is skewed toward the lower end, an average of using several times in their life time. The mean frequency of depressant use is even lower at 1.22, indicating that students in this sample report that their lifetime use of depressants is once or twice time on average. However, there is enough dispersion across the frequency scale to allow using these variables as ordinal level data. As noted, this was not true of tobacco use, and that measure was dichotomized. The mean of the binary tobacco use variable indicates that about 46% of students report that they have ever used tobacco in their life time.

In this sample, 52% of the participants are male students while 48% of students are female; 53 % of the participants were attending liberal type of high school at the time of the survey. The participants report that they attend religious service, on average, about once or twice a month. With regard to the structural level characteristics, the mean population density across the 15 Gus in Busan is 11472.67 per kilometer which ranged from 367 to 21318. The average proportion of residents on public welfare is 6.45%. That indicates on average 6.45% of residents of each 15 Gus in Busan were under the poverty level and therefore were receiving public welfare. The range of the proportion of welfare recipients in districts are from 1.42% to 12.32 %. Finally, residential mobility measured by the average proportion of residents' moving in and out of each Gu is 18.23%. It means that on average 18.23% of

residents in 15 districts in Busan moved in and out of each district during the previous year of 1999, the year when these data were collected.

Bivariate Correlations

Table 4-3 reports the zero-order correlations of each measure of substance use with social structure, social learning, social bonding, and self-control variables. For alcohol use, seventeen out of nineteen variables the bivariate correlations are statistically significant. All of the individual-level variables are statistically significant predictors for alcohol use. Four of the social structure and community level predictors, sex, type of school, religiosity, and population density have significant bivariate relationships with alcohol use. The percent of the population on public welfare and percent who have moved in the past year are not significant predictors of the level of use of alcohol.

With regard to depressant use, for eleven out of nineteen variables bivariate correlations are statistically significant. Unlike the bivariate correlations between the explanatory variables and alcohol use, none of the social bonding variables are significantly correlated with depressant use. Also, only two of the social structure and community level predictors, sex and residential mobility have significant bivariate relationships with depressant use.

Finally, sixteen of nineteen variables are statistically significant bivariate correlates of tobacco use. At the individual level, all of the explanatory variables, except for the measure of commitment (social bonding theory) are significantly correlated with tobacco use at the bivariate level. At the social structural level, four variables, sex, type of school, population density and percent on public welfare are significant bivariate correlates of tobacco use. Combined the social learning variables are strongly correlated with each of the dependent variables.

Each of the social learning variables is at least moderately correlated, with fairly strong correlations of peer association, imitation, and differential reinforcement variables, with the three substances (alcohol, depressant, and tobacco). Social bonding and self-control variables tend to be more weakly correlated with use of the three substances, but some are quite substantially correlated with the measures of substance use. Overall, social learning, social bonding, and self-control variables are all statistically significantly correlated with adolescents' alcohol, depressant and tobacco use and these bivariate analysis findings supports Hypothesis 3. In addition, gender, type of school, and population density show noticeable effects with religiosity, welfare, and mobility having low to negligible effects, on the three substances. All correlations are in the hypothesized direction. The correlation matrix for all independent and dependent variables are reported in Table A-1, A-2, and A-3 (see Appendix).

Hierarchical Linear Model Analyses: Alcohol and Depressant Use

The core proposition of the Social Structure-Social Learning model is that social learning variables substantially mediate the effects of any structural influences on delinquent or deviant behaviors. To test the arguments of the SSSL model, several hierarchical linear regression models were analyzed for both alcohol use and depressant use behaviors among South Korean youths. The results are presented in this chapter. Due to the complexity of the models, the interpretations of a set of HLM models are presented separately by type of substance, alcohol and depressant, respectively. Here the two dependent variables, frequency of alcohol and depressant use are treated as continuous measures.

Alcohol Use

Unconditional (Random ANOVA) Model

This first model intended to examine whether the frequency of alcohol use of students are significantly different across districts (Gus). This finding that there is significant

variations in alcohol use among the Gus supports Hypothesis 1 for adolescents' alcohol use. The results of the unconditional one-way random ANOVA model are presented in Table 4-4. In this fully unconditional model, the grand mean alcohol use is 2.14. The coefficient representing the amount of variation in the mean frequency of alcohol use across the 15 districts (Gus) is $\tau_{00} = 0.218$ which is statistically significant. In addition, the variation at the individual level is $\sigma^2 = 0.91$. The intraclass correlation coefficients estimated by within (σ^2) and between (τ_{00}) variations ($\rho = \tau_{00} / (\tau_{00} + \sigma^2) = 0.21897 / (0.21897 + 2.20539) = 0.09$), shows a portion of between-group variance in the total variance (Duncan & Raudenbush, 1999). Approximately 9 percent of the variation in alcohol use comes from differences between Gus. Although this between-group variation is small, it is still reasonably acceptable compared to other studies that have found small variance between macro-level units ranging from around 5 to 10 percent (Reisig & Parks, 2000; Sampson & Bartusch, 1998; Sampson, Morenoff, & Earls, 1999).

The district-level reliability (0.844) indicates that the sample mean was a reliable measure of the true district mean for alcohol use. If reliability is close to 1, the group means, β_{0j} , vary substantially across level-2 units holding constant the sample size per group (Raudenbush & Bryk, 2002, p.257). This reliability indicates that district-level differences can be modeled with a reasonable degree of precision, another encouraging result for multilevel analyses along with the intraclass correlation.

Structural Level Model

Table 4-5 shows the findings from the structural model analysis. In this model, structural level predictors, population density, percent of residents on public welfare, percent of residential mobility during the past year, sex, type of school, and religiosity are introduced. Although three of the structural level factors, sex, type of school, and religiosity are drawn from individual level of data, Akers (1998, Lee et al, 2004) defines the three factors as

indicators of social structural dimensions in the SSSL model. Sex is an indicator for differential locations in the social structure, and type of school and religiosity are indicators for differential location in primary and secondary groups. Sex, type of school, and religiosity may vary across districts as well as population density and unemployment do. However, they are measured by responses to the questionnaire not by census data. This model reveals that all of these predictors but percent of residents on public welfare are significantly associated with the frequency of alcohol use. Population density ($\gamma_{01} = 0.00004$) and sex ($\gamma_{90} = 0.47$) have positive and significant relationships with alcohol use, while residential mobility ($\gamma_{03} = -0.08$), type of school ($\gamma_{100} = -0.76$) and religiosity ($\gamma_{110} = -0.10$) have negative and significant relationship with alcohol use. The findings indicate that, on average, the more densely populated the district in which respondents reside, the less frequently resident moving in and out of the district during the past year. This findings support Hypothesis 2a. Further, being male and attending industrial school are associated with increased frequency of alcohol use within Gus (districts). And the less respondents participate in religious services the greater the frequency of alcohol use in that district. The direction of each of the coefficients is consistent with the Hypothesis 2b.

With these variables in the model, the between-Gus variance in average alcohol use is 0.06 and it is not significant. The variance of the district-specific slopes for sex is the only significant variance component. That is, in Gus with low average alcohol use the relationship between sex and alcohol use is strong. In fact, when a structural level model only contains the three community level predictors, population density, percent of residents on public welfare and percent of mobility, the R^2 variance explained based on the level-2 predictor is $[\rho = (\tau_{00}(\text{unconditional model}) - \tau_{00}(\text{the intercept only structural model})) / \tau_{00}(\text{unconditional model}) = [(0.21897 - 0.08036) / 0.21897 = 0.633009]$ and remains significant. Thus, including structural variables explains approximately 62% of the between-Gu variance in alcohol use. However, after taking into

account the three predictors, sex, type of school, and religiosity, the between variance at district-level became insignificant. This findings suggest that meso-level social structural factors such as gender, (differential location in the social structure), type of school, and religiosity (differential location in primary and secondary groups) explain greater proportion of influence on adolescents' alcohol use than more distal social structural measures such as population density (differential social organization) and percent of residents on public welfare, and percent of residential mobility (theoretically defined structural variables).

Random Coefficient Model

Social learning model

Prior to modeling the effects of all the variables on alcohol use, to test the separate effects of each set of social psychological variables measuring concepts taken from social learning, bonding, and self-control theories respectively are run. These are followed by models examining the net effects of structural variables and each set of the social psychological variables. I begin with a random coefficient regression model containing social learning variables only shown in Table 4-6. All social learning variables are grand-mean centered, centered around the mean of districts (Gus). The expected frequency of alcohol use among students when each of social learning variables are entered is 2.17. The findings in the table can be interpreted to mean that, students' alcohol use increases when students: 1) have greater proportion of peers who use alcohol ($\gamma_{10}=0.97^{***}$); 2) have fathers who use alcohol more frequently($\gamma_{20}=0.08^*$); 3) have definitions favorable toward use of alcohol($\gamma_{40}= 0.08^*$); 4) perceive that on balance overall effects of using alcohol are good($\gamma_{50}= 0.11^{**}$); 5) perceive that parental reactions to their alcohol use are not discouraging ($\gamma_{70}= 0.08^*$); and 6) have a greater chance of imitating use of alcohol by behavioral models ($\gamma_{80}= 0.20^{***}$). The directions of the effects of all of the variables are consistent with the social learning hypotheses (Hypothesis3).

The between-district variance (τ_{00}) in average alcohol use is 0.002, but it is not significant with eight social learning variables in the model. In terms of the Gu specific slopes variance components of the social learning variables, only the two slopes of differential association with friends and imitation are significant. The other six social learning variable slopes variance components are not significant, indicating that the relationships between these variables and individual alcohol use do not significantly differ between Gus. However, the between-Gu variance is not significant; the significance of each slope may not contain importance and need not be interpreted in this model.

Within Gus, “R²” (proportional reduction in error) based on the level-1 predictors $[(2.20539-0.84746)/ 2.20539 = 0.615732]$ is 0.62. This tells us that social learning variables account for about 62% of the variance in student-level frequency of alcohol use. The within district variation mirrors the findings of Hwang’ (2000) dissertation who report that social learning variables explain around 60 % of the variation in alcohol use.

Social bonding model

This model includes only a set of social bonding variables without containing any other variables. The findings are presented in Table 4-7 and only partially support Hypothesis 3 for social bonding variables. All of the social bonding variables are grand-mean centered. Averaged across Gus, there is a significant relationship between belief and involvement and adolescents’ alcohol use ($\gamma_{130} = - 0.09^*$, $\gamma_{150} = - 0.29^{***}$, respectively). These findings suggest that having higher level of approval for general law and conforming belief and spending more time for study are negatively associated with alcohol use.

The between-district (Gus) variance in mean alcohol use is 0.11 and is significant with the four social bonding variables in the model. However, only one of the Gu level slopes variance components of the social bonding variables, attachment, is significant ($\gamma_{120} = 0.02^*$). That indicates the relationship between attachment and alcohol use is stronger in Gus with

low mean alcohol use, while the relationships between the three other social bonding variables and individual alcohol use do not significantly differ between Gus. Within Gus, the “R²” (explained variance) of this model [$\rho = (\sigma^2_{\text{(unconditional model)}} - \sigma^2_{\text{(the social bonding model)}}) / \sigma^2_{\text{(unconditional model)}} = (2.20539 - 2.04967) / 2.20539 = 0.070608$] is 0.07. That indicates that 7% of the variance in student-level frequency of alcohol use is explained by social bonding variables.

Self-control model

This model includes only the self-control variable. Table 4-8 shows the findings of the multilevel test of self-control theory. The self-control variable is grand-mean centered. Averaged across Gus, the self-control variable, as expected by the theory, is negatively associated with alcohol use, indicating having lower level of self-control is associated with increased alcohol use ($\gamma_{160} = -0.43^{***}$). This finding supports Hypothesis 3 for self-control.

The between Gu variance (τ_{00}) in mean alcohol use is 0.14 and is significant. Within Gus, “R²” (variance explained) of this model [$\rho = (\sigma^2_{\text{(unconditional model)}} - \sigma^2_{\text{(the self-control model)}}) / \sigma^2_{\text{(unconditional model)}} = (2.20539 - 2.01097) / 2.20539 = 0.088156$] is about 0.09. That means the measures of the self-control construct explain approximately 9% of the variance of student-level alcohol use. The between-district variance in the Gu specific slopes of self-control is not significant, indicating that there is no statistically significant difference among Gus in the relationship between the self-control variable and alcohol use.

Models with Structural Variables and Variables from the Three Theories

The social structure social learning (SSSL) model

The full SSSL alcohol model includes all predictors at the structural level and all of the social learning variables to assess the central hypothesis of the SSSL that the social learning variables will mediate the effects of social structure on alcohol use (Hypothesis 4). The findings of the model presented in Table 4-9 are consistent with the SSSL model predictions.

At the structural level, four of the structural level factors, which were significant in the structural model (Table 4-5), population density, percent of residential mobility, type of school and religiosity, became insignificant once the social learning variables are taken accounted for the model. Also, the regression coefficients of the structural level factors are reduced compared to the structural model ($\gamma_{01} = -0.000004$, $\gamma_{03} = -0.01$, $\gamma_{100} = -0.11$, $\gamma_{110} = -0.05$, respectively). The social learning variables, however, remain significant with similar magnitudes of effects, consistent with those in the social learning only model (Table 4-6). That indicates social structural measures are substantially mediated by the inclusion of the social learning variables as the SSSL model predicted. This finding supports Hypothesis 4 for the mediation effects of social learning variables. The net effect of sex on alcohol use in the SSSL model is significant, but is also substantially reduced by the inclusion of the social learning variables (by more than half) from its effect shown in Table 4-5 (from $\gamma_{90} = 0.47^{**}$ to $\gamma_{90} = 0.18^*$).

Here it is noteworthy to compare the findings from Holland-Davis' (2006) dissertation. In her dissertation, she found that the variable of "percent on welfare", which was measured in the same way with the percent of residents on public welfare as in this dissertation, was not a significant predictor of school specific mean alcohol use in the structural-level only model. Yet, after the inclusion of the social learning variables it became a significant predictor (p.80). Thus, she concluded that the change of significance in this variable may imply there may be moderation effects in addition to mediation effects For the social learning variables, however, the findings here are that Gu specific slopes on alcohol use in this SSSL model, their significance and strength of regression coefficients are relatively unchanged from the estimates of the slopes in the social learning only model.

The between-Gu variance in average alcohol use has been reduced from the unconditional model (from $\tau_{00} = 0.21$ to $\tau_{00} = 0.05$), and it is insignificant in this full model. That indicates this model explains the between-Gu variance substantially.

Social structure with social bonding model

This model includes all of the social structure and social bonding variables to test the extent to which the bonding variables mediate the effects of the structural-level variables on alcohol use (see Table 4-10). The findings in this table show that the social bonding variables have some but not very substantial mediating effects. Only one structural variable, religiosity appears to be mediated by the bonding variables. Population density and percent of residential mobility are not much changed from the structural model in Table 4-5 ($\gamma_{01} = 0.00004^{***}$ from 0.00004^{***} , $\gamma_{03} = -0.08^*$ from -0.06^\dagger), sex effects actually increase ($\gamma_{90} = 0.58^{**}$ from $.47^{**}$). Type of school effect is reduced ($\gamma_{100} = -0.42^*$ from -0.76^{**}) but remains significant. Oddly, percent on public welfare, which was not significant in the structural level model, became significant ($\gamma_{20} = -0.01^\dagger$ from -0.02) and the coefficient of sex has been slightly increased in this model with the social bonding variables are ($\gamma_{90} = 0.58^{**}$ from 0.47^{**}). Furthermore, the relationship between belief and alcohol use was insignificant in the social bonding only model, but the coefficient in this model is stronger and statistically significant ($\gamma_{130} = -0.1^*$ from -0.09). The relationship between involvement and alcohol use remains relatively unchanged but its coefficient has been slightly reduced from the social bonding only model ($\gamma_{150} = -0.23^{**}$ from -0.29^{***}). Therefore, it appears that social bonding variables did not mediate the effects of social structural variables on alcohol use. Therefore, this finding does not support Hypothesis 4 which states that the social bonding variables will have mediation effects. The between-district variance in mean alcohol use is 0.04 and is no longer significant. However, the between Gus variance is reduced from the unconditional model by including the social bonding variables ($\tau_{00} = 0.21$ versus $\tau_{00} = 0.04$).

Social structure with self-control model

The model in Table 4-11 includes all the social structure and self-control variables to examine if self-control mediates the influence of social structural variables on alcohol use. The effects of population density, percent of mobility, sex, and type of school in this model are essentially the same as in the structural level model (Table 4-5), but the effect of religiosity became insignificant. The regression coefficients of the four significant structural-level predictors have been slightly reduced in the model (from $\gamma_{01} = 0.00004^{***}$ to $\gamma_{01} = 0.00002^{**}$, from $\gamma_{03} = -0.08^*$ to $\gamma_{03} = -0.07^*$, from $\gamma_{10} = 0.47^{**}$ to $\gamma_{10} = 0.35^{**}$, from $\gamma_{20} = -0.76^{***}$ to $\gamma_{20} = -0.66^{***}$). In terms of the self-control variable, the relationship between low self-control and alcohol use remains significant but the coefficient has been slightly reduced from the self-control model (from $\gamma_{160} = -0.43^{***}$ to $\gamma_{160} = -0.36^{***}$). These findings suggest that while self-control is significantly related to alcohol use, it does not substantially mediate the structural predictors on adolescents' alcohol use (Hypothesis 3).

The between-Gu variance in mean levels of alcohol use is reduced from the structural level model (Table 4-5) ($\square \square 0.21$ versus $\square \square 0.03$) and becomes insignificant.

Full Comparison Model for Alcohol Use with All Social Structural, Social Learning, Social Bonding, and Self-Control variables

This final full comparison model for alcohol use includes all social structural and social psychological variables. This model allows examining the relative mediation impact of the variables from the three different theories on the effects of social structural variables on alcohol use. It is expected that the variables with relatively stronger mediation effect in the separate models would remain significant with higher regression coefficients compared to variables having weaker mediation effects in the separate models. The findings are presented in Table 4-12. In this full comparison model, all of the structural predictors but sex are significantly reduced toward zero and became insignificant in this model. Differences

between male and female respondents are significant but the magnitude of the difference is substantially reduced (by about 75%) from the structure-only model (from $\gamma_{90} = 0.47^{**}$ to $\gamma_{90} = 0.15^{\dagger}$). The relationships of alcohol use to differential association with alcohol using friends, father's use of alcohol, definitions, differential reinforcement, parental reaction to alcohol use, and imitation remain significant and relatively unchanged from their relationships found in the social learning only model (Table 4-6). The effect of the measures of self-control remains significant but the regression coefficients in this model has been substantially reduced from the self-control only model shown in Table 4-8 (from $\gamma_{160} = -0.43^{***}$ to $\gamma_{160} = -0.07^{\dagger}$) and from the model with social structure and self-control variables (from $\gamma_{160} = -0.36^{***}$ to $\gamma_{160} = -0.07^{\dagger}$) as shown in Table 4-11. Furthermore, none of the social bonding variables have significant effects in this full comparison model. Among social psychological predictors in this full comparison model, differential association with alcohol using friends has the strongest net effect. As has been found in previous research this differential peer association measure is a robust predictor, which in these data retains essentially the same impact found in the series of HLM analyses for alcohol use with social learning variables only model and the SSSL model as shown in Table 4-6 and Table 4-9 ($\gamma_{10} = 0.97^{***}$, $\gamma_{10} = 0.93^{***}$, $\gamma_{10} = 0.93^{***}$, respectively). These findings support Hypothesis 5 indicating that the relative mediation effects of the social learning variables are substantially greater than the mediation effects of the self-control and social bonding variables. The between-Gu variance in mean alcohol use is 0.004 which is reduced substantially from the variance of the unconditional model in Table 4-4 ($\square \square 0.21$) and it is not significant.

Depressant Use

Unconditional (Random ANOVA) Model

This model examines the extent to which the frequency of use of depressants varies across Gus (see Table 4-13). The grand mean for depressant use is 1.26, indicating that each

students has used depressant at least once or twice in their lifetime on average. The between-Gu variance in depressant use is 0.14 and is significant, suggesting that mean use of depressant significantly differs between Gus in this sample. This finding also provides support for Hypothesis 1. In terms of within district variance, it was 1.68 which is greater than the between-Gu variance. Therefore, the between-Gu variance (intraclass correlation coefficients) accounts for approximately 7.7 % of the total variance in depressant use, where the vast majority of variance is explained by the variance between students (92.3%). The coefficient of reliability for the sample mean of depressant use is .82. It suggests that the sample means are reliable estimates of the true district (Gu) means.

Structural Level Model for Depressant Use

This structural model includes all the structural-level variables outlined in the SSSL model (see Table 4-14). Among the structural level predictors, population density and percent on residential mobility are significant predictors of Gu specific mean depressant use ($\gamma_{01}=0.00002^*$ and $\gamma_{03}=0.06^*$, respectively). It indicates that as the Gu's population becomes denser and as the Gu's residential mobility becomes higher, depressant use in these Gus increases. In terms of testing Hypothesis 2b, unlike the structural model for alcohol use, sex is the only significant structural variable in this model ($\gamma_{90}=-0.59^{***}$) among structural variables drawn self-report data. Furthermore, the coefficient for the effects of sex is in the opposite direction as predicted. That is, females are more likely than males to use depressant drugs in this sample. These findings provide only partial support for Hypothesis 2a and 2b, in that percent on public welfare, type of school and religiosity do not have significant effects on depressant use and while the gender effects is significant as expected it is not in the direction expected. However, the finding that the adolescent girls in the sample are somewhat more likely than the boys is not really surprising considering that it is in the use of stimulants and depressants that the gender ratio is often small and sometimes is tilted toward females.

Depressant drugs, affect mood and emotions. It may be that adolescent girls in Korea are more prone to self-medication for depression and emotional issues and therefore are more likely to find the use of depressants positively or negatively reinforcing.

The between district variance in mean depressant use in this model is 0.001 which has been reduced substantially from the unconditional model and has become insignificant. The inclusion of sex, type of school and religiosity, into the structural model has reduced the between-Gu variation in individual depressant use.

In this model, the R^2 based on the level-2 predictor is $[\rho = (\tau_{00}(\text{unconditional model}) - \tau_{00}(\text{the intercept only structural model})) / \tau_{00}(\text{unconditional model}) = [(0.13930 - 0.11741) / 0.13930 = 0.15714]$. That is, including structural variables explains approximately 15% of the between-Gu variance in depressant use. However, again similar to the structural model for alcohol use, after taking into account the three predictors of sex, type of school, and religiosity, the between variance at district-level became insignificant.

Random Coefficient Models

Social learning model

The social learning model for depressant use contains the eight social learning variables only (Table 4-15). The significant predictors in this model include differential association with depressant using friends ($\gamma_{10} = 0.58^{***}$), mother's use of depressants ($\gamma_{30} = 0.18^{***}$), definition favorable to depressant use ($\gamma_{40} = 0.20^{**}$), reinforcement balance for depressant use ($\gamma_{50} = 0.11^*$), parental reaction to the use of depressant ($\gamma_{70} = 0.11^*$) and imitation ($\gamma_{80} = 0.07^*$). That is, having 1) greater proportion of friends using depressants, 2) mothers who use depressant more frequently, 3) more favorable attitudes toward the use of depressant use, 4) greater perceived rewards of using depressants, 5) less punitive parental reaction to use of depressants, and 6) greater exposure to depressant using behavioral models are associated with increased depressant use. Interestingly, this model shows that adolescents' depressant

use is significantly influenced by mother's depressant use. This finding is compared to the findings from the social learning model for alcohol use, which found significant influence of father's alcohol use on adolescents' alcohol use, but non-significant influence of mother's alcohol use. That indicates that parental influence is important but for those substances used more frequently by boys the father's influence is more apparent while mother's influence is more apparent for those substances used more by girls. Overall, most of social learning variables are significantly associated with adolescents' depressant use as predicted by the theory.

The between-district variance in mean depressant use is 0.008 and not significant. But the between-Gu variance has been reduced substantially from the unconditional model ($\tau_{00} = 0.14$). Also, by including the social learning variables, 62% of the variation in student depressant use is explained within districts.

Social bonding model

Table 4-16 shows the findings from the multilevel analysis of social bonding theory. As can be seen from the table none of the social bonding variables significantly predicts depressant use. This finding does not support Hypothesis 3 which states that the social bonding variables will have significant effects on substance use.

The between district variance in mean depressant use is 0.15, which has not been reduced from the unconditional model ($\tau_{00} = 0.14$), and is significant. These findings suggest that social bonding variables explain very little the variance of depressant use among adolescents in this sample. Within districts, only 7% of the variance in depressant use is explained by including the social bonding variables. Also, none of the Gu specific slopes of the social bonding variables are significantly vary among districts.

Self-control model

Table 4-17 presents the findings for the self-control model for depressant use. As with alcohol use, self-control is a significant predictor for the use of depressants ($\gamma_{160} = -0.11^{**}$). That indicates the lower an individual's self-control, the higher likelihood of using depressant as the theory predicts. This finding supports Hypothesis 3 for self-control.

The between-Gu variance in mean depressant use is 0.14 and is significant. Similar to the social bonding model, the between-Gu variance has not been reduced from the unconditional model ($\tau_{00} = 0.14$). Within Gus, only 9% of the variation in depressant use is explained due to the self-control variable. The between-Gu variance in the Gu specific slope of self-control and depressant use is not significant, indicating that there is no difference among Gus in the relationship between depressant use and the self-control variable.

Models with Structural Variables and Variables from the Three Theories

The social structure social learning (SSSL) model

The SSSL model includes all of the social structural variables and the social learning variables to assess the mediating impact of the social learning variables on the social structure predictors of depressant use (see Table 4-18). Population density, percent residentially mobile and sex, which are significant in the structural model, are no longer significant after the social learning variables are included. Furthermore, the coefficients of population density, percent of residential mobility, and sex have been reduced substantially from the structural model (from $\gamma_{01} = 0.00002^*$ to $\gamma_{01} = 0.000001$, from $\gamma_{03} = 0.06^*$ to $\gamma_{03} = 0.04$, and from $\gamma_{90} = -0.59^{***}$ to $\gamma_{90} = -0.10$, respectively). The relationships between the social learning variables that were significant in the social learning model remain relatively unchanged, including the magnitude of their coefficients. These findings support the social learning mediation Hypothesis 4; that is, the social learning variables substantially mediate the social structural predictors of

adolescents' depressant use as the SSSL theory predicted. The between district variance in mean depressant use is 0.004 and is not significant.

Social structure and social bonding variables model

The findings of this social bonding and social structure model are presented in Table 4-19. This model was designed to examine if there is mediation effects of social bonding variables on the structural-level effects on depressant use. The three structural level predictors, population density, percent on residential mobility and sex remained unchanged from the structural model. The three predictors are significant and their coefficients are the similar in magnitude (from $\gamma_{01} = 0.00002^*$ to $\gamma_{01} = 0.00001^\dagger$, from $\gamma_{03} = 0.06^*$ to $\gamma_{03} = 0.07^*$ and from $\gamma_{90} = -0.59^{***}$ to $\gamma_{90} = -0.62^{***}$, respectively). As with the social bonding only model, none of the relationship between social bonding variables and depressant use is significant. That means that the social bonding variables do not mediate the structural level effects on adolescents' depressant use in this sample (Hypothesis 4). The between Gu variance in mean depressant use is 0.006 and not significant.

Social structure and self-control variables model

This model is intended to assess whether the individual's level of self-control would mediate the influence of structural level predictors on individual depressant use (Table 4-20). Although population density is no longer significant, residential mobility and sex remains relatively unchanged from the structural model and is not reduced toward zero. Oddly, the coefficient for gender effects is slightly increased compared to the social structure only model ($\gamma_{90} = -0.59^{***}$ to $\gamma_{90} = -0.63^{***}$). As with the self-control model, the relationship between low self-control variable and depressant use is significant. Also, the coefficient of self-control is also slightly increased ($\gamma_{160} = -0.11^{**}$ to $\gamma_{160} = -0.14^{**}$). That indicates living in Gus where people move in and out more frequently and being a female increase the use of depressant. Similarly, having low self-control increases individual use of depressant. In sum, this finding

suggests little support for the Hypothesis 4 proposing mediating effects of the self-control variable. The between Gu variance in mean depressant use is not significant ($p > 0.007$).

Full Comparison Model with Social Structural, Social Learning, Social Bonding, and Self-Control Variables

As was true for the full comparison model for alcohol use, this full model for depressant use also contains all social structural variables, social learning, social bonding and self-control variables. This model also was developed to assess the Hypothesis 5 examining relative mediation impact of these social psychological variables on the relationships between social structural-level variables and depressant use. Table 4-21 presents the findings of the full comparison model. Consistent with the full comparison model for alcohol use (Table 4-12), sex is the only significant predictor among social structural variables in the full comparison model. However, the coefficient and the level of significance of the gender difference has been substantially reduced in this model compared to the coefficient in the structural model (from $\gamma_{90} = -0.59^{***}$ to $\gamma_{90} = -0.13^{\dagger}$, a mediation of about 75% of the main effects of the gender variable on depressant use). The level of reduction of the coefficients of sex as well as other structural variables are similar to the social structure social learning model (the SSSL model). That indicates the significant reduction in coefficients and the level of significance among the structural variables are explained by the mediation effects of the social learning variables more so than any other set of variables. It should also be noted that the effects of the sex variable, which were mediated to insignificance in the SSSL model, but significant in this full comparison model, may indicate that the social bonding and self-control variables somehow counteract rather than add to the mediating effects of the social learning variables. As shown in the social bonding and self-control models (Table 4-16 and Table 4-17), it can be suggested that there are some moderation effects on social bonding and self-control variables by social structural variables. Furthermore, the relationships between

the social learning variables and depressant use remained relatively unchanged from the social learning model and the SSSL model. On the other hand, involvement, a social bonding measure, became significant and the coefficient is slightly increased in this full comparison model, but the direction of the relationship between involvement and depressant use is opposite to what social bonding theory would predict (from $\gamma_{140} = 0.08$ to $\gamma_{140} = 0.10^\dagger$). That is, the more time in homework study, the greater probability of depressant use. Finally, the self-control measure is significant but the coefficient and level of significance of this variable has been substantially reduced in this comparison model (from $\gamma_{160} = -0.11^{**}$ to $\gamma_{160} = -0.06^\dagger$). Overall, the findings from this comparison model support Hypothesis 5, indicating strongest mediation effects of social learning variables than both social bonding and self-control variables. The between-Gu variance in this model is 0.004 and not significant.

Hierarchical Generalized Linear Model Analyses: Tobacco Use

In the entire HGLM model for tobacco use, the results from the analyses are reported as odds-ratios in order to improve interpretability. The odds-ratios indicate the change in the odds of students' smoking use, relative to the odds of not smoking, associated with a one-unit change in a certain independent variable when holding constant other variables in the model (Hedeker & Gibbons, 2006). Odds-ratios greater than one suggest an increase in students likelihood of using tobacco, where values less than one indicate a reduction in their likelihood of tobacco use (Hedeker & Gibbons, 2006).

Unconditional (Random ANOVA) Model

Table 4-22 presents the findings of a HGLM Bernoulli unconditional model for differences in tobacco use across Gus. The estimates result from the unit-specific model with robust standard errors. The estimated average mean (or logit or log-odds) of tobacco use across Gus is -0.21. Assuming the Gu's log-odds of tobacco use to be approximately

normally distributed with a mean of -0.21 and variance of 0.65, one would expect about 95% of the Gus' to have level of tobacco use between 0.671 and 0.965 (confidence interval).

The variance between Gus in Gu-average log-odds of tobacco use is 0.65 ($\chi^2 = 93.383^{***}$) and is significant. This finding supports Hypothesis 1. That indicates there are significant differences in tobacco use between Gus. The coefficient of reliability for the intercept of tobacco use is 0.87, indicating that the mean probability of tobacco use among Gus are quite reliable estimates of the true probability of tobacco use across Gus.

Structural Level Model

Table 4-23 presents the results for the model analysis with social structural variables only. Population density, percent of residential mobility, sex and type of school are significantly associated with the odds of tobacco use. Residential mobility and type of school are associated with a lower expected probability (log-odds) of tobacco use ($\gamma_{03} = -0.1\uparrow$, and $\gamma_{100} = -1.12^{***}$, respectively), holding constant the other predictors in the model and the random effects. The interpretation is that, the expected odds of tobacco use for students who live in Gus with higher level of mobility is reduced by $\exp^{(-0.1)} = 0.90$ (odds ratio) times the odds of tobacco use for an otherwise-similar student who lives in Gus with lower level of mobility. Also, the expected odds of tobacco use of students who attend liberal type of school reduced by $\exp^{(-1.12)} = 0.32$ (odds ratio) times the odds of tobacco use than students who attend industrial type of school. That is, living in Gus where people move in and out frequently during the last year and attending liberal school significantly reduced the odds of tobacco use compared to their counterparts living in Gus with lower level of residents move in and out and students attending to industrial school. The direction of the effects of residential mobility is opposite of what would be expected to the extent that such mobility is seen as an indicator of less integrated or more disorganized districts. On the other hand, population density and sex are positively associated with the odds of tobacco use

($\gamma_{01}=0.00003\ddagger$, and $\gamma_{90}= 1.20^{**}$, respectively). That indicates male students have significantly greater odds (odds ratio = 3.34) of tobacco use than female students. In terms of population density, it has significant and positive direction, but its odds of tobacco use is negligible (odds ratio s =1.0). That indicates that, in fact, there is not a substantial odds difference between students who live in Gus where population is highly dense and their counterparts for the expected odds of tobacco use. These findings give mixed support Hypothesis 2a and 2b.

The between Gu variance in the odds of tobacco use is 0.03 ($\chi^2=23.74$) and is significant. The variance of the Gu-specific slope for sex and the log-odds of tobacco use is significant. That is, in Gus with high log-odds of tobacco use, there is a significant and strong relationship between sex and tobacco use. Therefore, it appears that in Gus with more tobacco use, the group that is at higher risk of using tobacco is male students

Random Coefficient Models

The social learning model

Table 4-24 presents the social learning model for tobacco use. For this model, the results suggest that differential association with tobacco using friends, definitions, perceived effects of tobacco use, parental reaction to the use of tobacco and imitation are significantly associated with the log-odds of tobacco use ($\gamma_{10} = 1.78^{***}$, $\gamma_{40} = 0.40^{**}$, $\gamma_{50} = 0.51^{***}$, $\gamma_{70} = 0.29^*$, and $\gamma_{80} = 0.47^{**}$, respectively). Having more friends who use tobacco greatly increases the odds of tobacco use (odds ratio = 5.97) compared to those with fewer tobacco using friends. Students who have definitions approving the use of tobacco are more likely to use tobacco than students holding disapproving attitudes toward tobacco use (1.5 odds ratio). Also perceiving more rewards than costs from smoking is associated with a 1.65 (odds ratio) times increase in the log-odds of tobacco use. Students who expect more encouraging parental reactions to their use of tobacco have increased log-odds of tobacco use by 1.33 (odds ratio) times of the odds that of their counterparts. Finally, having greater exposure to

role models using tobacco increases the odds of tobacco use by 1.60 (odds ratio) times the odds of the students who have less exposure to role models using tobacco. This finding also supports Hypothesis 3 for social learning variables. The between-Gu variance in the odds of tobacco use is 0.02 ($\chi^2 = 11.15$) and is not significant.

Social bonding model

Table 4-25 presents the findings of the social bonding model for tobacco use. Consistent with social bonding theory, attachment and involvement are significantly and negatively associated with the odds of tobacco use ($\gamma_{120} = -0.27^{***}$, $\gamma_{150} = -0.44^{***}$). Greater attachment of students to friends and parents lowers odds of tobacco use by 0.75 time than the odds of students less attached to friends and parents (odds ratio = 0.75). Spending more time in study significantly reduces the odds of tobacco use by 0.64 (odds ratio) times, compared to students who spend less time in study.

The between-Gu variance of the mean odds of tobacco use is 0.43 ($\chi^2 = 62.04^{***}$) and is significant. The variance of the Gu-specific slopes for involvement and the odds of tobacco use is significant. That indicates, Gus with high mean log odds of tobacco use tend to have strong relationship between time spent in studying and the odds of individual tobacco use.

Self-control model

The findings of this model are presented in Table 4-26. In this model, self-control is a significant predictor for the log-odds of tobacco use ($\gamma_{160} = -0.61^{***}$). Students with high self-control have reduced log odds of tobacco use by 0.53 (odds ratio) times the odds of tobacco use by students with low self-control. The results are consistent with self-control theory and supports Hypothesis 3. The between-Gu variance in the odds of tobacco use is 0.47 ($\chi^2 = 71.06^{***}$) and is significant. However, the variance of the Gu specific slope for the relationship between self-control and tobacco use is not significant.

Models with Structural Variables and Variables from the Three Theories

The social structure social learning (SSSL) model

The SSSL model includes all of the social structure and social learning variables to examine if the social learning variables mediate the influence of structural predictors on students' tobacco use (Hypothesis 4). The findings of this model are presented in Table 4-27. As the SSSL model predicted, all of the structural variables which were significant in the structural model became no longer significant and their coefficients are substantially reduced by including the social learning variables (population density, residential mobility, sex, and type of school). Particularly, the coefficients of, sex and type of schools are very substantially reduced (from, $\gamma_{90} = 1.20^{**}$ to $\gamma_{90} = 0.42$, from $\gamma_{100} = -1.12^{***}$ to $\gamma_{100} = -0.37$). In terms of social learning variables, differential association with friends using tobacco, definitions favorable for using tobacco, differential reinforcement for tobacco use, encouraging reactions to tobacco use by parents and greater exposure for smoking models are all positively and significantly associated with adolescents' risk of smoking, as the SSSL theory expected (from $\gamma_{10} = 1.78^{***}$ to from $\gamma_{10} = 1.67^{***}$, from $\gamma_{40} = 0.40^{**}$ to $\gamma_{40} = 0.40^{**}$, from $\gamma_{50} = 0.51^{***}$ to $\gamma_{50} = -0.50^{***}$, from $\gamma_{70} = 0.29^*$ to $\gamma_{70} = 0.25^\dagger$, from $\gamma_{80} = 0.47^{**}$ to $\gamma_{80} = 0.45^{**}$, respectively). These variables are significant predictor of tobacco use and the magnitudes of their coefficients also remain relatively unchanged. The findings support the arguments of the SSSL model suggesting the social learning variables substantially mediate the impact of structural predictors on deviant behaviors (Hypothesis 4). Interpretations of this model is as follows: Having higher proportion of friends who use tobacco increases the odds of the tobacco use $\exp^{(1.67)} = 5.36$ (odds ratio) times the odds of students who do not have friends who use tobacco. Definitions favorable to the use of tobacco increased the odds of students' use of tobacco by 1.53 times the odds of tobacco use. Students who reported a balance of reinforcement with greater perceived rewards than costs from smoking have greater odds of

tobacco use by 1.68 times than the odds of their counterparts. Students who expected encouraging parental reactions to their smoking increased the log-odds of tobacco use by 1.28(odd ratio) than the odds of students who expected discouraging parental reaction to their smoking. Lastly, students who reported that they received greater influence by observing role model's tobacco use have greater odds of tobacco use by 1.61 (odds ratio) times compared to their counterparts who reported less influence from observing others smoking. The between-Gu variance in mean log-odds of tobacco use is 0.03 and not significant.

Social structure and social bonding model

The findings on the model with social structure and social bonding variables are presented in Table 4-28. In this model, all social structural predictors and social bonding variables are included to examine if the social bonding variables would mediate the impact of structural predictors on students' tobacco use. First, the relationship between residential mobility and tobacco use became insignificant after including the four social bonding variables, while the relationships for population density, sex and type of school remain significant ($\gamma_{01} = 0.00003 \uparrow$, $\gamma_{90} = 1.48^{***}$, $\gamma_{100} = -0.68^{**}$, respectively). Oddly, although the coefficient for type of school reduced substantially (from $\gamma_{20} = -1.12^{**}$ to $\gamma_{20} = -0.68^{**}$), the coefficient for sex increased (from $\gamma_{90} = 1.20^{***}$ to $\gamma_{90} = 1.48^{***}$). That indicates the social bonding variables partially mediate the impact of type of school on students' tobacco use. In addition, the findings suggest that there are may be some moderation effects between social structural variables and social bonding variables. That is, in addition to the differences in effect of sex on tobacco use, the effects of belief and commitment became significant when social structural variables are entered in this full model. The level of significance and level of magnitude of coefficients of attachment and involvement variables remained relatively unchanged from the social banding only model (from $\gamma_{120} = -0.27^{**}$ to $\gamma_{120} = -0.27^*$, from $\gamma_{150} = -0.44^{**}$ to $\gamma_{150} = -0.43^{**}$, respectively). The findings of this model can be interpreted as

follows: Attending liberal schools reduces the odds of smoking by 0.50 times the odds of students attending industrial school. Also, male students have 4.42 times greater odds of smoking compared to the odds of smoking for female students. Furthermore, the coefficients for belief and commitment have been increased by including the structural predictors ($\gamma_{130} = -0.04^{***}$ to $\gamma_{130} = -0.10^\dagger$, $\gamma_{140} = 1.0$ to $\gamma_{140} = 0.13^\dagger$, respectively). That is, having greater belief in general law reduced the odds of smoking among students by 0.9 times. The direction of commitment is positive relationship with smoking, which is opposite to the expectation of the social bonding theory. That is, students who are more committed to their school work and future employment are more likely to use tobacco by 1.14 times than their counterparts. The findings of these two variables suggest some moderation effects of social bonding variables in that the effects of some social bonding variables on the tobacco use increased once the structural variable are included. The between Gu variance in mean log-odds tobacco use is 0.04 and is not significant.

Social structure and self-control model

The social structure with self-control model includes all social structure predictors and the self-control variable (see Table 4-29). By including the self-control variable, population density and percent on mobility are no longer significant. However, sex and type of school are significant and maintain the similar magnitude their coefficients to the structural model (from $\gamma_{90} = 1.20^{***}$ to $\gamma_{90} = 1.13^{***}$, from $\gamma_{100} = -1.12^{***}$ to $\gamma_{100} = -1.03^{***}$, respectively). As in the self-control only model, the self-control variable is significant but has slightly reduced coefficient from the self-control only model (from $\gamma_{160} = -0.61^{***}$ to $\gamma_{160} = -0.52^{**}$).

Therefore, the self-control variable substantially mediates the impact of community level structural predictors, but it does not mediate the social structural variables, sex and type of school. The findings indicate that for being male students, attending industrial school increase

the odds of tobacco use among students regardless of their level self-control. The between district variance in the mean log-odds of tobacco use is 0.02, but it is not significant.

Full Comparison Model with Structural, Social Learning, Social Bonding, and Self-Control Variables

As with the full comparison model for alcohol and depressant use, this full model for tobacco use also contains all social structural variables, social learning variables, social bonding variables and self-control variables. This model compares the relative mediation impact of these variables from the three theories on the social structural-level variables on tobacco use. Table 4-30 presents the findings from the full comparison model for tobacco use. Unlike with the full comparison model for alcohol use and depressant use (Table 4-12 and 4-21), sex became not significant in the full comparison model even. Also, its coefficient and the level of significant is substantially reduced (by more than half) compared to the structural model ($\gamma_{90} = 0.53$ from 1.20**). The rest of social structural predictors are also not significant. The relationships between the social learning variables and tobacco use remained relatively unchanged from the social learning model and the SSSL model. Differential association with tobacco using friends, definition, reinforcement balance of rewards and costs of tobacco use, and imitation remain significant predictors, while parental reaction toward tobacco use became insignificant. In addition, the magnitudes of their coefficients have been slightly increased from the social structure social learning model. With regard to the social bonding variables, attachment, belief, and involvement are no longer significant in this model. Commitment is the only significant predictor from social bonding theory. These changes in significance are not consistent with the social bonding only model, in which attachment and involvement are significant while belief and commitment are not significant. In the social structure and social bonding model, however, belief and commitment became significant and the magnitudes of coefficients are also increased. In the final comparison model, only

commitment, which is not the strongest predictor in the previous social bonding only and social structure social bonding models, became the only significant predictor among the four social bonding variables. Furthermore, the coefficient for commitment increased substantially from the full social bonding model after including social learning variables and self-control variable (from $\gamma_{140} = -0.13^{\dagger}$ to $\gamma_{140} = -0.34^*$). Finally, self-control in this model is not a significant variable and the coefficient is substantially reduced from the self-control and social structure model (from $\gamma_{160} = -0.52^{**}$ to $\gamma_{160} = -0.07$). These findings indicate that the mediation effects of social learning variables are greater than the effects of social bonding and self-control variable. The between-Gu variance in mean tobacco use is 0.05 which is reduced greatly from the variance of the unconditional model ($\square \square 0.65$) and is insignificant.

Table 4-1. Percentages of students who ever used different substances in their lifetime

District ID (Gu name)	Alcohol	Depressants	Tobacco	Total Sample
	Freq.=Yes (%)	Freq.=Yes (%)	Freq.=Yes (%)	
01 (Jung Gu)	34 (85%)	23(57%)	26(65%)	40
02 (Dongrae Gu)	83 (90%)	56(61%)	43(46%)	92
03 (Sa-Sang Gu)	38 (97%)	15(38%)	24(62%)	39
04 (Nam Gu)	129 (89%)	71(49%)	76(52%)	145
05 (Seu Gu)	35 (90%)	10(25%)	30(77%)	39
06 (Jin Gu)	115 (87%)	71(54%)	70(53%)	132
07 (Yeunjae Gu)	30 (83%)	25(70%)	22(61%)	36
08 (Sooyoung Gu)	36 (88%)	34(83%)	11(27%)	41
09 (Haeyundae Gu)	90 (83%)	49(45%)	53(49%)	108
10 (Buck Gu)	27 (79%)	26(76%)	20(59%)	34
11 (Keumjung Gu)	62 (76%)	54(66%)	23(28%)	82
12 (Dong Gu)	61 (85%)	41(57%)	27(37%)	72
13 (Youngdo Gu)	61 (86%)	32(45%)	35(49%)	71
14 (Kangse Gu)	35 (76%)	26(56%)	6(13%)	46
15 (Saha Gu)	21 (50%)	26(74%)	3(8%)	35
Total	859/1,012	559/1,012	469/1,012	1,012

Table 4-2. Descriptive statistics on students and districts

Variables	Mean	S.D.	Min.	Max.
Level-1 measures^a				
Frequency of alcohol use	2.17	1.54	0	6
Frequency of depressant use	1.22	1.35	0	5
Tobacco use (0-1)	0.46	0.49	0	1
Sex (male=1)	0.52	0.49	0	1
Type of school (liberal =1)	0.53	0.49	0	1
Religiosity	1.81	1.10	1	4
Social learning variables				
Differential association				
Peer association				
Alcohol	6.04	2.56	0	9
Depressant	3.36	1.91	0	8
Tobacco	5.02	3.65	0	9
Father's use				
Alcohol	4.40	1.97	0	6
Depressant	1.53	1.11	0	6
Tobacco	4.61	2.80	0	6
Mother's use				
Alcohol	2.53	1.64	0	6
Depressant	1.80	1.30	0	5
Tobacco	1.15	0.90	0	6
Definitions				
Alcohol	1.75	0.55	1	3
Depressant	2.19	0.64	1	3
Tobacco	2.45	0.69	1	3
Differential reinforcement				
Reinforcement balance				
Alcohol	1.83	0.64	1	3
Depressant	2.42	0.58	1	3
Tobacco	2.52	0.62	1	3
Friend's reactions				
Alcohol	2.81	0.93	1	7
Depressant	3.56	0.95	1	7
Tobacco	3.41	0.97	1	7
Parent's reactions				
Alcohol	2.60	0.67	1	5
Depressant	2.75	0.93	1	5
Tobacco	3.24	0.68	1	5
Imitation	2.87	0.80	1	4
Social bonding variables				
Attachment	6.18	1.62	3	12
Belief	6.81	1.63	3	12
Commitment	3.02	1.20	2	8
Involvement	2.35	1.38	1	6
Self-control variable				
Self-control	2.64	0.35	1	5
Level-2 Measures^b				
Population density	11472.67	6422.30	367	21318
Percent on public welfare	6.47 %	3.10%	1.42 %	12.32 %
Residential mobility	18.23%	1.34%	15.8 %	20.3 %

^a Source: Hwang (2000) dissertation; ^b 1999 South Korea Census data and BST data.

Table 4-3. Bivariate correlations of the independent variables with alcohol, depressant and tobacco use

Variable	Alcohol	Depressant	Tobacco
	Coefficients	Coefficients	Coefficients
Social learning variables			
Differential association			
1. Peer association	0.77*	0.64*	0.71*
2. Father's use	0.14*	0.31*	0.11*
3. Mother's use	0.15*	0.45*	0.09*
4. Definitions	-0.31*	-0.45*	-0.44*
Differential reinforcement			
5. Reinforcement balance	-0.37*	-0.42*	-0.52*
6. Friend's reactions	-0.34*	-0.30*	-0.43*
7. Parent's reactions	-0.21*	-0.37*	-0.28*
8. Imitation	-0.49*	-0.12*	-0.50*
Social bonding variables			
9. Attachment	0.13*	0.002	0.16*
10. Belief	0.12*	0.01	0.06*
11. Commitment	0.09*	-0.004	0.03
12. Involvement	-0.24*	0.02	-0.24*
Self-control variable			
13. Self-Control	-0.31*	-0.06*	-0.28*
Social structural variables			
14. Sex (male = 1)	0.19*	-0.22*	0.29*
15. Type of school (liberal = 1)	-0.25*	0.005	-0.26*
16. Religiosity	-0.06*	0.03	-0.01
17. Population density	0.19*	0.01	0.16*
18. Percent on public welfare	0.002	-0.03	0.06*
19. Residential mobility	0.02	0.10*	-0.006

*P < 0.05 (one-tailed t-test)

Table 4-4. Unconditional random ANOVA model for variation in alcohol use across Gus

Parameter	Coefficient	se		
Fixed effects				
Grand mean	2.14***	0.127		
Frequency of use				
			Variance	χ^2 D.F.
Random effects				
Between Gus (τ_{00})	0.21 ^a		92.75***	14
Within Gus	2.20 ^b			

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001
^a = τ_{00} , ^b = σ^2

Table 4-5. Structural level model for alcohol use

Parameter	Coefficient	Se		
Fixed effects				
Between districts (Gus)				
Intercept	2.15***	0.073		
Population density	0.00004***	0.000008		
Percent on public welfare	-0.02	0.018		
Residential mobility	-0.08*	0.034		
Within districts (Gus)				
Sex	0.47**	0.139		
Type of school	-0.76***	0.100		
Religiosity	-0.10†	0.047		
			Variance	χ^2 D.F.
Random effects				
Between districts (Gus) (τ_{00})	0.08 ^a		13.40	11
Sex	0.11**		7.56	14
Type of school	0.07		2.15	14
Religiosity	0.01		1.82	14
Within districts (Gus)	2.03 ^b			

Note: the three variables, sex, type of school, & religiosity, are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001
^a = τ_{00} , ^b = σ^2

Table 4-6. Social learning model for alcohol use

Parameter	Coefficient	Se		
Fixed effects				
Within districts (Gus)				
Social learning variables				
Intercept	2.17***	0.029		
Differential association				
Peer association	0.97***	0.047		
Father's use	0.08*	0.026		
Mother's use	0.01	0.033		
Definitions	0.07*	0.031		
Differential reinforcement				
Reinforcement balance	0.11**	0.027		
Friend's reactions	0.03	0.023		
Parent's reactions	0.08*	0.029		
Imitation	0.20***	0.042		
	Variance	χ^2	DF	
Random effects				
Between districts (Gus) (τ_{00})				
Differential association	0.002 ^a	16.91	14	
Peer association	0.017*	22.30	14	
Father's use	0.001	15.77	14	
Mother's use	0.007	15.18	14	
Definitions	0.003	14.86	14	
Differential reinforcement				
Reinforcement balance	0.003	7.41	14	
Friend's reactions	0.0007	6.83	14	
Parent's reactions	0.004	14.65	14	
Imitation	0.010*	22.52	14	
Within districts (Gus)	0.85 ^b			
% Reduction in within school conditional error variance				
	62%			

Note: Level-1 predictors were grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-7. Social bonding model for alcohol use

Parameter	Coefficient	Se		
Fixed effects				
Within districts (Gus)				
Intercept	2.13***	0.100		
Attachment	-0.07	0.062		
Belief	-0.09†	0.041		
Commitment	-0.06	0.048		
Involvement	-0.29***	0.053		
	Variance	χ^2	D.F.	
Random effects				
Between districts (Gus) (τ_{00})				
Intercept	0.117*** ^a	52.84	14	
Attachment	0.02*	24.42	14	
Belief	0.009	13.12	14	
Commitment	0.01	13.28	14	
Involvement	0.019	19.50	14	
Within districts (Gus)	2.05 ^b			
% Reduction in within school conditional error variance				
	7%			

Note: Level-1 predictors were grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-8. Self-control model for alcohol use

Parameter	Coefficient	Se		
Fixed effects				
Within districts (Gus)				
Intercept1	2.13***	0.109		
Self-control	-0.43***	0.055		
	Variance	χ^2	D.F.	
Random effects				
Between districts (Gus) (τ_{00})				
Intercept	0.14*** ^a	76.31	14	
Self-control	0.013	20.93	14	
Within districts (Gus)	2.01 ^b			
% Reduction in within school conditional error variance				
	9%			

Note: Level-1 variable is grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-9. The SSSL model with social structure and social learning variables for alcohol use

Parameter	Coefficient	Se	
Fixed effects			
Between districts (Gus)			
Intercept	2.18***	0.038	
Population density	-0.000004	0.000007	
Percent on public welfare	-0.01	0.013	
Residential mobility	-0.01	0.032	
Within Districts (Gus)			
Sex	0.18*	0.080	
Type of school	-0.11	0.084	
Religiosity	-0.05	0.030	
Differential association			
Peer association	0.93***	0.046	
Father's use	0.07*	0.035	
Mother's use	0.003	0.042	
Definitions	0.09*	0.034	
Differential reinforcement			
Reinforcement balance	0.11*	0.038	
Friend's reactions	0.03	0.034	
Parent's reactions	0.09*	0.035	
Imitation	0.20***	0.044	
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})	0.05	0.296	11
Sex	0.02	1.109	14
Type of school	0.03*	3.772	14
Religiosity	0.003	2.12	14
Differential association			
Peer association	0.01	1.101	14
Father's use	0.004	0.527	14
Mother's use	0.01*	4.627	14
Definitions	0.002	0.472	14
Differential reinforcement			
Reinforcement balance	0.003	2.659	14
Friend's reactions	0.001	1.128	14
Parent's reactions	0.004†	3.662	14
Imitation	0.01	1.667	14

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-10. Model with social structure and social bonding variables for alcohol use

Parameter	Coefficient	se		
Fixed effects				
Between districts (Gus)				
Intercept,	2.19***	0.067		
Population density	0.00004***	0.000005		
Percent on public welfare	-0.01†	0.009		
Residential mobility	-0.06†	0.029		
Within districts (Gus)				
Sex	0.58**	0.136		
Type of school	-0.42*	0.149		
Religiosity	-0.06	0.050		
Attachment	-0.06	0.053		
Belief	-0.10*	0.055		
Commitment	-0.05	0.044		
Involvement	-0.23**	0.052		
	Variance	χ^2		D.F.
Random effects				
Between districts (Gus) (τ_{00})	0.04	11.80		11
Sex	0.10**	6.97		14
Type of school	0.12*	5.39		14
Religiosity	0.01	2.29		14
Attachment	0.02	0.13		14
Belief	0.02	4.00		14
Commitment	0.008*	3.93		14
Involvement	0.01	1.59		14
Within districts (Gus)	1.90			

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-11. Model with social structure and self-control variables for alcohol use

Parameter	Coefficient	se		
Fixed effects				
Between districts (Gus)				
Intercept	2.15***	0.068		
Population density	0.00002**	0.000006		
Percent on public welfare	-0.01	0.011		
Residential mobility	-0.07*	0.029		
Within districts (Gus)				
Sex	0.35**	0.109		
Type of school	-0.66***	0.099		
Religiosity	-0.08	0.054		
Self-control	-0.36***	0.051		
	Variance	χ^2		D.F.
Random effects				
Between districts (Gus) (τ_{00})	0.03	11.19		11
Sex	0.07**	7.50		14
Type of school	0.08	1.88		14
Religiosity	0.02	2.51		14
Self-control	0.01†	3.69		14

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-12. Full model comparing the relative mediating effects of social learning, social bonding and self-control variables for alcohol use

Parameter	Coefficient	se		
Fixed Effects				
Between districts (Gus)				
Intercept	2.17***	0.037		
Population Density	0.000001	0.000007		
Percent on Public Welfare	-0.02	0.013		
Residential Mobility	-0.02	0.032		
Within districts (Gus)				
Sex	0.15†	0.078		
Type of school	-0.05	0.089		
Religiosity	-0.05	0.030		
Differential association				
Peer association	0.93***	0.050		
Father's use	0.08†	0.034		
Mother's use	0.006	0.041		
Definitions	0.07*	0.035		
Differential reinforcement				
Reinforcement balance	0.11*	0.036		
Friend's reactions	0.02	0.034		
Parent's reactions	0.05†	0.036		
Imitation	0.16**	0.047		
Attachment	0.009	0.036		
Belief	-0.04	0.033		
Commitment	0.008	0.038		
Involvement	-0.06	0.036		
Self-control	-0.07†	0.038		
	Variance	χ^2	D.F.	
Random effects				
Between districts (Gus) (τ_{00})	0.004	0.284	11	
Sex	0.02	1.78	14	
Type of school	0.02*	5.80	14	
Religiosity	0.002	1.06	14	
Differential association				
Peer association	0.01	1.65	14	
Father's use	0.003	0.50	14	
Mother's use	0.01*	6.12	14	
Definitions	0.003	0.59	14	
Differential reinforcement				
Reinforcement balance	0.005	3.05	14	
Friend's reactions	0.005	0.90	14	
Parent's reactions	0.006*	4.85	14	
Imitation	0.01†	3.33	14	
Attachment	0.005†	5.14	14	
Belief	0.0001*	0.004	14	
Commitment	0.01*	5.53	14	
Involvement	0.002	2.17	14	
Self-control	0.006**	6.24	14	
Within districts (Gus)	0.78			

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-13. Unconditional random ANOVA model for variation in depressant use across Gus

Parameter	Coefficient	se	
Fixed effects			
Grand mean	1.26***	0.106	
Frequency of use			
	Variance	χ^2	D.F.
Random Effects			
Between districts (Gus) (τ_{00})	0.14 ^a	78.94***	14
Within districts (Gus)	1.68 ^b		

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-14. Structural level model for depressant use

Parameter	Coefficient	Se	
Fixed effects			
Between districts (Gus)			
Intercept	1.20***	0.047	
Population density	0.00002*	0.000008	
Percent on public welfare	0.002	0.012	
Residential mobility	0.06*	0.032	
Within districts (Gus)			
Sex	-0.59***	0.068	
Type of school	0.10	0.144	
Religiosity	0.03	0.044	
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})	0.001 ^a	0.30	11
Sex	0.009	0.37	14
Type of school	0.20**	7.03	14
Religiosity	0.01	1.75	14
Within districts (Gus)	1.62 ^b		

Note: All variables are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-15. Social learning model for depressant use

Parameter	Coefficient	se		
Fixed effects				
Within districts (Gus)				
Social learning variables				
Intercept	1.23***	0.033		
Differential association				
Peer Association	0.58***	0.034		
Father's Use	0.04	0.041		
Mother's Use	0.18***	0.035		
Definitions	0.20**	0.046		
Differential reinforcement				
Reinforcement balance	0.11*	0.041		
Friend's Reactions	-0.001	0.028		
Parent's Reactions	0.11*	0.038		
Imitation	0.07†	0.040		
	Variance	χ^2	DF	
Random effects				
Between districts (Gus) (τ_{00})	0.008 ^a	18.74	14	
Differential association				
Peer association	0.001	9.38	14	
Father's use	0.008	23.29†	14	
Mother's use	0.003	14.13	14	
Definitions	0.01	19.03	14	
Differential reinforcement				
Reinforcement balance	0.01	18.84	14	
Friend's reactions	0.001	10.27	14	
Parent's reactions	0.009	12.88	14	
Imitation	0.01	20.62*	14	
Within districts (Gus)	0.87 ^b			
% Reduction in within school conditional error variance				
	62%			

Note: Level-1 predictors were grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-16. Social bonding model for depressant use

Parameter	Coefficient	se	
Fixed effects			
Within districts (Gus)			
Intercept	1.26***	0.110	
Attachment	-0.005	0.046	
Belief	-0.03	0.020	
Commitment	-0.01	0.033	
Involvement	0.06	0.047	
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus)(τ_{00})	0.15	74.00***	14
Attachment	0.008	13.87	14
Belief	0.0002	3.91	14
Commitment	0.009	9.70	14
Involvement	0.007	15.25	14
Within districts (Gus)	1.65 ^b		
% Reduction in within school conditional error variance	7%		

Note: Level-1 predictors were grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-17. Self-control model for depressant use

Parameter	Coefficient	se	
Fixed effects			
Within districts (Gus)			
Intercept1	1.26***	0.107	
Self-control	-0.11**	0.028	
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})	0.14 ^a	77.11***	14
Self-control	0.001	6.22	14
Within sistricts (Gus)	1.66 ^b		
% Reduction in within school conditional error variance	9%		

Note: Level-1 variable is grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-18. The SSSL model, with social structure and social learning variables for depressant use

Parameter	Coefficient	se		
Fixed effects				
Between districts (Gus)				
Intercept	1.25***	0.035		
Population density	0.000001	0.000007		
Percent on public welfare	0.006	0.01		
Residential mobility	0.04	0.03		
Within districts (Gus)				
Sex	-0.10	0.081		
Type of school	0.09	0.079		
Religiosity	-0.01	0.031		
Differential association				
Peer association	0.5***	0.045		
Father's use	0.04	0.042		
Mother's use	0.19***	0.037		
Definitions				
Differential reinforcement	0.20**	0.050		
Reinforcement balance	0.11*	0.042		
Friend's reactions	-0.005	0.027		
Parent's reactions	0.10*	0.036		
Imitation	0.09†	0.040		
	Variance	χ^2	D.F.	
Random effects				
Between districts (Gus) (τ_{00})	0.003 ^a	2.05	11	
Sex	0.01	0.408	14	
Type of School	0.02	4.00*	14	
Religiosity	0.003	4.84*	14	
Differential association				
Peer association	0.007	4.46*	14	
Father's use	0.008	10.73**	14	
Mother's use	0.001	0.07	14	
Definitions				
Differential reinforcement	0.01	1.10	14	
Reinforcement balance	0.004	0.35	14	
Friend's reactions	0.0009	0.37	14	
Parent's reactions	0.007	2.54	14	
Imitation	0.02	4.12*	14	
Within districts (Gus)	0.84 ^b			

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-19. Model with social structure and social bonding variables for depressant use

Parameter	Coefficient	se		
Fixed effects				
Between districts (Gus)				
Intercept	1.21***	0.048		
Population density	0.00001†	0.000008		
Percent on public welfare	0.002	0.012		
Residential mobility	0.07*	0.032		
Within districts (Gus)				
Sex	-0.62***	0.061		
Type of school	0.06	0.131		
Religiosity	0.03	0.048		
Attachment	-0.02	0.047		
Belief	-0.001	0.041		
Commitment	-0.001	0.028		
Involvement	0.08†	0.044		
	Variance	χ^2	D.F.	
Random effects				
Between districts (Gus) (τ_{00})	0.002	0.37	11	
Sex	0.006	0.57	14	
Type of school	0.12*	3.17	14	
Religiosity	0.01	0.93	14	
Attachment	0.006**	7.29	14	
Belief	0.0002	0.84	14	
Commitment	0.0007	0.10	14	
Involvement	0.004†	3.17	14	
Within districts (Gus)	1.60			

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-20. Model with social structure and self-control variables for depressant use

Parameter	Coefficient	se		
Fixed effects				
Between districts (Gus)				
Intercept	1.20***	0.049		
Population density	0.00001	0.000008		
Percent on public welfare	0.004	0.012		
Residential mobility	0.06†	0.029		
Within districts (Gus)				
Sex	-0.63***	0.067		
Type of school	0.12	0.144		
Religiosity	0.03	0.043		
Self-control	-0.14**	0.032		
	Variance	χ^2	D.F.	
Random effects				
Between districts (Gus) (τ_{00})	0.007 ^a	0.62	11	
Sex	0.01	0.37	14	
Type of school	0.13**	7.40	14	
Religiosity	0.01	1.71	14	
Self-control	0.003	1.24	15	
Within districts (Gus)	1.60 ^b			

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

^a = τ_{00} , ^b = σ^2

Table 4-21. Full model comparing the relative mediating effects of social learning, social bonding and self-control variables for depressant use

Parameter	Coefficient	se		
Fixed effects				
Between districts (Gus)				
Intercept	1.23***	0.035		
Population density	0.000008	0.000007		
Percent on public welfare	0.011	0.012		
Residential mobility	0.02	0.034		
Within districts (Gus)				
Sex	-0.13†	0.073		
Type of school	0.02	0.078		
Religiosity	-0.02	0.037		
Differential association				
Peer association	0.56***	0.043		
Father's use	0.03	0.042		
Mother's use	0.20***	0.038		
Definitions	0.20**	0.048		
Differential reinforcement				
Reinforcement balance	0.11*	0.043		
Friend's reactions	0.01	0.041		
Parent's reactions	0.10†	0.049		
Imitation	0.08†	0.041		
Attachment	0.06	0.040		
Belief	-0.03	0.043		
Involvement	0.10†	0.057		
Commitment	-0.01	0.038		
Self-control	-0.06†	0.038		
	Variance	χ^2	D.F.	
Random effects				
Between districts (Gus) (τ_{00})	0.004 ^a	3.50	11	
Sex	0.004	0.14	14	
Type of school	0.006	2.07	14	
Religiosity	0.007	2.26	14	
Differential association				
Peer association	0.005*	4.56	14	
Father's use	0.01**	11.21	14	
Mother's use	0.002	0.02	14	
Definitions	0.01	1.79	14	
Differential reinforcement				
Reinforcement balance	0.006	0.81	14	
Friend's reactions	0.005	2.71	14	
Parent's reactions	0.01†	0.84	14	
Imitation	0.009	2.52	14	
Attachment	0.01*	5.14	14	
Belief	0.001	1.67	14	
Involvement	0.02	2.52	14	
Commitment	0.008†	0.35	14	
Self-control	0.003	0.68	14	
Within districts (Gus)	0.79 ^b			

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-22. Unconditional random ANOVA model for variation in tobacco use across Gus

Unit-specific model parameter	Coefficient	se	Odds ratio
Fixed effects			
Intercept	-0.21	0.214	0.81
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})	0.65	93.383***	14

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-23. Structural level model for tobacco use

Unit-specific model parameter	Coefficient	se	Odds ratio
Fixed effects			
Between districts (Gus)			
Intercept	-0.21*	0.084	0.80
Population density	0.00003†	0.00001	1.00
Percent on public welfare	0.001	0.018	1.00
Residential mobility	-0.1†	0.051	0.90
Within Districts (Gus)			
Sex	1.20**	0.256	3.34
Type of school	-1.12***	0.159	0.32
Religiosity	-0.02	0.048	0.97
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})	0.03*	23.74	11
Sex	0.5	18.61***	14
Type of school	0.0006	1.81	14
Religiosity	0.0001	0.50	14

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-24. Social learning model for tobacco use

Unit-specific model parameter	Coefficient	se	Odds ratio
Fixed effects			
Within districts (Gus)			
Social learning variables			
Intercept	0.17	0.095	1.18
Differential association			
Peer Association	1.78***	0.114	5.97
Father's Use	0.11	0.092	1.12
Mother's Use	-0.08	0.094	0.92
Definitions	0.40**	0.123	1.50
Differential reinforcement			
Reinforcement balance	0.51***	0.113	1.65
Friend's Reactions	0.22	0.164	1.24
Parent's Reactions	0.29*	0.114	1.33
Imitation	0.47**	0.109	1.60
	Variance	χ^2	DF
Random effects			
Between districts (Gus) (τ_{00})	0.02	11.15	14
Differential association			
Peer association	0.06	4.82	14
Father's use	0.02	8.68	14
Mother's use	0.06	13.38	14
Definitions	0.09	11.39	14
Differential reinforcement			
Reinforcement balance	0.05	8.21	14
Friend's reactions	0.14	16.78†	14
Parent's reactions	0.06	12.35	14
Imitation	0.04	7.10	14

Note: Level-1 predictors were grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-25. Social bonding model for tobacco use

Unit-specific model parameter	Coefficient	se	Odds ratio
Fixed effects			
Within districts (Gus)			
Intercept	-0.25	0.186	0.78
Attachment	-0.27**	0.086	0.75
Belief	-0.04	0.061	0.96
Commitment	0.10	0.060	1.11
Involvement	-0.44**	0.124	0.64
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})	0.43	60.02***	14
Attachment	0.04	21.27	14
Belief	0.01	15.18	14
Commitment	0.0003	13.08	14
Involvement	0.13	34.75**	14

Note: Level-1 predictors were grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-26. Self-control model for tobacco use

Unit-specific model parameter	Coefficient	se	Odds ratio
Fixed effects			
Within districts (Gus)			
Intercept	-0.21	0.195	0.80
Self-control	-0.61***	0.058	0.53
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})	0.47	71.06***	14
Self-control	0.00006	10.29	14

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-27. The SSSL Model, with social structure and social learning variables for tobacco use

Unit-specific model parameter	Coefficient	se	Odds ratio
Fixed effects			
Between districts (Gus)			
Intercept	0.13	0.133	1.13
Population density	0.000003	0.00002	1.00
Percent on public welfare	0.008	0.050	1.006
Residential mobility	-0.1	0.118	0.83
Within districts (Gus)			
Sex	0.42	0.291	1.58
Type of school	-0.37	0.271	0.68
Religiosity	-0.04	0.105	0.95
Differential association			
Peer association	1.67***	0.173	5.36
Father's use	0.12	0.114	1.14
Mother's use	-0.10	0.141	0.90
Definitions	0.40**	0.158	1.53
Differential reinforcement			
Reinforcement balance	0.50***	0.146	1.68
Friend's reactions	0.12	0.163	1.18
Parent's reactions	0.25†	0.147	1.28
Imitation	0.45**	0.140	1.61
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})	0.03	0.33	11
Sex	0.36	1.85	11
Type of school	0.2	1.82	11
Religiosity	0.02	0.32	14
Differential association			
Peer association	0.04	1.56	14
Father's use	0.02	1.80	14
Mother's use	0.07	0.46	14
Definitions	0.1	0.02	14
Differential reinforcement			
Reinforcement balance	0.05	1.36	14
Friend's reactions	0.1	3.37†	14
Parent's reactions	0.1	1.97	14
Imitation	0.04	2.13	14

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-28. Model with social structure and social bonding variables for tobacco use

Unit-specific model parameter	Coefficient	se	Odds ratio
Fixed effects			
Between districts (Gus)			
Intercept	-0.25*	0.083	0.77
Population density	0.00003†	0.00001	1.00
Percent on public welfare	0.02	0.014	1.02
Residential mobility	-0.03	0.050	0.97
Within districts (Gus)			
Sex	1.48***	0.229	4.42
Type of school	-0.68**	0.169	0.50
Religiosity	0.01	0.065	1.01
Attachment	-0.27*	0.106	0.75
Belief	-0.10†	0.076	0.90
Commitment	0.13†	0.068	1.14
Involvement	-0.43**	0.123	0.65
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})	0.04	7.12	11
Sex	0.3	13.95***	14
Type of school	0.07	1.31	14
Religiosity	0.01	1.63	14
Attachment	0.09	0.44	14
Belief	0.02	2.73	14
Involvement	0.1	0.31	14
Commitment	0.01	0.82	14

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-29. Model with social structure and self-control variables for tobacco use

Unit-specific model parameter	Coefficient	se	Odds ratio
Fixed effects			
Between districts (Gus)			
Intercept	-0.22*	0.078	0.79
Population density	0.00002	0.00001	1.00
Percent on public welfare	0.006	0.015	1.00
Residential mobility	-0.09	0.052	0.91
Within districts (Gus)			
Sex	1.13***	0.244	3.12
Type of school	-1.03***	0.158	0.35
Religiosity	-0.01	0.049	0.98
Self-control	-0.52**	0.052	0.58
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})	0.02	7.22	11
Sex	0.4	15.99***	14
Type of school	0.0008	2.24	14
Religiosity	0.00005	0.42	14
Self-control	0.0001	0.31	14

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

Table 4-30. Full model comparing the relative mediating effects of social learning, social bonding and self-control variables for tobacco use

Unit-specific model parameter	Coefficient	se	Odds ratio
Fixed effects			
Between districts (Gus)			
Intercept	0.14	0.148	1.15
Population density	-0.00001	0.00002	0.99
Percent on public welfare	0.02	0.039	1.02
Residential mobility	-0.08	0.103	0.92
Within districts (Gus)			
Sex	0.53	0.22	1.85
Type of school	-0.20	0.401	0.77
Religiosity	-0.05	0.128	1.02
Differential association			
Peer association	1.85***	0.197	6.37
Father's use	0.05	0.127	1.05
Mother's use	0.01	0.177	1.02
Definitions	0.42*	0.156	1.53
Differential reinforcement			
Reinforcement balance	0.63**	0.187	1.89
Friend's reactions	0.15	0.199	1.24
Parent's reactions	0.18	0.167	1.24
Imitation	0.54**	0.151	1.72
Attachment	-0.08	0.185	0.91
Belief	0.01	0.167	1.01
Commitment	0.34*	0.159	1.41
Involvement	-0.28	0.211	0.74
Self-control	-0.04	0.160	0.96
	Variance	χ^2	D.F.
Random effects			
Between districts (Gus) (τ_{00})			
Sex	0.05	0.18	11
Type of school	0.4	0.72	14
Religiosity	0.4	0.45	14
Religiosity	0.03	0.13	14
Differential association			
Peer association	0.1	2.13	14
Father's use	0.03	0.62	14
Mother's use	0.1	0.11	14
Definitions	0.09	0.39	14
Differential reinforcement			
Reinforcement balance	0.1†	3.17	14
Friend's reactions	0.2	2.46	14
Parent's reactions	0.1†	3.47	14
Imitation	0.04	2.29	14
Attachment	0.2	0.49	14
Belief	0.1	0.29	14
Commitment	0.1	0.89	14
Involvement	0.3	2.09	14
Self-control	0.1	0.31	14

Note: All predictors are grand mean centered.

†p-value<.1; *p-value<.05; **p-value<.01; ***p-value<.001

CHAPTER 5 SUMMARY AND CONCLUSIONS

This chapter summarizes findings from the models run for use of alcohol, depressants, and tobacco. The findings from several HLM models for alcohol and depressants use and HGLM models for tobacco use will be interpreted and conclusions stated in relation to the hypotheses of this study. Moreover, the limitations of the current study and the implications for future research are discussed in this chapter.

Variations in Alcohol, Depressant and Tobacco Use across Gus

The models examining variations in of adolescents' lifetime prevalence of alcohol, depressant and tobacco use found supportive evidence for Hypothesis 1 which states that alcohol, tobacco and depressant use will significantly vary across districts (Gus). The uses of these substances varied significantly vary across fifteen Gus (districts) in Busan, South Korea (Tables 4-4, 4-13, and 4-22). These findings are consistent with previous studies examining substance and drug use variations between districts, communities or schools in American studies (Holland-Davis, 2006; Ennett et al., 1997; Krohn, Lanza-Kaduce & Akers, 1984) and the relatively small size of the differences across macro-level group or geographical units is consistent with what is typically found in empirical studies (Reisig & Parks, 2000; Sampson & Bartusch, 1998; Sampson, Morenoff, & Earls, 1999). Therefore, although the variances are small, they are sufficient to allow testing the SSSL model and the comparable models using social bonding and self-control variables. The majority of the variations in substance use among adolescents in Busan is found in between-individual differences. The differences in variation between-groups and between-individual sources are consistent with findings in previous studies (Holland-Davis, 2006; Ennett et al., 1997).

Social Structural Dimensions of Use of Alcohol, Depressants and Tobacco Among Adolescents in Busan

Following three unconditional ANOVA models that estimated between-Gus differences for each of three substances, three social structural models were run that included social structural variables to assess their impact on differences in alcohol, depressant, and tobacco use. These models examined Hypotheses 2a, which states that social structural variables such as population density, residential mobility and percent of residents on public welfare will be associated with adolescents' substance (alcohol, depressant, and tobacco) use; and Hypothesis 2b, which states that male adolescents, students attending industrial type of school, and students with low level of religiosity (social structural variables) will be more likely to use alcohol, depressants and tobacco. These models were analyzed as a prior step to examining the central proposition in Akers' SSSL model that social learning variables measured at the individual level will mediate the effects of the structural level variables adolescents' alcohol, depressant and tobacco use (see Tables 4-5, 4-14, and 4-23).

The findings support the conclusion that some social structural dimensions were significant predictors for adolescents' substance use, while some of them were not. All of social structural variables representing differential location in the social structure and differential location in primary and secondary groups, such as sex, type of school and religiosity were significantly associated with adolescents' lifetime alcohol use (Hypothesis 2b). With regard to the community level measures of differential social organization and theoretically defined dimensions of social structure, two of the variables, population density and residential mobility were significantly associated with adolescents drinking behavior but percent on public welfare was not (Hypothesis 2a). Also, two community level variables (population density, and residential mobility) and one measure of differential location in the social (sex) significantly predicted adolescents' depressants use. This findings offer partial

support for Hypotheses 2a and 2b. The model examining adolescents' tobacco use also found partial support for the Hypothesis 2a and 2b. The findings on this model revealed that population density, residential mobility, sex and type of school, were significant predictors of adolescents' smoking experience.

The conclusion is that population density was a consistent and positive predictor for alcohol, depressant and tobacco use among adolescents. These findings seem to be consistent with some previous studies (Sundquist & Frank, 2004); however, there are also still some differences from previous studies that found positive relationships between population density and adolescent use of marijuana and other illicit drugs, but not with alcohol and tobacco use (Holland-Davis, 2006; O'Malley et al, 1988). Generally, this finding from South Korean youths support the arguments by Osgood and Chambers (2000) that communities with greater population density pose greater opportunities for youth to engage in delinquent behaviors such as substance use.

Residential mobility was also a statistically significant predictor of all three types of substance use, but *the direction of the effects was not consistent* in the three models. Residential mobility was positively associated with depressant use, but it was negatively associated with alcohol and tobacco use. That is, adolescents living in Gus where higher levels of residential mobility are more likely to use depressants but less likely to use alcohol and tobacco. These findings suggest that residential mobility does not have consistent negative influence on substance use for adolescents, as predicted by social disorganization theory (Sampson & Groves, 1989). These findings are consistent with previous studies that found some mixed effects of residential mobility or residential instability (Clark & Loheac, 200; DeWit, 1998; Ennett et al., 1997).

Overall, community level social structural predictors, which are at the most macro level and more distal causal factors, such as population density, percent on public welfare and

residential mobility have less predictive power than differential location in the social structure and differential location in the primary and secondary groups variables (which are more meso-level elements of social structure. Again these findings are not surprising and are consistent with previous research findings that structural predictors are often only weakly associated with individual behaviors (Holland-Davis, 2006, p.103; Verill, 2008).

Sex of the respondent was a consistently significant and strong predictor for all three types of substance use. Such a strong gender effect is consistent with previous studies (Landza-Kaduce et al., 2006; Lee, et al., 2004; Holland-Davis, 2006; Verill, 2008). More interestingly, gender effects were different by type of substances. Male students were significant more likely to use alcohol and tobacco than female students, but female students were significantly more likely to report higher level of depressant use compared to male students. It is not clear how much these findings for depressant use are in line with previous studies (Jensen, 2003; Mears et al., 1998; Piequero et al., 2005; Sevansson, 2003).

Type of school attended by the respondents (industrial or liberal high school) was also a significant predictor for alcohol and tobacco use, but not depressant use, among South Korean adolescents. Such findings appear to be relevant to the gender composition of liberal and industrial schools. In this sample, 59.6 percent of students were attending liberal type of school. Among those students attending liberal high schools, 20.6 percent were female students. That might attenuate the differences of type of schools in using depressants. Generally, this type of school effect is consistent with findings from South Korean research investigating adolescents' substance use behaviors (National Youth Commission, 2002, 2005, 2007). For example, the National Youth Commission (2005) found that students attending industrial schools more frequently use alcohol and are at greater risk of binge drinking than students attending liberal type of schools. South Korean studies also suggest that students attending industrial schools are more likely to be under greater peer pressure for using

substances, more exposure to role models using substances compared to counterparts and less supervision by parents (Kim et al., 1990; National Youth Commission, 2005; Yun et al, 1999). Therefore, the type of school where students attend may provide certain circumstances that certain social learning process may operate to lead increased or decreased adolescents engagement in substance use.

Furthermore, this finding may indicate that type of school may be an indicator of social status for adolescence years. That is, generally students attending industrial school have lower grades and their parents tend to be in lower levels of socioeconomical status compared to the students attending liberal school. Therefore, students attending industrial school may perceive inability to achieve academic or occupational aspiration than students attending liberal school. That is because it is expected that students attending industrial schools are headed for blue collar jobs after graduation, and will earn less income compared to the students graduating from liberal schools who have more opportunity to achieve college level education or more and expect to earn more income and respects. According to Braithwaite (1981), self-report studies may find more significant findings in studies of adolescents if the social class measure actually captures the adolescents' social class rather than the parents' social class. Therefore, type of school can be considered as an indicator measuring adolescents' social status or class considering the social and cultural meaning and expectations from type of school where students attending. In this sense, this measure also would be considered as one of theoretically defined variables indicated in the SSSL theory in South Korean context.

Unlike some American studies found which found evidence for the negative relationship between religiosity and substance use, this study did not find that students' religiosity insulate them from using substances (Holland-Davis, 2006, Johnson et al., 2000). In the bivariate analysis, religiosity was negatively associated with alcohol use but it was not

significantly associated with depressant use and tobacco use. This may reflect in part a weak measure of religiosity. The measure of religiosity here imply how often students go to church or temple. The mean frequency of church or temple attendance was less than once a month, and this question does not directly ask if the respondent attend for worship services or other purposes. On the other hands, other studies that have found significant effects of religiosity used different question in operationalizing the variable. For example, Holland-Davis (2006) measured religiosity by using question requiring respondents to assess how religious they are (p.67). Furthermore, some studies suggest that the concept of religiosity is composed of multiple components such as emotion, knowledge, and behaviors (Cornwall, Albrecht, Cunningham & Pitcher, 1986).

Finally, the between-Gus variance of the two structural level models for alcohol and depressant use (but not tobacco use) was not significant models were run including all of the social structural variables (population density, residential mobility, percent on public welfare, sex, type of school, and religiosity). In fact, when the two structural level models analyzed the intercept only models containing the three community level predictors only, such as population density, percent of residents on public welfare and residential mobility, the between-Gus variations in alcohol and depressant uses models were all statistically significantly. More specifically, for example, the models containing population density, percent on public welfare, and residential mobility explained about 62 % and 15 % of the between-Gu variance in alcohol and depressant use respectively. However, once sex, type of school, and religiosity are entered into the structural models, the significance of the between variance at district-level were disappeared.

Social Learning, Social Bonding and Self-Control Variables in Multi-Level Analyses

The next step in the research was to Hypothesis 3 drawn from social learning, social bonding and self-control theories. The models testing Hypothesis 3 examine which of the

major variables taken from each the three theories have the most apparent mediating effects on the structural relationships. The findings fairly substantially support the conclusion that the social learning variables have the most consistent and strong mediating effects. First, social learning theory received strong support with regard to all three substances use (see Tables 4-6, 4-15, and 4-24). Among the social learning variables, differential peer association measures indicating association with friends using each of the substances (alcohol, depressant, and tobacco) were found to be the strongest predictors for all three substance models. This finding is consistent with a large body of previous study findings (Akers & Sellers, 2009; Pratt et al., 2000, 2006; Warr, 2002).

Interestingly, this study found that imitation was one of the consistently strong and significant explanatory variable for adolescents substance use in the three models. This is a little different from conclusions based on previous studies, including Akers et al. (1979)'s research, that the influence of imitation is relatively weaker than that of other social learning variables. This may be due to the modifications in the measure of imitation used here from Hwang's (2000) questionnaire compared to prior research. Here four items were used asking "Observing (other teenagers, parents and other adults, persons on TV, or advertisement) has influenced me to use . . ." These items measure more directly the influence on one's own behavior of observing others using substances than do previous measures which asked about observing "admired" models without asking to what extent that had an influence on one's own substance use. This study found that parental use of substances (which is intended as a measure of differential association but is used in some studies as a measure of imitation of parents) affected the use by their adolescent children but the influence differed by type of substances. Father's substance use increased adolescents' alcohol use but not depressant use, while mother's substance use increased adolescents' depressant use, but not alcohol use. In addition, both of measures were not significant in predicting adolescents' smoking. Such

findings are consistent with previous South Korean research that reported higher level of alcohol and tobacco use among adolescents who reported father's alcohol use or alcohol use problems. Moreover, studies contains narrative interview information reported that fathers sometimes support drinking or smoking by their male children while they do not encourage using alcohol and tobacco for their female children (Kang & Kim, 2005, National Youth Commission, 2005). In previous structural level models, it was found that girls are more likely to use depressant while boys are more likely to use alcohol and tobacco. That indicates mother's and father's substance use may have its most relevant influence on the same sex children. Additionally, these findings would suggest that there are some other theoretical interpretations, such as biological theories and general strain theories besides social learning theory, possibly applicable for interpreting these findings. Therefore, these findings suggest that more scrutiny is necessary for future studies. For example, future studies examining adolescents' substance or drug use should investigate the influence of father from mother separately by gender of their children and type of substance use and apply different criminological theories.

Overall, most of social learning variables are significantly associated with adolescents' substance use and these findings support Hypothesis 3 for the social learning theory. These findings are consistent not only with previous American studies but also other cross-cultural studies testing social learning theory (Akers, et al., 1979; Hwang & Akers, 2003).

The between-district variance in mean alcohol, depressant and tobacco use were not significant with eight social learning variables in the three models. That means none of the social learning models examining random variance components of the social learning variables are significant and, therefore, the relationships between these variables and individual alcohol, depressant and tobacco use do not significantly differ across Gus. In other words, while social learning variables mediate structural effects, Gus do not moderate the

effects of the social learning variables on individual behavior. Social learning variables explain most of between-district differences in substance use. That is because social learning models considerable reduced the between-Gus variances in substance uses from the random ANOVA models. These conclusions differ somewhat from those of Holland-Davis (2006)'s Holland-Davis (2006) found significant between-school variance from the multi-level social learning models in examining drug and substance use and reported that the some relationship between some social learning variables and for marijuana and overall illicit drug use significantly differ by schools and neighborhoods. She concludes that the finding of interaction effects of social learning variables with community characteristics shows moderating effects on the impact of social learning processes for some drug use behaviors. On the other hands, this current study found that the social learning process works in the same manner across social contexts in the three substances in Busan, South Korea. The conclusion here is more similar to that of the Krohn et al (1984)'s study.

According to the calculation of the reduction in between-Gus variance accounted for by the individual level social learning variables, social learning variables account for about 62% of the variance in student-level frequency of alcohol and depressant use. These within-district variations are similar to those found by Hwang' (2000) dissertation who reported that social learning variables explain around 60 % of the variation in alcohol and depressant use.

Next, the findings from the hierarchal models testing the mediating effects of social bonding and self-control variables lead to a conclusion of mixed support for Hypotheses 3 (see Table 4-7, Table 4-16, and Table 4-25). Belief and involvement were significant predictors for youths' alcohol use and attachment and involvement were significant predictors for tobacco use, but none of the social bonding variables were significantly associated with depressant use. The models revealed that greater attachment to friends and parents, spending more time for study, and higher level of approval for general law and

conforming belief reduced adolescents' engagement in alcohol and tobacco use. Although the directions of these significant relationships are in the direction expected by social bonding theory they were generally weak. Compared to the social learning variables, the social bonding variables explained very little (about 7%) variance in alcohol and depressant use.

With regard to between-Gus variances, influences of some social bonding variables differ by community context. The relationship between attachment and alcohol use were different across Gus. That may suggest that Gu had moderating effects on the relationship between social bonding and substance use but testing interactions or moderation effects for these and other variables are left to future research. Also, the relationship between involvement and tobacco use varied across Gus. This finding also suggests that Gus with high mean of log odds of tobacco use tend to have strong relationship between time spent studying and the odds of individual tobacco use. These findings imply that social bonding variables interact with community context and, therefore, operate differently depending on average levels of use for alcohol and tobacco use. That is, the impacts of attachment and involvement are different across districts, again suggesting that the influence of these variables may be moderated to some extent by the structure of the districts. More specifically, attachment is more important in predicting alcohol use in Gus that have high levels of alcohol use and less important in Gus with low levels of alcohol use. Also involvement is more important in Gus where students mean use of tobacco is high, while it is less important in Gus with low level of tobacco use. In addition, although the between-Gu variance in mean alcohol, depressant and tobacco use were significant for the social bonding models, the variance have not been reduced from the unconditional model, indicating social bonding variables mediate very little of the between-district variances in adolescents substance use.

Self-control, on the other hand, was significantly and negatively associated with adolescents' alcohol, depressant and tobacco use as predicted by the theory supporting

Hypothesis 3 (see Tables 4-8, 4-17, and 4-26). Individuals with lower self-control are more likely to be engaged in increased alcohol, depressant and tobacco use. However, the amount of variance explained by self-control for each substance was not great. The self-control models explained only about 9 % the variance of student-level alcohol and depressant use.

The three self-control models found that the between-district variance in each substance use are significant, indicating the influences of self-control variables on substance use vary significantly across Gus. However, the variance of the Gu-specific slopes for the relationship between self-control and each of the three substances were not significant. That is, the influence of self-control variable on substance use is the same across Gus regardless of the differences of level of substance use of each district. Also, as with the case of social bonding variables, the between-Gu variance in mean alcohol, depressant and tobacco use have not been reduced from the unconditional model, indicating those self-control variables explain very little of the between-Gu differences in adolescents substance use. Again, it is reasonable to conclude that self-control has limited mediation of the effects on substance use by differences across Gus.

The SSSL Model and Models with Social Structure and Social Psychological Variables

All the social structural variables used in the previous structural level models were included in each set of social learning, social bonding, and self-control models to test Hypothesis 4. Hypothesis 4 states that the relationships between substance use and all of the social structural variables will be partially and substantially mediated by social learning variables, social bonding variables, and self-control variables. More specifically, these models not only examined the SSSL theory but also expanded the SSSL to include other social psychological variables. Therefore, comparing social structure and social learning models with social structure and social bonding models and social structure and self-control

models allows conclusions about whether other social psychological variables better able to mediate social structural effects than social learning variables.

With regard to the SSSL models that used social structural variables and social learning variables, all three SSSL models for alcohol, depressant and tobacco use provide strong support for Hypothesis 4 (see Tables 4-9, 4-18, and 4-27). As the SSSL model predicted, social learning process substantially mediates the social structural influences on adolescents' alcohol, depressant and tobacco use. In all the three multilevel analyses models, social learning variables substantially reduced the magnitude of the coefficients of all structural predictors, which was significant in the structural level models, towards zero and made them insignificant. For the alcohol use model, the coefficients for population density, percent of residential mobility, type of school and religiosity were reduced and became insignificant with social learning variables in the model. Gender effects (sex) remained significant but the magnitude of the coefficient is reduced substantially. Therefore, gender effects are not fully mediated but they are consistent with SSSL theory substantially mediated by social learning variables. Moreover for the depressant and tobacco use models, the coefficients for all of the social structural variables including sex not only were substantially reduced but are rendered statistically insignificant. The three models generally revealed that social learning variables, as compared with social bonding and self-control variables, mediated the four social structural dimensions of differential social organization, theoretically defined variables, differential social location and differential location in primary and secondary groups successfully. Such conclusions are generally consistent with those reached by previous researchers testing the SSSL model with American samples (Holland-Davis, 2006; Lanza-Kaduce & Capeace, 2003; Lee et al., 2004). This supports the conclusion that the mediation of structural effects on adolescent deviancy by social learning variables is not confined to the United States where the previous research has been done. In fact, the mediation effects of the

social learning process found in this study among Korean adolescents were stronger than found in previous studies directly testing the SSSL theory in America (Holland-Davis, 2006; Lanza-Kaduce & Capeace, 2003; Lanza-Kaduce et al, 2006; Lee et al., 2004; Gibson et al., 2010; Verill, 2008). This flies in the face of the assumption that to the extent a theory is culture-bound it would apply more appropriately in the society in which it was developed. Some have concluded that gender effect are not mediated by social learning variables but rather interacts with or moderates the effects of social learning variables (Mears, Ploeger & Warr, 1998; Piquero, Gover, MacDonald & Piquero, 2005). That is, the learning process is conditioned by individuals' gender. It may be boys are more strongly affected by association with alcohol use friends and differential reinforcement of alcohol use than girls or vice-versa. Since the structural model for alcohol use revealed that boys are more likely to use alcohol than girls, the significant gender effects on drinking in the SSSL model may support the argument. Also, the depressant use model found that girls are more likely to use depressant than boys, the insignificant gender effects in the SSSL model for depressant may be linked to the gender effects that operate differently in the social learning process. But this argument is not supported by the finding of strong mediation effects of social learning variables on gender and little support for moderation of social learning by gender for the three substances among South Korean youths compared to American studies.

Furthermore, this study mostly found significant mediation effects rather than moderation effects compared to some previous studies (Holland-Davis, 2006; Verill, 2008). For example, Holland-Davis (2006) found some moderation effects of the social learning variables in model predicting students' alcohol use. She found that the effect of poverty on alcohol use increased and became significant which was not significant in the structural model. She suggests that this finding indicate that "poverty has a direct effect on alcohol use which is unmasked when the social learning variable are controlled" (p.106). Also, her study

found that in the SSSL model for alcohol use, age and gender remained significant, while the coefficient of socioeconomic status increased and became significant (it was not significant in the structural level only model) (see, p.106). Another direct test of the SSSL model by Verill (2008) also reported most of moderation effects rather than mediation effects of social learning variables on adolescents' involvement in delinquent behaviors.

Overall, this current study provides as strong or stronger evidence for the mediation proposition of the SSSL theory than any other previous studies. These findings generally confirmed the conclusion reached in previous American studies that “[social structural] factors are in some way impacting the normative and cultural climate in which the learning process operates rather than directly impacting behavior” (Holland-Davise, 2006, p.106) .

On the other hand, conclusions about the social structure and social bonding and self-control models with regard to Hypothesis 4(see Tables 4-11, 4-20, and 4-29 for social bonding variables, see Tables 4-10, 4-19, and 4-28 for self-control variables) are more limited. Indeed, one could conclude that these models are not supported. Rather some findings may suggest that there may be some moderation effects in addition to or rather than mediation effects . For the all three substance use models, most of structural variables remained significant and the magnitude of coefficients were either unchanged or increased by including social bonding variables, except for religiosity and residential mobility which became insignificant for alcohol use model and for tobacco use model, respectively. The coefficient for gender effects increased by including social bonding variables for alcohol and tobacco use models. Particularly, social bonding variables appear to neither mediate nor moderate any structural factors in the depressant use model. Notably, percent on public welfare which was not significant in the structural level model became significant when social bonding variables are controlled in this model. Moreover, some of variables which were not significant in the social bonding models became significant when social structural

variables were taken into account for in this model. For the alcohol use model, the magnitude of coefficient for belief slightly increased and it became significant. Also, belief and commitment became significant in the social structure and social bonding model for tobacco use. These findings support the conclusion that social bonding variables do not mediate social structural variables.

Hypothesis 4 regarding social structure and self-control also has little support. Most of the social structural variables remained significant after self-control is taken into account for the models. Only one or two social structural variables are mediated by self-control variable: religiosity for alcohol use model, population density for depressant use model, and population density and residential mobility for tobacco use model. Additionally, however, unlike the social structure and social bonding models, there is little suggestion in these findings that there are moderation effects in the social structure and self-control models. Additionally, the regression coefficients of these significant structural-level predictors have been slightly reduced in the models while self-control variables remained significant. Therefore, the social structure and self-control models have weak mediation effects compared to the social learning variables in the SSSL models. Overall, these social psychological variables taken from social bonding and self-control theory do not mediate, or do so weakly, the relationship between social structural influences and adolescents' substance use as the social learning variables do in this study. Moreover, these findings suggest that social bonding variables may be affected significantly by differences of district context.

The between-Gu variance in mean substance use of all three social structure and social bonding models and all three social structure and self-control models became insignificant. Also, these models substantially reduced the variance of between-Gu from the unconditional random ANOVA models. That means these models explained a lot of between Gu differences in each of substance use. However, these reductions in between district difference variations

may be due to the influence of the social structural variables that explained considerable portion of between Gus differences in substance use in structural level models.

Comparison Models of Social Learning, Social Bonding and Self-Control Variables

This final set of models are full comparison models containing all social structural variables as well as all social learning, social bonding and self-control variables. This model aims to examine Hypothesis 5 that predicts relatively stronger mediation impact of social learning variables on the social structural variables on each substance use compared to other social psychological variables. It is expected that social learning variables which have relatively stronger mediation effects would exert significant effects on each type of substance use with greater magnitude of regression coefficients than social bonding and self-control variables.

The findings from the three full comparison models for alcohol, depressant and tobacco use support Hypothesis 5: Social learning variables have greater mediation effects than the other two sets of social psychological variables. In the three comparison models, most of the structural predictors were substantially reduced toward zero and became insignificant. Sex was significant for the comparison models for alcohol and depressant use. In fact, the significance of sex variable in the depressant use comparison model is not consistent with the SSSL model for depressant use because the sex variable became insignificant after social learning variables mediated the gender effect. However, the significance of sex may be attributed to the moderation effects of social bonding variables included in the comparison models.

Furthermore, most social learning variables maintained significant effect coefficients found in the social learning only models and the SSSL models for the three substance use. The relationships between differential association with substance using friends, definitions favorable to substance use, differential reinforcement of each of substance use and having

more role models using substances were consistently significant predictors for all the three substance uses in the comparison model with all other variables entered. These social learning variables in the three comparison models remain significant and the magnitudes of coefficients were relatively unchanged from the social learning only models and the SSSL models. The effects of the social learning variables therefore are robust. Additionally, father's alcohol use remained significant in the full comparison model for alcohol use and mother's depressant use also remained significant in the full comparison model predicting depressant use. Encouraging parent's reactions to each substance use were significant for alcohol and depressant comparison models but not for tobacco use model. Also, consistent with previous models testing the SSSL models and the social learning only models, differential association with substance using friends was the strongest predictor among the all individual level predictors in all three substance use comparison models.

Overall, the effects of social learning variables in the comparison models mirrored the results of the social learning only models and the SSSL models for alcohol, depressant, and tobacco use. Such strong influences of social learning variables in the comparison models strongly support Hypothesis 5.

On the other hand, social psychological variables do not appear to mediate social structural variables as they have shown in the models with social structure and social psychological models. Moreover, the results for social bonding variables in the comparison models are more confusing. First, most of social bonding variables became insignificant in the models with social learning and self-control variables. For alcohol use comparison model, none of social bonding variables remained significant. For depressant and tobacco use comparison models, only one variable for each model, involvement for depressant use and commitment for tobacco use, were significant. Yet, the coefficients of these significant variables are substantially reduced from the social bonding only models and models with

social structural variables. These findings indicate that social bonding variables do not have mediation effects. Also, some of the measures became significant in the final model were not a significant predictor in the social bonding only model (commitment in the tobacco use model, and involvement in the depressant use model were not significant). As suggested above, these findings may suggest some moderation effects of social structural variables on social bonding variables in the comparison models. However, it is not clear because this study does not explicitly examine moderation effects of the social psychological theories on the relationship between social structural factors and individual substance use behaviors. Therefore, it is left to future research to consider more directly examining not only mediation effects but also moderation effects of these social psychological variables. In addition, the coefficients of commitment in tobacco use in the comparison model are substantially increased compared to the social bonding only model and the model with social structure variables for tobacco use. Moreover the direction of the effects of commitment in the comparison model for tobacco use was in the *opposite direction* from the theory prediction. As such, social bonding variables revealed somewhat inconsistent patterns in the series of multilevel models.

Overall, the conclusions are that there are relatively and substantially stronger mediation effects of the social learning variables on the relationships between social structural variables and substance use than self-control and social bonding variables.

Implications, Contributions, and Suggestions for Future Research

This study tested the main proposition of the SSSL theory by testing five Hypotheses. Overall, the study found strong support for the SSSL theory contentions. As hypothesized, this study found that South Korean youths' substance use was significantly different across districts. Most social structural variables representing the four social structural dimensions in the SSSL theory also have significant influences on adolescents' alcohol, depressant and

tobacco use. Importantly, these significant social structural influences were substantially mediated by social learning variables reflecting the major four concepts, differential association, definition, differential reinforcement and imitation. The mediation effects held for all the three substance uses and in comparison with other social psychological variables, such as social bonding and self-control variables.

Most interestingly, the mediation effects of social learning process found in this Korean study was stronger with regard to certain structural variables than has been found in previous American studies. That is, because most of these American studies reported not only mediation effects but also some moderation effects of social learning variables on several structural variables, or the other way around. That is, social structural variables conditions the way of social learning variables impacts individual behaviors. Particularly, studies noted considerable moderation effects of gender that interact with social learning variables (Lanza-Kaduce et al., 2006; Lee et al., 2004; Holland-Dvais, 2006; Verill, 2008). However, in fact, the direct gender effect on alcohol use was found in the SSSL model, yet not for depressant and tobacco use models. The gender effects, although substantially reduced, continued to have statistically significant influence on youths' alcohol use even after social learning variables were included. This is consistent with previous studies that found strong direct gender effects, which "may not mediate as much as it moderates" (Lee et al., 2004, p.30). Lanza-Kaduce et al (2006) found that gender effect were not as strongly mediated by social learning variables and concluded that "gender may interact with other variables in ways that social learning processes did not mediate" (p.138). According to Lanza-Kaduce et al., Akers' SSSL theory expects gender effects to be mediated like the effects of other social structural variables. However, their study found significant gender interaction effects with other social structural variable which does not fully support for the SSSL model. Therefore, they suggest that the SSSL hypotheses need to be advance to test "how gender orders social

relations and how it interacts with other social conditions” and to elucidate “theorizing gender” (p.139).

Similarly, Holland-Davis (2006) also found some evidence of moderation effects on social learning variables. In her multilevel analyses, she found that variations in social learning influence on individual drug and substance use were different depending on characteristics of the social structure across schools. She also found that some social structural variables, such as social status and gender were not mediated as much by social learning variables. On the basis of the findings, she interpreted it as “moderated mediation effects” rather than mediation effects only that are proposed in the SSSL theory (pp.110-111). Specifically, by citing Muller, Judd and Yzerbyt (2003)’s study, she explained the moderated mediation that “...moderated mediation...is responsible for ordering the effect of the treatment on the outcome depends on the values of a moderator variable...if the moderator is an individual difference variable, then it would mean that the mediating process that intervenes between the treatment and the outcome is different for people who differ on that individual difference. If the moderator is a contextual variable, then it would mean that the mediating process varies as a function of context.” (Holland-Dvais, 2006, p.111). That is, according to Holland-Davis (2006), social learning mediates social structure influences and, at the same time, social structure moderates the social learning influence on behaviors (p.110).

These are reasonable suggestions for future research to consider, but in the current study there was not much support for structural moderation of social learning but there was evidence for such moderation of social bonding and self-control variables that were not included in the earlier research. Also, there is a difference in findings in that for two of the three substances, depressant and tobacco, in this Korean study, gender effects were reduced to non-significance, and even for the alcohol use for which it remained statistically

significant, its initial effect was quite substantially reduced. According to South Korean research investigating adolescents' alcohol use, certain characteristics of social context, particularly family context, are significantly associated with the initiation and the frequency of adolescents' alcohol. Such as alcohol using fathers and adults around adolescents have positive impact on male adolescents' alcohol use, but not much for girls' use. Narrative studies found that boys frequently report that they are sometimes encouraged to drink with father or other adults. Also boys have more opportunity to drink alcohol when there is a family traditional service which originated from Confucian doctrine, "Jesa" which has become as a tradition since 1,500 A.C. in South Korea. "Jesa" is a type of spiritual service of a family to remember and honor their forefathers, such as great grandfather or grand fathers who are already passed away. This service is based on the belief that dead ancestors may protect and bless their offspring so that some families still practice Jesa at least several times a year. Jesa service is managed by men in the family only and, men are supposed to drink a glass of alcohol as one of the procedures of this Jesa, while women do not allowed to be a part of this Jesa service. Research also reported that some male adolescents are reported to drink alcohol after encouragement by fathers and other adults in their families. Needless to say, most of the cases, girls are not encouraged to drink alcohol. In addition to this Jesa case, male adolescents reported various occasions that parents or other adults allow them to drink small amount of alcohol but prohibit drinking by girls in their families. Therefore, the cultural normative social context encourages drinking by boys or, at least, do not consider it as problematic behaviors, but discourage drinking by girls is an example where cultural practices and traditions produce gender differences in drinking. This example fits well with the SSSL model because it is illustrates the way in which sociocultural contexts operate through social learning processes to affect individual behavior reflected in gender differences in rates of behavior. From a social learning perspective differences in gender rates of drinking

in this cultural context is produced by the operation of the social learning process in which differential reinforcement (encouragement from fathers and other adults), modeling (being in the company of admired adults who are drinking), and promotion of definitions favorable to drinking by boys but not for girls based on tradition of Jesa. The circumstances found in the South Korean context, therefore, are consistent with Akers' arguments in the SSSL model.

Taken together, the gender effects on the social learning process of substance use behaviors as well as the relationship between other social structural variables and social learning variables on various outcome behaviors may need further investigations in the future studies. The direct gender effects are substantially mediated by social learning variables in the SSSL models. Further, all social structural variables, including gender, were mediated substantially by social learning variables as Akers' predicted in the SSSL theory. However, it should be noted that other research has produced different findings. This may result from differences in the dependent variables, measures of independent variables, and other methodological differences. It may be that the model works better for less serious deviance, such as adolescent substance use and not as well with more serious criminal behavior, such as violence in which there are stronger gender and other structural effects. Moreover, this current study does not aim to test moderation effects of social structural variables on social learning variables as previous studies do (for example, Lanza-Kaduce et al., 2006 and Verill, 2008). No interaction terms were included in the models and moderation effects are only suggested not found by analyses in this dissertation. More research is needed to develop a larger body of findings to see well the SSSL model or variations on it supported by research on a range of deviant behavior and in different societal, social, and cultural contexts.

Comparison of Mediation Effects of Social Learning and Other Social Psychological Variables

The research in this dissertation is done in line with the suggestion by Lee et al (2004) that future studies need to examine not just the mediating effects of social learning variables but the mediating effects of other theoretical variables. This research follows the suggestion that research should evaluate SSSL models “that include, besides social learning variables, good measures of other potential mediating processual or micro-level variables. The most obvious of these would be social bonding, or other social psychological or personality variables”(p.31). In fact, some research by Akers and his colleagues conducted before the formulation of the SSSL model produced findings that in retrospect are relevant to testing the relative mediating effects of social learning compared to other potential mediating variables. They found that social learning variables had stronger mediating effects on the relationship between community context and adolescent substance use than did social bonding variables. Consistent with these findings, the present study also found that social learning variables demonstrate greater mediation effects on the relationship between social structural variables and adolescents’ substance use compared to social bonding. In addition, it found the same with regard to the mediating effects of self-control variables. Social bonding and self-control variables did not mediate social structural influences or did so only weakly. Consequently, the conclusion is that the SSSL model is supported both on its own and in comparison with how much social structural effects on the same set of dependent variables are mediated by variables from other theoretical models perspectives.

Furthermore, the analysis findings in this study suggest that the mediating effects of social bonding variables may be moderated to some extent by social structural variables. Therefore, Holland-Davis (2006)’ argument suggesting “parental monitoring may actually be conceptualized as a component of differential location in primary and secondary groups” may

be reasonable (p.112). Such findings have implications for future research which should address the issue of which social structural relationships are substantially mediated, which are not mediated, which variables are moderators and so forth in relation with not only to social learning variables but also other social psychological theoretical variables as well (p.139). In addition, future research should examine these issues in cross-cultural contexts in different societies.

The methodology and findings from this dissertation study, therefore contributes to and goes beyond the existing literature on the SSSL model and should provide some background and guidelines for this future research on and the development of the SSSL. The series of multi-level analysis models for three different dependent variables in this study addresses methodological issues that occur when uses cross-level data.

The current study significantly extended the testing and developing of the SSSL theory by comparing the mediation effects of social learning variables with social bonding and self-control variables on the same set of depended variables. In this way, the mediation effects of social learning variables were appropriately interpreted by comparing the mediation effects of other social psychological theory variables.

Most of all, this current study provides stronger evidence for the mediation proposition of the SSSL theory than previous studies. These findings do not eliminate the issues regarding development of the SSSL model to incorporate structural moderation of social learning processes as well as social learning mediation of structural effects. Yet, this current study found mediation effects of the social learning variables; even in the case of gender effects for which the issue of moderating effects have most often been raised, the social learning variables substantially mediated the effects of gender on all of the dependent variables.

Finally, this present study utilized a sample of South Korean adolescents to examine the generalizability of the SSSL model in cross-cultural context. As explained earlier, none of the previous studies has examined the SSSL model with a sample drawn from non-Western culture. The evidence supporting the SSSL theory in a sample of South Korean youths, therefore, is also supportive of the contention that the SSSL model is generalizable beyond American society. Consequently, this current study contributes significantly to the still small body of literature on adolescents' substance use in South Korea.

Limitations of the Current Research and Implications for Future Research

As shown, the methodology, findings, and conclusions of the present research provides implications for what future research should address. However, there are limitations of the present study that could be overcome in future research. One of the limitations is the small number of districts (15 GUs) at the macro-level. Because the secondary data utilized in the study were collected from only one city, it was not possible to include a larger number of macro-level units. In hierarchical models the optimal number of such units is 30 or more. The relevant issue of using less than 30 sites is that it may reduce the statistical power in multi-level analysis. In general, it is well known that the larger the variation in the treatment impact across sites, the more sample sites (level-2 sample) are needed to maximize power in examining the average effect of treatment (Mass & Hox, 2004). Also, the limited number of districts limited the number of available structural level variables in HLM and HGLM analysis models. In multi-level analysis, having one predictor per ten sample sites or individual samples is used as rule of thumb. That is, even the data used in this study include various types of social structural variables representing four social structural dimensions proposed in the SSSL theory, in the analysis models, only one structural variable per one or two of social structural dimensions was able to be included in the analysis models (i.e., population density for differential social organization, residents on public welfare and

residential mobility for theoretically defined variables). Therefore, it is important in future research to utilize a larger number of level-2 units to enable a larger number of measures of structural variables in testing the SSSL model.

Better measurements for the level-2 units than were available in the census data for this study should be sought. Although this study had measures of all four social structural components in the SSSL theory, the measures utilized in this study were not an ideal. For example, location in social groups is not well indicated by the measure of religiosity in this study and better indicators of religion affiliation and membership should be devised in future studies. Also, this study does not include a measure of collective efficacy which is one of structural measures representing theoretically defined social structural dimension in the SSSL theory. As Akers (1998) suggested the concept of collective efficacy is considered theoretically and empirically related with the SSSL model. In some studies, it has been found that collective efficacy has some significant influences on individuals' substance use, deviance and criminal behaviors in American studies (Gibson et al, 2010; Holland-Davis, 2006; Verill, 2009). Therefore, it would be beneficial for future research on SSSL to measure collective efficacy and examine.

In addition, other measures of population characteristics beyond population density need to be found. In this study, this structural factor did not show great differences between districts in Busan. The structural variables drawn from the South Korean census data do not explain a lot the variance in behaviors across districts. In addition to stronger measures of the structural independent variables, different dependent variables should be included in research. The dependent variables used this study represent rather minor type of deviant acts, alcohol, tobacco use and depressant use among adolescents. Future research should test structural and social psychological effects on various types of criminal and delinquent acts, including more serious types of offending. Future studies should consider collecting data on structural

variables in addition to census data. In particular theoretically defined structural conditions such as social disorganization might be better measured by interviewing or surveying residents in each neighborhood, district, communities, or perhaps nations (Sampson et al., 1997).

Additionally, it might be considerable that using smaller level of level-2 units such as smaller unit of neighborhood or community level and classroom for the future study. Partially, since the data used in this dissertation has been collected from students attending high schools, it might be able to examine if there are any classroom differences influencing students' substance use behavior instead of using larger geographical units of districts (Gus). Using this kind of smaller level-2 units would benefit the current research in a different way if it was possible. However, since this current data utilized secondary data and the original researcher does not have classroom identifier for the participants, it was not possible to use the smaller level of unit, such as classroom as level-2 unit in multilevel analyses.

This study compared the findings from South Korean youths to the previous studies used American samples, such as Holland-Davis (2006), Lanza-Kaduce et al (2006), and Lee et al. (2004) to examine the cross-cultural applicability of the SSSL theory. This attempt is very valuable, but the next step would be to conduct more direct comparisons by collecting data from multiple country sites with the same measures and instruments in order to test the validity and applicability of the SSSL theory. Those instruments should allow for testing effects of other social psychological variables beyond the social learning, social bonding, and self-control variables and theoretically defined structural variables beyond the social disorganization in this study. Ideally, future research should also include measures of strain, labeling, and personality factors as well as indicators of conflict, anomie, and patriarchy.

Finally, future research needs to pay more attention to additional ways of examining direct and indirect mediation effects of the social learning (and other) variables on the social

structural influences. For example, more direct investigation of mediation estimation is also applicable for multilevel modeling. Raudenbush and Sampson (1999) conducted HLM analysis to estimate indirect effects of structural level of factors (i.e., poverty) on perceived violence through perceived informal social control with data drawn from Chicago. In an attempt to address measurement error in hierarchical regression models, they adopted the approach that presented measurement error as a level within the hierarchical model. It makes it possible to examine if the social learning variables have more mediation effects or moderation effects on the relationship between social structural influences on individual behaviors more closely. Although there is only one study that has attempted this analysis (Raudenbush & Sampson, 1999), future research benefit greatly by utilizing this approach. Because such a rigorous analytic approach focuses on distinguishing mediation effects from moderation effects it may serve better, where it can be used, than the approach used here to confirm or suggest modification in the SSSL model.

APPENDIX
CORRELATION MATRIX FOR ALCOHOL USE SCALE RELATED EXOGENOUS
VARIABLES

Table A-1 through A-3 presents correlation matrixes for each set of exogenous variables run on the three difference substances, alcohol, depressant and tobacco. The three correlation matrixes reveal that there are no correlation coefficients exceeding more than 0.70 between exogenous variables and each dependent variable. These findings indicate that there are no mulitcolinearity issues in the data used for this study.

Table A-1. Correlation matrix for alcohol use related exogenous and dependent variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1)	1																			
(2)	.77*	1																		
(3)	.14*	.12*	1																	
(4)	.15*	.13*	.25*	1																
(5)	.31*	.30*	.08*	.12*	1															
(6)	.43*	.43*	.03	.12*	.37*	1														
(7)	.34*	.37*	.03	.10*	.23*	.37*	1													
(8)	.21*	.17*	.00	.16*	.19*	.26*	.22*	1												
(9)	.49*	.50*	.05	.08*	.18*	.33*	.28*	.06*	1											
(10)	-.13*	-.12*	.00	-.02	-.05	-.07*	-.07*	-.00	-.18*	1										
(11)	-.10*	-.07*	.04	-.04	-.06*	-.09*	.02	-.08*	-.11*	.18*	1									
(12)	-.09	-.90*	.03	.00	-.03	-.06*	-.02	-.03	-.11*	.28*	.20*	1								
(13)	-.24*	-.24*	-.01	-.02	-.08*	-.12*	-.10*	-.05	-.18*	.20*	.11*	.16*	1							
(14)	-.31*	-.28*	-.03	-.03	-.10*	-.20*	-.25*	-.09*	-.03*	.15*	.20*	.07*	.18*	1						
(15)	-.25*	-.27*	.00	.00	.05	-.08*	-.08*	-.05	-.19*	.11*	.08*	.14*	.47*	.16*	1					
(16)	.19*	.15*	.02	-.06*	.03	.05	.15*	-.00	.18*	-.01	.10*	.02	.07*	-.14*	-.03	1				
(17)	-.06*	-.04	-.13*	-.08*	-.03	-.03	.00	-.01	.01	.04	.06*	.03	.12*	.01	.06	.04	1			
(18)	.19*	.20*	-.01	-.02	.13	.13*	.10*	.09*	.14*	.08*	-.01	-.04	-.17*	-.12*	-.34*	.21*	.02	1		
(19)	.00	.01	.02	-.02	.04	.04	-.03	-.01	.04	-.05	-.01	-.05	.00	-.00	-.06	.09*	.02	-.18*	1	
(20)	.02	.05	-.02	-.02	-.04	-.04	.02	-.01	-.00	.02	-.02	.02	-.07*	-.05	-.17*	-.08*	-.01	.41*	-.45*	1

(1) Alcohol Use;(2) Peer association; (3) Father's use; (4) Mother's use; (5) Definition; (6) Reinforcement balance; (7) Parent's reaction;(8) Friend's reaction; (9) Imitation; (10) Attachment; (11) Belief; (12) Commitment; (13) Involvement; (14) Self-control; (15) Sex; (16) Type of school; (17) Religiosity; (18) Population density; (19) Percent of residents on public welfare; (20) Residential mobility

Sources: Hwang (2000), 1999 South Korean Census, 1999 Busan Yearly Statistics

Note: all of exogenous variables are standardized as Z-scores

*p< 0.5

Table A-2. Correlation matrix for depressant use related exogenous and dependent variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1)	1																			
(2)	.64*	1																		
(3)	.31*	.35*	1																	
(4)	.45*	.49*	.43*	1																
(5)	.45*	.41*	.22*	.31*	1															
(6)	.41*	.39*	.19*	.30*	.44*	1														
(7)	.30*	.28*	.15*	.20*	.39*	.44*	1													
(8)	.37*	.33*	.17*	.26*	.44*	.48*	.59*	1												
(9)	.12*	.09*	.07*	.08*	.12*	.14*	.00	.01	1											
(10)	-.00	-.01	-.03	-.04	-.10*	-.02	-.03	-.02	-.18*	1										
(11)	-.03	-.00	.03	.01	-.00	-.07*	-.05	-.08*	-.11*	.18*	1									
(12)	.00	.00	.04	.01	-.02	-.02	-.00	.01	-.11*	.28*	.20*	1								
(13)	.02	.01	-.07*	-.07*	.01	-.05	-.05	-.07*	-.18*	.20*	.11*	.16*	1							
(14)	-.06*	-.00	-.05	-.02	-.09*	-.04	-.00	.00	-.39*	.15*	.10*	.07*	.18*	1						
(15)	.00	-.00	-.05	-.04	.05	.03	.04	.02	-.19*	.11*	.08*	.14*	.47*	.16*	1					
(16)	-.22*	-.29*	-.04	-.13*	-.08*	-.15*	-.15*	-.18*	.18*	-.01	.10*	.02	.07*	-.14*	-.03	1				
(17)	.03	.05	.01	.04	.01	-.04	-.02	.02	.01	.04	.06*	.03	.12*	.01	.06	.04	1			
(18)	.01	-.00	.00	-.01	.01	.04	.01	-.01	.14*	.08*	-.01	-.04	-.17*	-.12*	-.34*	.21*	.02	1		
(19)	-.03	-.03	.01	-.01	-.04	-.06*	-.00	-.00	.04	-.05	-.01	-.05	.00	-.00	-.06	.09*	.02	-.18*	1	
(20)	.10*	.12*	-.05	.05	.04	.04	.02	.04	-.00	.02	-.02	.02	-.07*	-.05	-.17*	-.08*	-.01	.41*	-.45*	1

(1) Depressant Use; (2) Peer association; (3) Father's use; (4) Mother's use; (5) Definition; (6) Reinforcement balance; (7) Parent's reaction; (8) Friend's reaction; (9) Imitation; (10) Attachment; (11) Belief; (12) Commitment; (13) Involvement; (14) Self-control; (15) Sex; (16) Type of school; (17) Religiosity; (18) Population density; (19) Percent of residents on public welfare; (20) Residential mobility

Sources: Hwang (2000), 1999 South Korean Census, 1999 Busan Yearly Statistics

Note: all of exogenous variables are standardized as Z-scores

*p<0.5

Table A-3. Correlation matrix for tobacco use related exogenous and dependent variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1)	1																			
(2)	.71*	1																		
(3)	.11*	.11*	1																	
(4)	.09*	.13*	.01	1																
(5)	.44*	.46*	.11*	.08*	1															
(6)	.49*	.52*	.06*	.07*	.45*	1														
(7)	.28*	.32*	.00	.11*	.16*	.21*	1													
(8)	.37*	.33*	.17*	.26*	.44*	.48*	.59*	1												
(9)	.50*	.56*	.04	.13*	.40*	.45*	.00	.17*	1											
(10)	-.16*	-.15*	-.07*	-.08*	-.15*	-.16*	-.03	-.08	-.18*	1										
(11)	-.06*	-.03	.00	-.01	-.04	-.12*	-.05	-.05	-.11*	.18*	1									
(12)	-.03	-.09*	-.00	-.01	-.07*	-.09*	-.00	-.04	-.11*	.28*	.20*	1								
(13)	-.24*	-.28*	-.13*	-.10*	.11*	-.21*	-.05	-.16*	-.18*	.20*	.11*	.16*	1							
(14)	-.28*	-.31*	-.06*	-.11*	-.21*	-.30*	-.00	-.13*	-.39*	.15*	.10*	.07*	.18*	1						
(15)	-.26*	-.34*	-.09*	-.11*	-.08*	-.23*	.04	-.19*	-.19*	.11*	.08*	.14*	.47*	.16*	1					
(16)	.29*	-.31*	-.02	.01	.13*	.18*	-.15*	.21*	.18*	-.01	.10*	.02	.07*	-.14*	-.03	1				
(17)	-.00	-.01	-.11*	.04	.02	-.06	-.02	.00	.01	.04	.06*	.03	.12*	.01	.06	.04	1			
(18)	.16*	.21*	-.02	.03	.09*	.17*	.01	.11*	.14*	.08*	-.01	-.04	-.17*	-.12*	-.34*	.21*	.02	1		
(19)	.06*	.03	-.00	.02	.03	-.00	-.00	.06*	.04	-.05	-.01	-.05	.00	-.00	-.06	.09*	.02	-.18*	1	
(20)	-.00	.04	.05	.01	.00	-.01	.02	.02	-.00	.02	-.02	.02	-.07*	-.05	-.17*	-.08*	-.01	.41*	-.45*	1

(1) Tobacco Use;(2) Peer association; (3) Father's use; (4) Mother's use; (5) Definition; (6) Reinforcement balance; (7) Parent's reaction;(8) Friend's reaction; (9) Imitation; (10) Attachment; (11) Belief; (12) Commitment; (13) Involvement; (14) Self-control; (15) Sex; (16) Type of school; (17) Religiosity; (18) Population density; (19) Percent of residents on public welfare; (20) Residential mobility

Sources: Hwang (2000), 1999 South Korean Census, 1999 Busan Yearly Statistics

*p< 0.5

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BIOGRAPHICAL SKETCH

Eunyoung Kim is originally from Seoul, South Korea, where she was born and raised until the 8th grade of school. Later, she and her family moved to Kyoung-Ju city, and she graduated from Kyoung-Ju Girl's High school in 1992. She earned her B.S. in Psychology from DaeGu University in Deagu, South Korea in 1996. After graduation, Eunyoung worked for Lufthansa German Airline Company as a Korean interpreter. Unfortunately, she had a serious injury in an airplane accident which fractured backbone in 1998. Because of that accident, she would be disabled and was not expected to be able ever to walk again. However, thanks to the amazing grace of God, she completely recovered after a couple of years of hospitalization just like a miracle. Eunyoung, then, began to have a vision of helping and supporting marginalized people in society and spent a couple of years in service for several faith-based non-governmental organizations in South Korea. In 2003, Eunyoung entered graduate school at the University of Maryland at College Park to obtain the M.A. degree in Criminology and Criminal justice. After graduation from the University of Maryland with the M.A, she worked for the Police Foundation, a renowned research institution in Washington D.C. from 2006 to 2007. She also served a non-government organization assisting North Korean refugees in the United States as well. Eunyoung continued her graduate education at the University of Florida in Sociology and Criminology and Law to earn her Ph.D. in Criminology. With invaluable support from Dr. Akers, my mentor and my adviser, Eunyoung was able to work effectively.

Upon completion of her Ph.D. program in 2010, Eunyoung will have a job with the Korean Institute of Criminology in Seoul, South Korea, where her great husband, Minwoo, and family currently live.