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Keywords Self-control · Social learning theory · Problem behavior theory · Drug use · Hallucinogens

A reported 1.1 million individuals age 12 or older in the United States reported to using hallucinogens in the prior month (NSDUH, 2013). Hallucinogens represent a body of

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drugs that distort a person's perception of reality. Commonly known hallucinogens include peyote, psilocybin, PCP, and LSD. In the research on drug use, LSD is often separated from other hallucinogens and we follow this line of inquiry. In addition, psilocybin has surpassed LSD as the most commonly used hallucinogen. As a whole, the use of hallucinogens has decreased in the past 10 years, down from a peak of 6.8 % of the population in 2001 to 4.9 % of the population in 2012. The use of hallucinogens by adolescents is lower compared to adult population, whereas only 0.7 % of the population age 12 to 17 years old used hallucinogens (NSDUH, 2013). Despite the low usage among adolescents, drug use among adolescents remains a concern and little research exists that examines the use of hallucinogens.

A significant body of literature examines the relationship between theoretical predictors and adolescent drug use. Evidence has been shown to support the use of social bond theory (Rebellon & Van Gundy, 2006), social learning theory (Gallupe & Bouchard, 2013), and problem-behavior theory (Donovan, 1996) all explain adolescent drug use. None of these theories; however, examine adolescent hallucinogen use. The research tends to group hallucinogens with other hard drugs in a composite measure, but it is important to understand if the theories can explain each type of drug use to be considered a general theory. Further, the research into hard drug use has not applied problem-behavior theory in conjunction with other criminological theory.

The present study seeks to fill in the gap in the drug use literature by examining the theoretical predictors of adolescent hallucinogen use. The data for this study came from the Monitoring the Future (MTF) 2011 survey form 2. The study contributes to the literature in two ways. First, the study applies a multi-theoretical framework (i.e., self-control, social learning theory, and problem behavior theory) to explain adolescent use of hallucinogens. Second, the study tests problem-behavior theory with social learning theory, and social bond theory to account for alternative explanations. This is the first study, to the researcher's knowledge, that applies these four theories to an examination of drug use. To accomplish these goals, the present study uses a national survey to examine the relationship between adolescent behavior and hallucinogen use. The study first provides a review of self-control theory, social learning theory, and problem behavior theory. Next, there is a discussion on the sample, measures, and analysis plan for this study. Last, the study presents the findings and provides a discussion.

Literature Review

Self-Control Theory

Gottfredson and Hirschi (1990) published their version of self-control. They argue that rational individuals are likely to decide to perform criminal or deviant acts when an opportunity presents itself because they cannot foresee the long-term consequences of their actions. The curtailing of the foresight of the consequences of actions comes from an individual's level of self-control. Gottfredson and Hirschi (1990) argue that individuals that have low levels of self-control are may be characterized as impulsive, insensitive, risk taking, and attracted to easy, simple, and physical tasks. These

characteristics have a direct impact on the acknowledgement of the consequences of criminal or deviant behavior. Gottfredson and Hirschi (1990) argue:

The dimensions [characteristics] of self-control are, in our view, factors affecting calculation of the consequences on one's acts. The impulsive or shortsighted person fails to consider the negative or painful consequences of his acts, the insensitive person has fewer negative consequences to consider; the less intelligent person also has fewer negative consequences to consider (has less to lose).

In Gottfredson and Hirschi's (1990) view, individuals with low self-control are the products of poor or ineffective parenting practices. They argue that parents are to perform four tasks consistently and early in a child's age. First, parents are to form an emotional bond with their child. Second, parents are to monitor their child's behavior to gather behavioral information. Third, parents are to analyze the behavioral information to determine if the behavior is criminal, delinquent, or deviant. In this analysis, if the parents determine that the child has been criminal, delinquent, or deviant, the parents are to apply non-corporal punishment. These activities are supposed to occur consistently before the child is eight to 10 years old. After the child is 8 to 10 years old, their level of self-control remains relatively stable over time.

To date, a number of researchers have examined Gottfredson and Hirschi's (1990) theory. The majority of the research has emphasized the link between low self-control and crime or deviance, with this research supporting the link (Gottfredson, 2006; Pratt & Cullen, 2000). Other researchers have used Gottfredson and Hirschi's (1990) theory to show the link between low self-control and drug use is present. The drugs that have been used are as follows: cigarette smoking (Arneklev, Grasmick, Tittle, & Bursik, 1993), drinking alcohol (Arneklev et al., 1993; Gibson, Schreck, & Miller, 2004), binge drinking (Higgins & Tewksbury, 2007), drug use (Wood et al., 1993), and marijuana use (Jones, Lynam & Piquero, 2011). The issue for this paper is not whether low self-control has a link with these drugs, but whether low self-control has a link with hallucinogen use. Based on the literature, we hypothesize that low self-control has a link with hallucinogen use.

While our review of the literature suggests that low self-control has a link with hallucinogen use, it is important to consider that Hirschi (2004) revised self-control theory. He revises self-control theory because he believed that too much emphasis has been placed on low self-control. Hirschi (2004) acknowledges that the emphasis comes from the presentation of the characteristics of low self-control. The characteristics provide some indication about one part of self-control, and the field has focused only on the low portion of self-control. In his estimation, self-control theory has been validated by previous research, but more work is necessary to move the research focus away from low self-control toward higher levels of self-control. Hirschi (2004) argues the focus on high self-control brings the research on theory in line with the premise of control theories, which is to understand why people do not commit crime and deviance. Further, this focus provides a clearer method of measurement. Hirschi (2004) argues that individuals with higher levels of self-control are able to see the consequences (i.e., any consequences) of their actions. Those with higher levels of self-control are able to form strong and constructive bonds. Gottfredson (2006) argues that the future of self-control theory is a merger with social bonding theory.

To date, some research has examined the link between higher levels of self-control and criminal and deviant behavior. Hirschi (2004) using a single index of social bonds and an attitudinal measure of self-control shows that both measures are capable of explaining juvenile delinquency. Piquero and Bouffard (2007) using self-generated measures of consequences, social bonds, and an attitudinal measure of self-control show that all three measures are able to explain crime and deviance among college students. Higgins, Wolfe, and Marcum (2008) using self-generated measures of consequences, social bonds, and the Grasmick et al. (1993), they show that all three measures have a link with digital piracy. Using measures of social bonds and a modified version of the Grasmick et al. scale, Morris, Gerber, and Menard (2011) show all three measures of self-control have a link with delinquency. Jones, Lynam and Piquero (2011) show bonding measures have a link with substance use. To date no study has shown whether the revised version of self-control has a link with hallucinogen use. While we understand that a number of studies have shown a link with social bonds and drug use (non-exhaustively, Durkin, Wolfe, & Clark, 1999; Ford, 2006; Martino, Collins, Ellickson, Schell & McCaffrey, 2006; Rebellon & Van Gundy, 2006; Whaley, Hayes-Smith & Hayes-Smith, 2010), but no study has used them as a measure of the revised version of self-control theory. Therefore, we hypothesize that higher levels of self-control through social bonds will have a negative effect on hallucinogen use.

Social Learning Theory

Akers (1985, 1998) defines social learning theory as a theoretical explanation that states that criminal or deviant behavior is a learned behavior just like any other type of behavior. Common measures used when measuring social learning theory, such as associating with deviant peers and sharing similar attitudes on behavior, are seen throughout the drug-use literature. The likelihood of a person taking part in criminal or deviant behavior is based on the amount of time spent learning either pro-social or criminal behavior as deemed by society.

Akers (1985, 1998) built on the works of Bandura (1986), Skinner (1953) and Sutherland (1947) to create social learning theory that is made up four concepts. First, differential association is defined as a person's belief in participating or acknowledging the use of criminal behavior is related to the amount of exposure to criminal behavior through one's peer group. If an adolescent has friends or family who approve of using hallucinogens, it can affect the likelihood of adolescent using hallucinogens. Second is definitions that are the belief in the use of criminal behavior as good or bad by the individual. An example of would this would be an adolescent who believes using hallucinogens is acceptable behavior will then be more likely to use hallucinogens. Third is imitation that is defined as where the person models their criminal behavior based on others around them. An adolescent who has friends who use hallucinogens is then more likely to use hallucinogens because of the close friends in their social environment approve of the behavior. Fourth is differential reinforcement that is the anticipated reward or punishment the individual intends to take place from committing criminal or deviant behavior. How the behavior makes an individual feel causes the behavior to either be a negative or positive reinforcement. The adolescent who uses hallucinogens and likes the feeling that it gives them is more likely to keep using hallucinogens because they want to keep having this same feeling.

Evidence has been shown to support the use of social learning theory to explain adolescent drug use (Durkin, Wolfe, & Clark, 2005; Gallupe & Boucharde, 2013; Lee, Akers, & Borg, 2004; Mercken, Steglich, Knibbe, & de Vries, 2012; Miller, Jennings, Alvarez-Rivera, & Miller, 2008). Gallupe and Buchard (2013) study showed that an adolescent's peer group has the biggest impact on whether or not an adolescent will binge drink. Pratt et al. (2010) conducted a meta-analysis on social learning theory and found that differential association ($r=0.23$) and definitions ($r=0.22$) were the best predictors of social learning theory to explain crime and deviance. We hypothesize that differential association will have a link with hallucinogen use.

Problem Behavior Theory

According to Jessor and Jessor (1977), problem behavior theory is a psychological perspective that views a person's behavior as learned behavior to help the person achieve a goal. The way that a person participates in a problem behavior is based on personality, perceived environment, and behaviors. The theoretical explanation of problem behavior theory is to see what factors control behavior and what causes a person to take part in problematic behavior.

Problem behavior theory has been used to explain the behavior of adolescents transitioning into young adults. Problem behavior theory is made up of three major systems. First, is the perceived-environment system that is defined as the level of closeness a person has with problem behavior. An adolescent who has friends who use hallucinogens increases the likelihood of the adolescent also displaying this behavior. Second, the personality system is made up of a person's values, beliefs, and attitudes about acceptable behavior that is based on the individual's experiences. The final system is the behavior system that is made up of both problem behaviors and conventional behaviors. Problem behaviors are behaviors that are viewed as risk taking, deviant, delinquent, or criminal acts. What happens then is when a person is involved in just one problem behavior it increases the chances that the person will become involved in other problem behaviors as well. Conventional behaviors are behaviors that society has viewed as being socially acceptable.

Evidence has been shown to support the use of problem behavior theory to explain adolescent drug use (Donovan, 1996; Donovan & Molina, 2011; Farrell, Danish & Howard, 1992; Jessor, 1987; Jessor, Van Den Bos, Vanderryn, Costa & Turbin, 1995; Lombe Yu, Nebbitt & Earl, 2011). Farrell et al. (1992) and Donovan (1996) found that an adolescent's behavior system could explain adolescent marijuana use. The studies found that marijuana use was related to having lower grades, not attending religious services and participating more often in delinquent behavior (Farrell et al., 1992; Donovan 1996). Donovan and Molina (2011) showed that adolescent binge drinking could be explained using the perceived-environment system. What this study showed was that having friends who approve of binge drinking and having parents who do not disapprove of adolescent binge drinking will increase the likelihood of adolescent binge drinking (Donovan & Molina, 2011). What these results show is that problem behavior theory can be used to explain adolescent use of hallucinogens.

The Present Study

The purpose of the present study is to provide an understanding of the theoretical links that may explain adolescent use of hallucinogens. To the researchers knowledge no one has applied self-control theory, social learning theory, and problem behavior to explain adolescent use of hallucinogens. Using Monitoring the Future (2011) data, this paper can be seen as contributing to these literatures. Further, this study contributes to the hallucinogens literature. The results of the study may provide a better understanding of the behavior, which in turn can lead to policy implications for reducing the instances of adolescent hallucinogen use.

Methods

Sample and Procedures

The data for this study came from the Monitoring the Future (MTF) 2011 survey form 2. In general, the MTF is designed to explore the lives of contemporary American youth. To capture the data, 420 public and private high and middle schools were selected to provide an accurate representative cross-section of students in the United States. In groups within classrooms, the surveys were administered during a normal class period. Particular attention is given to their values, behaviors, and lifestyles. The 2011 MTF survey was disaggregated into six questionnaire versions (forms), and this does not include the core survey. In this study, form 2 is selected because it contains the most fruitful theoretical measures for this study. The total sample size for this study is 2,465. A complete description of these data may be found in Johnston, O'Malley, Bachman, and Schulenberg (2011).

Measures

Hallucinogens Use

The measure was whether the participant ever used hallucinogens in the past year. The hallucinogens in this measure were: Mescaline, Peyote, "Shrooms", or Psilocybin, or PCP. The participants marked their responses using a dichotomous measure: (0) no and (1) yes.

Self-Control Theory

Low Self-Control. In the present study, we used two items as proxy measures of low self-control: "I get a kick out of doing dangerous things" and "I like to take some risks". This measurement is consistent with the measurement of the risk-taking portion of the Grasmick et al. (1993) scale. The participants marked their responses to these items using a 5-point Likert-type scale that was anchored by (1) "disagree" and (5) "agree". Higher scores on the measure indicated more non-social reinforcement. The correlation ($r=0.82$) between the two items was high, suggesting that they can be combined into a single index.

Homework. To address our hypothesis that social bonding will reduce instances in hallucinogens use, we use two measures in the present study. The first measure was,

“about how many hours do you spend in an average week on all of your homework including both in school and out of school?” This item addressed Hirschi’s (1969) ideas of school commitment. Others used this measure in their studies of drug use (Higgins et al., 2009). The participants marked their responses using a 7-point scale that was anchored by (1) “none” and (7) “25+ hours”. Higher scores on the measure indicated more hours spent on homework (i.e., social bonding).

Religiosity. The second measure was a religiosity measure. Consistent with bonding theory, the more religiosity that an individual has the stronger the belief in religious views; thus, the less likely the individual is to participate in hallucinogens use (Hirschi, 1969). To capture religiosity, two items were used. The first item was “how often do you attend religious services?,” and the participants marked their responses using a 4-point scale (1) “never” to (4) “1/week or more”. Higher scores on the measure indicated more attendance to religious services. The second item was “how important is religion in your life?,” and the participants marked their responses using a 4-point scale (1) “not important” to (4) “very important”. Higher scores on the item indicated the perception that the individual believes that religion is important in their lives. The two items were combined into a single index once it was discovered that their correlation was high ($r=0.63$). Overall, higher scores on the index indicated more religiosity.

Social Learning Theory

Differential Association. One of the purposes of the present study was to examine the link between social learning theory and hallucinogens use (i.e., testing Akers (1998) social learning theory). Differential association has been shown to have the strongest link of all of the social learning measures to behavior. Therefore, the first measure used three items to capture the participants’ perceptions of the number of friends that use soft drugs (i.e., hallucinogens and alcohol use). The participants marked their responses using a 5-point Likert-type scale that was anchored by (1) “none” and (5) “all”. The internal consistency was acceptable (Cronbach’s $\alpha=0.82$).

The second measure used ten items to capture the participants’ perceptions of the number of friends that use hard drugs (i.e., LSD, other hallucinogens, amphetamines, sedatives, tranquilizers, hallucinogens, heroin, pain relievers, inhalants, and crack). The participants marked their responses using a 5-point Likert-type scale that was anchored by (1) “none” and (5) “all”. The internal consistency of the scale was acceptable (Cronbach’s $\alpha = 0.93$).

We recognize that a current trend in criminology is the use of actual peer behavior when studying crime and deviance (Boman, Stogner, Miller, Griffin & Krohn, 2012). We concur with Akers (1998) that perceptual measures will have a stronger impact than actual measures of peer deviance, and the perceptual measures will still reveal peer influence. Young and Weerman (2013) using social network data show that this is the case. Thus, we use perceptual measures of deviant peer association.

Problem Behavior Theory

Polydrug use. Consistent with the Jessor and Jessor (1977) problem behavior theory, drug users will use more than one type of drug. In other words, polydrug use may have importance for understanding hallucinogens use in the past year. The polydrug use

measure asked the participants' to address the following stem: "have you ever used [insert drug] in the past year?". The drugs that were inserted for this study were: hallucinogens, LSD, hallucinogens, methamphetamine, heroin, inhalant, and PCP. The participants marked their responses the seven items using binary answer choices (0) "no" to (1) "yes". The additive measure ranged from 0 to 7, and higher scores indicated use of more drugs in the past year. The measure had a KR-20 of 0.72 indicating proper levels of internal consistency.

Control Measures

Several control measures were used in this study. The first control measure was age, and it was captured as below 18 years old (0) and above 18 years old (1). The second control measure as biological sex-(0) female and (1) male. The third measure was race-(0) white and (1) non-white. The fourth measure was grade point average (GPA)-(0) less than 3.0 and (1) greater than 3.0. The fifth control measure was urban-(0) non-metropolitan statistical area and (1) metropolitan statistical area.

Analysis Plan

The purpose of the present study is to determine which theoretical premise provides the better understanding of hallucinogens use. First, individuals that socially learn that hallucinogens are appropriate are likely to do so. Second, individuals that experience depression are likely to use use hallucinogens. Third, individuals that have worn or broken bonds are likely to use used hallucinogens.

The analysis of these hypotheses takes place in a series of steps. The first step is a presentation of the descriptive statistics. The second step is a presentation of logistic regression. Binary logistic regression is used in this study because the dependent measure-hallucinogens use in the past year-is dichotomous (Pampel, 2000). Multicollinearity may be an issue in binary logistic regression. Following Menard (2002), the tolerance measure is used to examine the extent of multicollinearity. Typically, tolerance levels that are closer to 0.20 indicate multicollinearity is a problem (Freund, Wilson & Sa, 2006).

Results

Table 1 presents the descriptive statistics. The descriptive statistics showed that 4 % of the sample used hallucinogens in the past year. The low self-control measure had a mean of 6.53. The social bonding measures, as measures of revised self-control, religion and time spent on homework had means of 5.05 and 1.31. For the social learning measures, peer association hard drug use had a mean of 2.88 and peer association soft drug use had a mean of 5.31. The problem behavior theory measure-polydrug use-had a mean of 0.50. For the control measures, over half (i.e., 56 %) of the sample was over 18 years old, 52 % of the sample was male, 31 % of the sample was non-white, 72 % of the sample had a GPA over 3.0, and 80 % of the sample lived in an urban area.

Table 1 Descriptive statistics

Measures	Mean	Standard deviation	Minimum	Maximum
Hallucinogens use 1 year	0.04	–	0.00	1.00
Low self-control	6.53	2.25	2.00	10.00
Religion	5.05	1.99	2.00	8.00
Homework	1.31	0.92	0.00	3.00
Peer hard drug use	2.88	4.85	0.00	40.00
Peer soft drug use	5.31	3.23	0.00	12.00
Polydrug Use	0.50	0.81	0.00	7.00
Age	0.56	–	0.00	1.00
Sex	0.52	–	0.00	1.00
Race	0.31	–	0.00	1.00
GPA	0.72	–	0.00	1.00
Urban	0.80	–	0.00	1.00

Table 2 presents the logistic regression results for Hallucinogen use in the past year. The results show that three measures are significant. The results confirm our expectation that low self-control has a link with hallucinogen use ($b=0.35$, $\text{Exp}(b)=1.70$ or 70 % increase). Our expectation that social learning theory will be fruitful in understanding hallucinogen use has been supported. Peer association for soft drug use increases hallucinogen use increases ($b=0.20$, $\text{Exp}(b)=1.22$ or 22 % increase). Finally, our expectation that polydrug use increases, the likelihood of hallucinogen increases

Table 2 Logistic regression analysis for hallucinogens use in 1 year

Measure	b	S. E.	Exp(b)	Tolerance
Low self-control	0.35**	0.13	1.70	0.86
Religion	-0.05	0.16	0.96	0.88
Homework	0.23	0.26	1.26	0.94
Peer hard drug use	-0.01	0.05	0.99	0.74
Peer soft drug use	0.20*	0.11	1.22	0.67
Polydrug use	2.82**	0.41	16.67	0.74
Age	1.03	0.58	2.80	0.96
Sex	0.22	0.52	1.24	0.95
Race	0.37	0.69	1.44	0.90
GPA	-0.21	0.54	0.81	0.92
Urban	-0.24	0.60	0.79	0.96

Model Chi-Square: 155.86**

-2 log likelihood: 124.68

Cox & Snell R-Square: 0.13

Nagelkerke R-Square: 0.59

* $p < 0.05$, ** $p < 0.01$

($b=2.82$, $\text{Exp}(b)=16.67$ or 1,567 % increase) has been supported providing support for problem behavior theory.

Discussion

The results of this study indicate continued support for criminological theories used in the past to explain hallucinogen use. First, our results add to the self-control literature showing that individuals with low self-control are more likely to use hallucinogens. This result is consistent with previous drug research (Arneklev et al., 1993; Gibson et al., 2004; Higgins & Tewksbury, 2007; Jones, Lynam, & Piquero, 2011; Wood et al., 1993). The results suggest that those that are not able to foresee the long term consequences of their behavior are more likely to use hallucinogens.

Our second expectation that bond measures of self-control would have a link with hallucinogens did not come to fruition. This does not follow Jones et al. (2011) who did find this link. It could be that the measurement that we used in the study did not allow for a full expansion of the types of bonds that could have a link with hallucinogen use. We refrain from making judgment on the revised theory because we believe that additional research is necessary in this area to clarify our results.

Our third expectation was supported, and the results indicated that the hallucinogen use by adolescents is a result of peer association. Juveniles in the sample were more likely to use this particular drug if it was supported by their peers. In other words, having peers who also used the drug, provided the drug, and/or encouraged the use of it had increased the likelihood a juvenile respondent would also use the drug for recreational use. While no studies to our knowledge have specifically examined this theory in regard to hallucinogen use, other theories have demonstrated social learning theory as an accurate predictor of drug use in general (Durkin et al., 2005; Gallupe & Bouchard, 2013; Lee et al., 2004; Mercken et al., 2012; Miller et al., 2008).

The results also indicated support for problem behavior theory. Past research has shown that problem behavior theory has demonstrated that risk factors are useful for explaining individual's involvement in drug use as risky behavior (Donovan, 1996; Donovan & Molina, 2011; Farrell et al., 1992; Jessor, 1987; Jessor, Van Den Bos, Vanderryn, Costa, & Turbin, 1995; Lombe et al., 2011). The findings of the present study demonstrated that polydrug use, a risk factor for juveniles, was a significant predictor of hallucinogen use. We can reasonably assume that juveniles who have experimented with different types of drugs are more likely to also use other drugs for reasons such as the intention to get a stronger high, the support and pressure from other friends, as well as the courage achieved by successful use of other drugs by oneself or another friend. Much like the findings supporting social learning theory, peer participation in any behavior is a catalyst for the choice of an individual to also participate.

The results for this study are interesting, but they also have to be consumed within their limits. First, our measure of low self-control is not a complete measure of self-control. In other words, our measure does not take into account all of the characteristics of low self-control. Second, our measure of the revised version of self-control does not take into account all of the other bonds. Third, our measure of social learning theory could be expanded. We realize that one measure of social learning theory does not completely account for all of the social learning process, and they need to be taken into

account as well in future research. Fourth, our data, while nationally representative, are cross-sectional restricting our ability to make causal inferences.

Despite these limits, these findings not only provide continued support for specific criminological theories in regard to substance use, but contribute to a lack in the literature that examines hallucinogen use by juveniles. As this study uses a nationally representative sample of juveniles, we can conclude that these findings can be applied nationwide and stress the implementation of drug use education for all adolescents. Hallucinogens are considered “hard drugs” and therefore can cause severe health problems or death. Furthermore, as peer behaviors have such an integral influence on their behaviors, these programs should not only focus on the dangers of drug usage in regard to health and death, but also the criminal sanctions associated with its use. The consequences of drug use may be downplayed by adolescent peers, while in actuality the repercussions of drug usage and drug possession are serious.

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