

age, social learning, and social bonding in adolescent substance use

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We propose that social learning and social bonding theories are capable of accounting for the well-known relationship of crime and delinquency to age. Models incorporating age and variables derived from these two theories are tested with data on adolescent substance use among a large sample of Midwest adolescents in Grades 7 through 12. Older adolescents consume more marijuana than younger adolescents, and the age–use curve is matched by the relationship between age and social learning variables. Differences in use by age are also correlated with differences in strength of social bonds by age, but to a lesser extent. The findings support the hypothesis that age variations in marijuana use are mediated by age-related variations in social learning; there is also support, although somewhat weaker, for the similar hypothesis that social bonding variables mediate the age–marijuana use relationship during adolescence.

Age differences in delinquency, crime, and deviance are well known, and inclusion of an age variable (along with gender, class, and other sociodemographic variables) is almost routine in research on crime and delinquency. Although most of this research treats age and these other variables as simply control or nontheoretical variables, they have theoretical connotations as indicators of differences in social roles, social characteristics, or sociocultural influences on behavior. The theoretical relevance of the age factor in crime and deviance has been given added significance and renewed attention by the work of Travis

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Hirschi and Michael Gottfredson (1983; Gottfredson and Hirschi, 1990). They have challenged existing theory to come up with a good explanation of the well-known empirical relationship of delinquency and crime to age. They and others have addressed the issue of the shape of this relationship, whether it is an inverted-J curve or fits another pattern and whether or not it is invariant (Greenberg 1985, 1988, 1994; Steffensmeier et al. 1989; Tittle 1995; Reed and Yeager 1996; see also Shavit and Rattner 1988; Gartner and Nash Parker 1990; Britt 1992; Jang and Krohn 1995). They have also, along with others (Greenberg 1988; Warr 1993; Sampson and Laub 1993; Tittle 1995; Bartusch et al. 1997), addressed the issue of what, if any, theoretical perspective can account for whatever pattern of relationship can be shown to exist between age and criminal or deviant behavior.

THEORETICAL PERSPECTIVE

It is this second issue of explaining the relationship on which we focus here. We account for the relationship of crime and deviance to age by means of existing general theoretical constructs. We are in agreement with Tittle's (1995; Tittle and Ward 1993) view that the causes of crime and deviance are the same at all age categories and that the explanation of age effects, therefore, lies in variations in the magnitude or values of the causative variables by age.

First, we hypothesize that these causes are principally the social psychological variables specified in social learning theory (Akers et al. 1979; Akers 1985, 1997, 1998; Bandura 1986; Patterson and Dishion 1985). This is not done in the manner of "all wise after the fact learning theory" that Hirschi and Gottfredson (1985) rightly deplored, but as a reasonable hypothesis to be tested in a before-the-fact fashion against empirical data. Both earlier and more recent statements of social learning theory (Akers, 1998) refer to age as one indicator of location in the social structure that exerts an influence on conforming and deviant behavior through its effects on the social learning variables, principally *differential association* (patterns of direct and indirect interaction), *modeling* (imitation), *differential reinforcement* (balance of reward and punishment), and *definitions* (balance of attitudes favorable and unfavorable toward the behavior).

The family, peer groups, schools, churches, and other groups provide the more immediate contexts that promote or discourage the criminal or conforming behavior of the individual Where individuals are situated in the social structure is indicated by age, sex, race, class, and other characteristics. These characteristics relate to the groups of which persons are likely to be members, with whom they interact, and how others around them are apt to respond to their behavior. These variables affect which behavioral models and normative patterns to which persons are exposed and the arrangements of reinforcement contingencies for conforming or law-violating behavior. (Akers 1997:69)

Social structure refers to the society and community and to the person's location in the age, sex, race, social class, and religious and other sociodemographic groupings in society. Differences in rates of drug and alcohol behavior by group or society reflect the extent to which the group's or society's cultural traditions, norms, and social control systems provide different socialization and learning environment conducive to abstinence, use, or abuse. (Akers 1992:14; see also Akers 1985:66–67)

The differences in the social learning variables at each age, supposedly reflecting age-related changes in social, economic, and other life circumstances, are hypothesized to account for variations in criminal and deviant behavior at each age. The theory would predict that persistence or desistance or increase or decrease in deviant behavior as persons grow older accompanies persistence or change in the social learning variables, operating in the sequential and reciprocal manner proposed by social learning theorists (Akers 1985; Akers and Lee 1996). The greater the extent to which these circumstances and situations move the individual into relatively more association with others who engage in and espouse attitudes favorable to deviance and provide behavior models of deviance, the more one's deviant acts are differentially reinforced, and the more one holds attitudes positively defining or justifying the deviant acts, the more likely he or she is to commit the acts.

Second, we hypothesize that the social psychological causes of delinquency, which mediate its relationship to age, include the elements of social bonding (attachment, commitment, involvement, and belief) derived from control theory (Hirschi 1969). This hypothesis has not been stated by Hirschi, but it is at

least implicit in social bonding theory. It is made explicit in later work by Sampson and Laub (1993) and others (see below). Attachment refers to stronger or weaker ties of affection and close relationships to parents, peers, and others. Commitment is the extent to which the individual has a vested interest or stake in conforming to conventional norms and the extent to which involvement in deviant acts would jeopardize present and future educational, occupational, and other conventional aspirations and investments. Involvement is defined as engagement in conventional lines of activity that either because of time or incompatibility inhibit engagement in deviant activity. Belief is the extent of endorsement or internalization of general conventional values. The greater the extent to which age strengthens these bonds, the less likely it is that the individual will behave deviantly and the weaker these bonds become, the more likely it is that deviant acts will be committed.

Third, we hypothesize that the age effects will be mediated more by the social learning variables than by the social bonding variables. This hypothesis is based on previous theoretical statements (Akers 1989) and also on research (Krohn, Lonza-Kaduce, and Akers 1984; LaGrange and White 1985; Benda, 1994) that has found that when bonding and learning variables are taken into account simultaneously in models of deviant or delinquent behavior the net effects of social bonding variables are less than those of social learning variables.

Obviously, then, these theoretically derived hypotheses are responsive to the assertion by Gottfredson and Hirschi (1990) that the age-crime relationship cannot be explained by any existing theory. In fact, the hypotheses propose that one of the theories that can probably explain at least some of the relationship is Hirschi's own bonding theory.

Tittle (1995) agreed with Hirschi and Gottfredson (1990) that the causes of crime are the same for each age but added that the inverted-J pattern of the probability of deviance increasing and then decreasing with age is a function of age-related changes in the values of those same causative variables. The models we propose conform to Tittle's position. Suppose it can be demonstrated that differences in attachment to others, commitment to conformity, or differential reinforcement for violative behavior account for variations in criminal behavior among persons who are younger adolescents, older adolescents, young adults, and older adults, with higher rates of offending found in

the middle group of older adolescents and young adults. It seems reasonable to expect that the different rates of crime by age are the result of greater attachment and commitment and a lower balance of reinforcement for criminal acts among the younger teenagers and the older adults compared with the other two groups. The explanatory variables would be the same; only the values of the variables would differ. Significant individual variations in commitment to conformity or reinforcement would account for differences in offense behavior within the same age category, and the differences across age in rate of offending should reflect cross-age differences in the average level of reinforcement or commitment. Given the empirical finding that crime is related to these causative factors at any given age, then variations by age in the presence, direction, and strength of these factors should sufficiently account for variations in crime by age. "This does not imply that the actual values of the variables are the same for all ages. Indeed, it is age variation in the magnitude of the variables that accounts for the age-deviance relationship" (Tittle 1995:248). If the causes of deviance in early, middle, and late adolescence are the same and they remain as causes of individual variations in adult deviance in early, middle, and late adulthood, then variations in those causes by age should account for variations in deviance by age.

PREVIOUS RESEARCH

Greenberg (1985, 1988) was one of the first to argue that the variables from Hirschi's (1969) social control theory could explain the relationship between age and crime; if control stems "from the formal and informal institutional memberships and affiliations of social life, it is difficult to believe that control variables could be independent of age" (Greenberg 1988:18; see also Greenberg 1994). LaGrange and White (1985) made essentially the same argument and tested a social bonding model of delinquency (with measures of parental attachment, school attachment, and educational commitment) on a sample of male adolescents aged 12, 15, and 18. They also included in the model a measure of differential peer association. They found that the magnitude of the relationship between delinquent behavior and the independent variables varied somewhat by age category. All of the variables in the model had significant effects in the combined sample of all ages. However, the

bonding variables had no significant net effects at ages 12 and 18. Differential peer association had significant effects in all models, but its strongest impact was seen among 18-year-old men. The overall level of explained variance in delinquent behavior ranged from 27 percent to 36 percent. Krohn et al. (1989) tested the direct and indirect effects of social bonding variables and peer association on the relationship between age and adolescent cigarette smoking. They found that the peer association variable was related to smoking behavior regardless of age and that changes in this variable were the principal explanation for changes in smoking behavior from early to later adolescence.

The most systematic effort to explain the age-related changes in deviant and criminal behavior from a social control perspective is by Sampson and Laub (1993; Laub and Sampson, 1993), who have proposed an "age-integrated" theory of informal social control (social bonds) as an explanation of the persistence and change in delinquency and crime from childhood, to adolescence, and into adulthood (see also Loeber and LeBlanc 1990; Conger and Simons 1995; Muffitt 1993; Bartusch et al. 1997; Paternoster and Brame 1997). Their major hypothesis is that the strength of bonds to social institutions increases from adolescence into adulthood, and this accounts for reduction in criminal behavior for most people after they have reached adulthood. On the other hand, for those who experience changes in family and occupation that weaken social bonds, the likelihood of criminal behavior is not reduced and may be increased.

Sampson and Laub (1993) tested these ideas with the Gluecks' (Glueck and Glueck 1959) famous data set with 500 official delinquents matched with 500 nondelinquents. The two groups were followed up at age 25 and again at age 32. The teenage delinquents who had desisted enough from law violation to avoid arrest as adults had experienced greater marriage success, employment stability, and other life changes that worked against continuing in law violation. The nondelinquents who became criminal as adults were more likely than those who had continued their conforming ways to have experienced changes that weakened social bonds.

Sampson and Laub (1993) found significant changes in criminal propensity later in life, and these were correlated with changes in the person's social and economic circumstances. They concluded that those changes related to age that induce

or enhance stronger bonds to society will sustain conformity and reduce deviance, and those changes that weaken social bonds will sustain or enhance deviance as one ages. Sampson and Laub (1993) explicitly invoked social control theory and used the language of social bonds and informal social control. On closer examination, however, it becomes obvious that they also drew on social learning theory. This is seen especially in their discussion of how and why family context is so important in the development of delinquent behavior. Their explication of family context and crime leans very heavily on Patterson's (1982, 1995) coercion theory, developed at the Oregon Social Learning Center. This model of how internal family interaction can produce deviant behavior incorporates the learning concepts of parental modeling, positive and negative reinforcement, and punishment of children's conforming and deviant behavior. Therefore, the Sampson and Laub model, although favoring the language of social control, can be seen as proposing both bonding and learning variables as mediating the age-crime relationship. A similar reliance on control theory but with a clear admixture of learning theory is found in the study by Horney, Osgood, and Marshall (1995) on the effects of short-term changes in employment, schooling, and marital relationships on criminal behavior. Labouvie (1996) reported findings from a longitudinal study of substance use and abuse in two birth cohorts from adolescence (ages 15 and 18) into young adulthood (tested at ages 21 and 24 and again at 28 and 31) that also parallel the findings from Sampson and Laub's analysis. The expected deviance reduction, after young adulthood, was accounted for by changes in family (stable marriage with children) and friends (with similar family status) that accompanied the aging process.

Tittle and Ward (1993; Tittle 1995) analyzed data from a 1972 survey of persons aged 15-94 in Iowa, Oregon, and New Jersey (Tittle 1980) and found that interactions between age and other variables in specific offense categories were not substantial enough to restrict generalizing from youth to adult samples. They concluded that the causes of crime are essentially the same (only the values of the causative variables differ) for each age category. Predicting offense behavior at any age by using the significant independent variables from any other age produced no more errors than expected by chance. Of the several variables in the Tittle and Ward model, differential association was strongly related to all five categories of offenses (both as

measured by self-reported offenses in the past and self-projection of offenses in the future), and the relationship was essentially the same at all ages. There were some significant differences among coefficients for "informal social control" (anticipated negative responses of significant others if they found out the person had committed the offense) with regard to previous behavior, but none with regard to projected behavior. The causes of crime found to be operative in the adolescent years are the same ones operative in adulthood at any age.

Drawing on data from the National Youth Survey (ages 11–21), Warr (1993) found that the rapid and large changes in substance use and criminal behavior from the preteen to young adult years were a function of the correspondingly quick and substantial changes in the rate of age-specific exposure to delinquent peers, which also rapidly increased through the adolescent years. The age distributions for exposure to peers for other offenses such as vandalism, burglary, and theft showed exposure to peers engaged in those acts followed the same pattern. These distributions fit the patterns for self-reported substance use in household and high school surveys and for reported crimes and arrests for the other offenses by age. Peer associations do change dramatically with age, and these changes closely parallel the age pattern of changes in crime.

When these peer influence variables are controlled, the age effects on offense behavior become nonsignificant. But when exposure to delinquent friends is added to the baseline regression equations, the significant age effects for all offenses were considerably reduced and disappeared altogether for marijuana use, serious theft, and burglary. Warr (1993:35) concluded,

Hirschi and Gottfredson contend that the age distribution of crime cannot be explained by any variables known to criminology. The analysis presented herein shows that when measures of peer influence are held constant, the association between age and crime is substantially weakened, and for some offenses, disappear[s] entirely. Instead of an impenetrable conundrum, the age-crime relation appears to be at least partially explicable by ... differential association.

It could be that because age causes both differences in peer associations and in offending behavior, the relationship between the two is spurious, owing to their common causation by age, and without causal significance.

That conclusion, however, is contradicted by the analysis. Recall that when age and peer behavior are introduced into the same equation, it is age—not peer behavior—that is rendered insignificant. Consequently, it is difficult to avoid the conclusion that it is age that is spuriously associated with delinquency. (Warr 1993:37)

Therefore, Warr's (1993) and other research have offered some evidence regarding the hypothesis that age effects on delinquency behavior are indirect, operating through at least one of the social learning variables, but the hypothesis is incomplete because it does not include other important learning variables and does not incorporate possible explanatory variables from bonding or other theories. Also, previous research has shown that social bonding and social learning are the two principal theoretical explanations at the individual social psychological level that seem capable of explaining the age-crime relationship. Although some of this research measures both bonding and learning variables, studies have yet to present a systematic analysis incorporating the chief variables taken from the two theoretical perspectives. The present study offers a more complete and direct examination of the relative age-mediating effects of bonding and learning variables.

METHOD

Sampling and Procedure

The data for this study come from the Boys Town study of alcohol, tobacco, and drug behavior among a secondary school population (Grades 7 through 12) in the Midwest (Akers et al. 1979; Krohn et al. 1984; Akers and Cochran 1985). Within each participating school district, junior and senior high schools were selected on the basis of size and location in the district. Within each school two to three required classes were selected and the survey questionnaire administered to all of the consenting students in attendance on that day for whom parental permission had also been obtained. Of the returned forms, 95 percent granted parental permission and 95 percent of the students with parental permission were present and completed the questionnaire on the day of the survey. The total number of completed and usable questionnaires was 3,065. This represented 67 percent of the total number of students enrolled in the selected classes.

Measurement of Variables

The dependent variable in this study is frequency of marijuana use as measured by responses to an item on the questionnaire asking respondents how often they used marijuana on a scale that ranged from abstinence through five levels of use up to *nearly every day*. Because age and grade in school are so highly intercorrelated ($r = .9$), we used only grade level to test age effects on substance use. Grade in school sets an age-related context of social interaction in which the social learning and bonding mechanisms differentially operate to influence adolescents toward abstinence or some level of use.

The social learning variables in the study are differential peer association, definitions favorable or unfavorable to marijuana, and differential reinforcement of marijuana use. In the LISREL analysis, these three variables are entered as indicators of a latent construct labeled *social learning*. Differential peer association was measured by a three-item scale asking respondents to report the proportion (none or almost none, less than half, more than half, almost all) of their best friends, longest time friends, and friends with whom they associated most often who had smoked marijuana ($\alpha = .96$). One's own definitions favorable and unfavorable to use of marijuana were measured by degree of approval or disapproval expressed in response to a single item, "What is your attitude toward using marijuana?" Differential reinforcement was measured by overall reinforcement balance as indicated by respondents' assessment of whether on balance "mainly good," "mainly bad," or "about as much good as bad" would most likely result from use (as perceived by nonusers) or usually had resulted from use (as reported by users). The expected direction of the relationship between these variables and marijuana use is positive. A measure of modeling-imitation is not included in this analysis because it was found to have relatively weak effects on marijuana use and dropped out of good-fitting models.

The social bonding variables in the study are attachment, commitment, and belief. Attachment is an index ($\alpha = .82$) combining four items on closeness and satisfaction with relationships with and supervision by the respondent's father and the same four items with regard to the respondent's mother. We originally included attachment to peers, but this measure did not correlate with parental attachment and the other bonding items, and

its inclusion prevents a good-fitting model. Also, it is only weakly correlated with marijuana use. Therefore, we dropped it from the final models in the analysis. Commitment was measured by an index of commitment to conventional lines of activity (school work, athletics, musical groups, and other activities at school as well as involvement in church and community activities), grades in school, and level of educational aspirations ($\alpha = .73$). Belief was indexed by the respondents' endorsement of conventional beliefs in education, the law, and the rules and moral beliefs of parents ($\alpha = .53$).¹ Involvement was not measured separately; rather, following Krohn and Massey (1980), as shown above, involvement in conventional activities was incorporated into the measure of commitment. The expected direction of the relationship between these variables and marijuana use is negative, but in order to convert all relationships that run in the theoretically expected direction into positive signs, the three bonding variables were reverse coded so that the higher the score, the lower the strength of the bond. In the LISREL analysis, these three variables are taken as indicators of a latent construct labeled *social bonding*.

FINDINGS

Figure 1 shows that the level of marijuana consumption increases noticeably from the 7th grade to the 11th grade and then declines slightly in the 12th grade. Figure 1 also shows curves for changes in the social learning and social bonding variables.

¹ Akers (1985, 1989) has argued that the concept of beliefs (general conventional values) in social bonding theory overlaps with the concept of definitions in social learning theory, which refers to both general and specific beliefs or attitudes favorable or unfavorable to deviance, and has used a general belief measure as one indicator of definitions unfavorable to deviance (Akers et al. 1989). Therefore, it is difficult to distinguish between the two theories along this cognitive-attitudinal dimension. However, if a distinction is to be made between the two, it is reasonable to conceptualize the measure of specific attitudes as more indicative of the definitions concept in social learning theory and the measure of general conventional beliefs as indicative of the beliefs concept in social bonding theory; this conforms to distinctions made in previous research (Akers and Cochran 1985). Akers (1989) also maintained that there is conceptual overlap between the commitment concept in social bonding and the differential reinforcement concept in social learning (commitment is a special case of negative reinforcement). There is no indication in the literature that control theorists would agree with any of this, and Gottfredson and Hirschi (1990) saw a bright-line distinction between control theory on the one hand and all "positivistic" theories, into which they categorize social learning, on the other. The issue does not have to be settled for our purpose of locating important theoretical variables that can explain the age-deviance relationship.

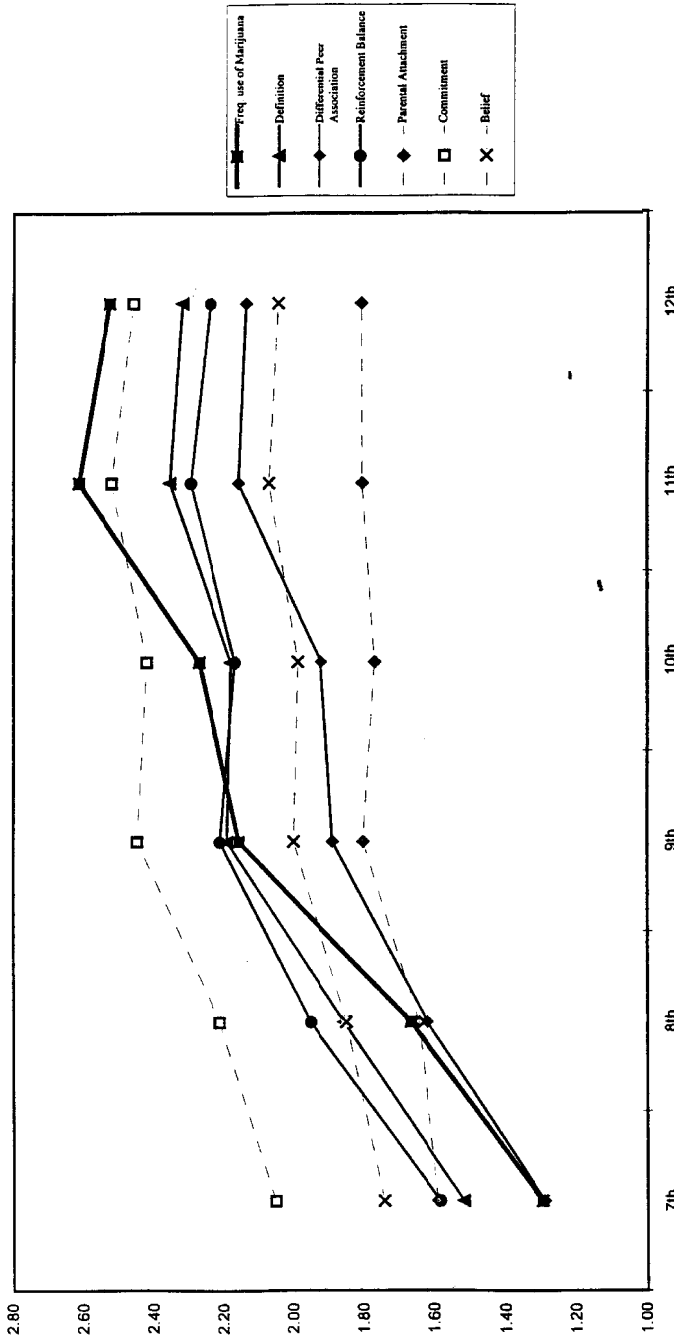


FIGURE 1 Mean Values of Marijuana Use, Social Learning, and Social Bonding Variables by Grade. Freq. = frequency.

The social bonding variables do not track the changes in the frequency of marijuana use well, but commitment and belief do so to a greater extent than parental attachment. On the other hand, it is apparent from Figure 1, in conformity with the social learning hypothesis, that the curve describing changes in marijuana use from the 7th to the 12th grade is matched almost exactly by the pattern of changes by grade in one's own positive or negative definition of marijuana, differential peer association, and reinforcement balance. An increase in mean levels of favorable attitudes toward marijuana, differential association with using peers, and reinforcement for using is accompanied by an increase in the mean level of marijuana use. If it is true that no theory or known set of variables can account for the age effect on crime and deviance (whether that effect is described by an inverted-J or some other curve), then the differences in marijuana usage in the early adolescent and later adolescent years would be only a function of age, unrelated to any other changes in life circumstances. There should be little or no correspondence between modifications in the context of learning to use or refrain from marijuana and modifications in use patterns from one school grade to the next. But this is not what is observed.

Table 1 shows that the probability of marijuana use is moderately a function of age (grade in school) and the values of each of the social learning variables are also moderately a function of age (for marijuana, $r = .23$, and for the three social learning variables, $r_s = .21$ to $.25$). The bonding variables of parental attachment, commitment, and belief are also significantly related, but at a somewhat lower level of magnitude, to grade in school. The table shows that marijuana use is strongly correlated with each of the social learning variables ($r_s = .58$ to $.78$) and with each of the social bonding variables ($r_s = .32$ to $.44$). Further, the zero-order correlations in Table 1 show a considerable amount of interrelations among the social learning and social bonding variables.

Table 2 places these variables in four multiple regression models. In Model 1, only grade in school is entered as the independent variable (comparing each higher grade with Grade 7), and that model accounts for a modest 6 percent of the variance in marijuana use. When the social learning variables are entered into the regression model (Model 2 in Table 2), the age effects disappear, and each of the social learning variables retains a significant net effect; that model explains a robust 67 percent of

TABLE 1 Bivariate Correlations for Grade, Marijuana Use, Social Learning, and Social Bonding (N = 2,521)*

Variable	1	2	3	4	5	6	7	8
Marijuana use	1.000							
Grade	.228	1.000						
Definition	.715	.201	1.000					
Different Peer Association	.782	.245	.704	1.000				
Reinforcement Balance	.577	.207	.672	.563	1.000			
Parental Attachment	.317	.114	.292	.300	.254	1.000		
Commitment	.440	.097	.384	.422	.328	.336	1.000	
Belief	.443	.166	.444	.427	.378	.412	.352	1.000

* All correlations are significant at .01 level. Variables have been recoded so that all relationships in the theoretically expected direction are shown as positive.

the variance in marijuana use. All of the partial regression coefficients for grade in school are reduced to zero. Basically, all but a trivial amount of the age effect is mediated by the social learning variables.² Model 3 contains grade in school and the social bonding variables. Comparison with Model 1 would indicate that some part of the age effects is mediated by the bonding variables. Although the coefficients in Model 3 show that the net age effects on marijuana use remain significant, the bonding variables add a substantial amount to explained variance in marijuana use ($R^2 = .31$). The findings from running Model 4—which incorporates all of the age, bonding, and social learning variables—indicate that most of the effects on marijuana use come from the social learning variables, particularly differential peer association and definition variables. This full model adds only one percent to the amount of variance explained by Model 2 with only the age and learning variables. In both Model 2 and Model 4, the age effects are reduced to essentially zero and are nonsignificant. The effects of the bonding variables, while remaining statistically significant, are also substantially reduced by the presence of the social learning variables in the model.

The first hypothesis, that learning variables mediate the relationship between age and marijuana use, is supported. The second hypothesis, that bonding variables mediate the age effects, is partially supported; there is some mediation of the relationship between grade in school and marijuana use, but the net age effects remain significant. Further, the strong net effects of the learning variables in the final model support the third hypothesis that age effects are more a function of social learning than of social bonding processes.

The LISREL models in Figures 2–4 present another way of testing the hypotheses. Figure 2 demonstrates that age effects on marijuana use are mediated by the latent construct social learning, measured by differential reinforcement, differential peer association, and definitions. The net direct effect of age (measured by grade in school) on marijuana use becomes essen-

² When age is controlled, the relationship of marijuana use to the social learning variables remains. When separate social learning models are run for each grade, the correlation of marijuana use with each of these social learning variables remains high for each grade, and the level of explained variance in marijuana smoking remains at similar levels in each of the grade-specific models (tables not shown).

TABLE 2 Regression of Adolescent Marijuana Use on Grade, Social Learning, and Social Bonding (N= 2,521)

Model	1		2		3		4	
	β	<i>t</i>	β	<i>t</i>	β	<i>t</i>	β	<i>t</i>
Grade								
8	.079**	2.95	-.022	-1.36	.050*	2.19	-.019	-1.23
9	.187***	6.78	-.010	0.62	.087**	3.65	-.017	-1.03
10	.232**	7.89	.009	0.52	.136**	5.38	.006	0.35
11	.298**	10.16	.014	0.76	.169**	6.64	.008	0.45
12	.287**	9.87	.010	0.54	.181**	7.21	.009	0.51
Social learning								
Definitions			.278**	15.22			.254**	13.90
Differential peer association			.532**	32.25			.494**	29.48
Reinforcement balance			.087**	5.50			.074**	4.71
Social bonding								
Parental attachment					.085**	4.57	.027*	2.09
Commitment					.297**	16.36	.082**	6.27
Belief					.278**	14.73	.049**	3.60
R ²	.059		.671		.315		.681	

* $p < .05$. ** $p < .01$.

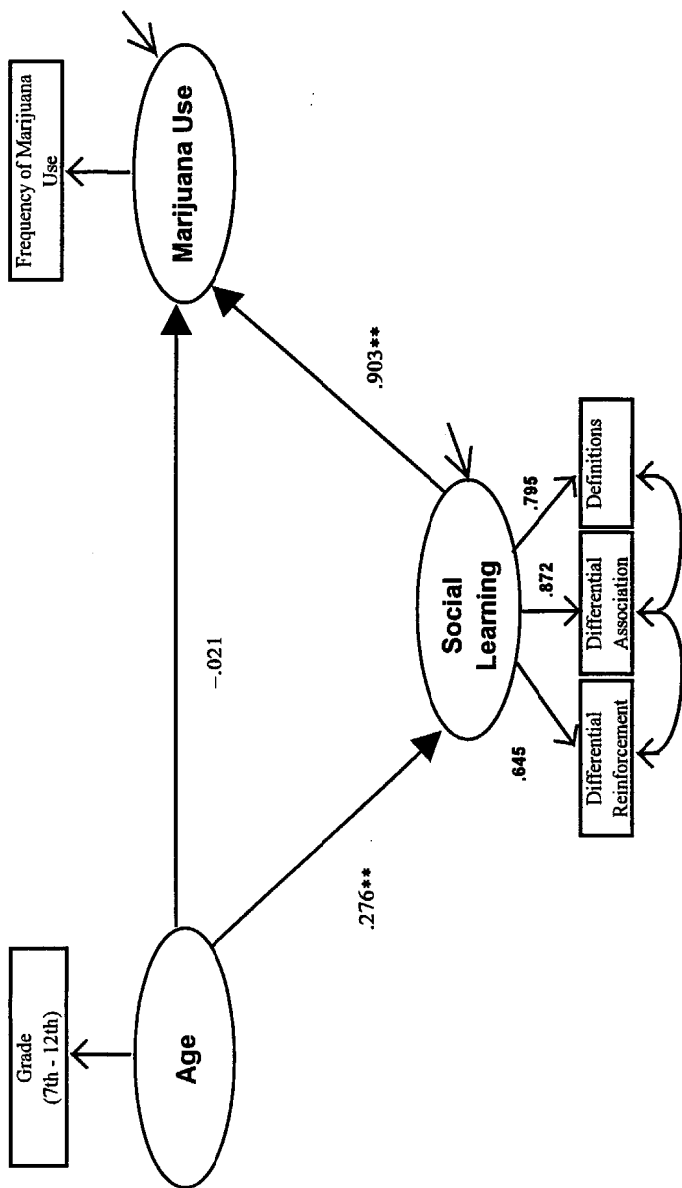


FIGURE 2 Model with Standardized Estimates for Age Effect, Adolescent Marijuana Use, and Social Learning ($N = 2,521$). $\chi^2 (2, N = 2,521) = 10.09, p = .006$; goodness-of-fit index = $.998$; adjusted goodness-of-fit index = $.998$. $^{**} p < .01$. (Adapted from Akers, 1988.)

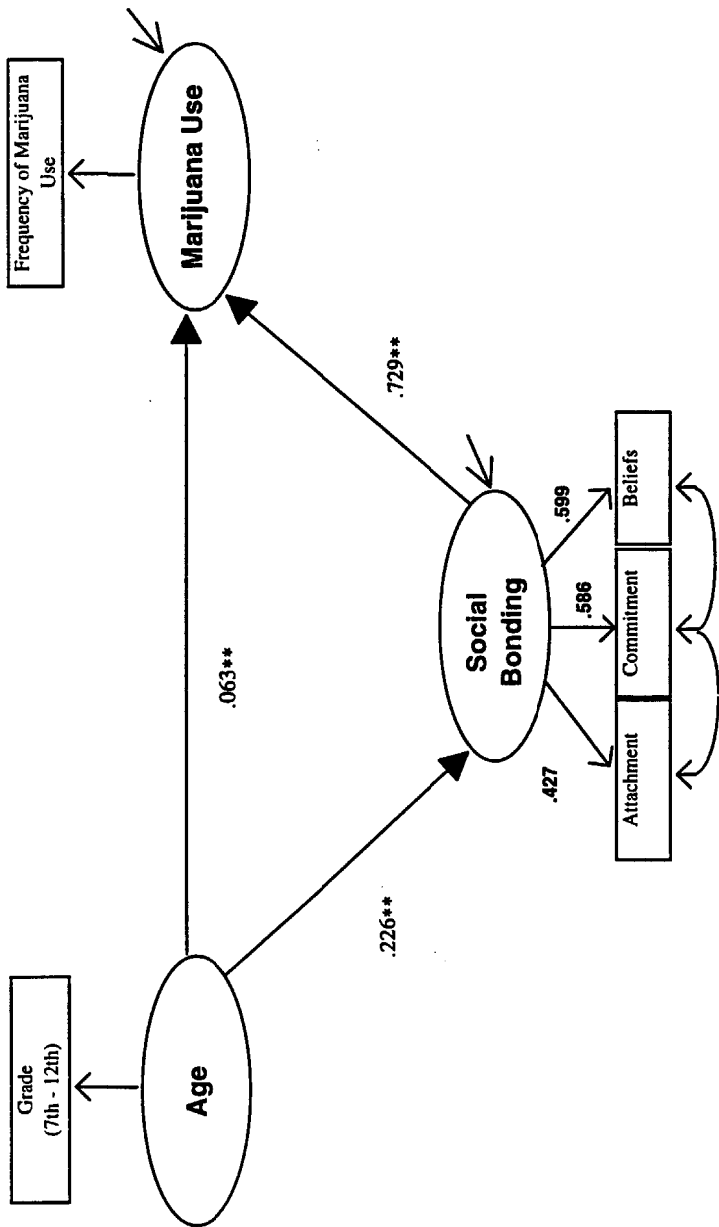


FIGURE 3 Model with Standardized Estimates for Age Effect, Adolescent Marijuana Use, and Social Bonding ($N = 2,521$). $\chi^2(2, N = 2,521) = 10.25, p = .006$; goodness-of-fit index = .998; adjusted goodness-of-fit index = .987. $** p < .01$.

tially zero ($\beta = -.021$) when entered in the same model with the social learning construct. Grade in school retains a significant direct effect on the social learning variables ($\beta = .28$), and the social learning construct retains a very strong effect on marijuana use ($\beta = .90$).

These findings conform very closely to the relationships predicted by social learning theory. Age produces changes in the social learning variables, and differences in marijuana use from the 7th to the 12th grade are a function of the differential probabilities that individuals at different locations in the adolescent age structure are exposed to associations, reinforcement, and definitions favorable to substance use. Although there is no grade level at which the majority of youth are involved in marijuana consumption, the findings suggest that as youth move from the 7th to the higher grades, their patterns of associations, actual and anticipated reinforcement, and attitudes toward marijuana are more likely to lean in the direction of marijuana use, and the probability of their smoking marijuana goes up. The LISREL mode in Figure 2 conforms to the theoretical expectations in the first hypothesis. The findings shown in Figure 3 show that the social bonding construct (measured by parental attachment, commitment, and beliefs) mediates some of the effects of grade in school on marijuana use, but age continues to have significant direct effects on marijuana smoking. Age does have a significant impact on social bonding, with bonds weakening to some extent among the older adolescents in the study, and the bonding variables have a significant and substantial effect on marijuana use ($\beta = .73$). However, the impact of grade in school on marijuana use appears to operate only partially through its impact on social bonding. The model conforms only partly to the expectation in the second hypothesis that the relationship between age and marijuana use is adequately accounted for by age-related variations in social bonds.

The differences in the findings for social learning and social bonding are underscored by the findings presented in Figure 4, which show that the social learning variables mediate the effects of both age and social bonding variables on marijuana use. In Figure 4, only social learning has significant and strong direct effects on the frequency of adolescent marijuana use. Age and social bonding retain only indirect effects on marijuana use, apparently operating through the social learning process. The direct net effect of age is essentially zero, and the effect of social

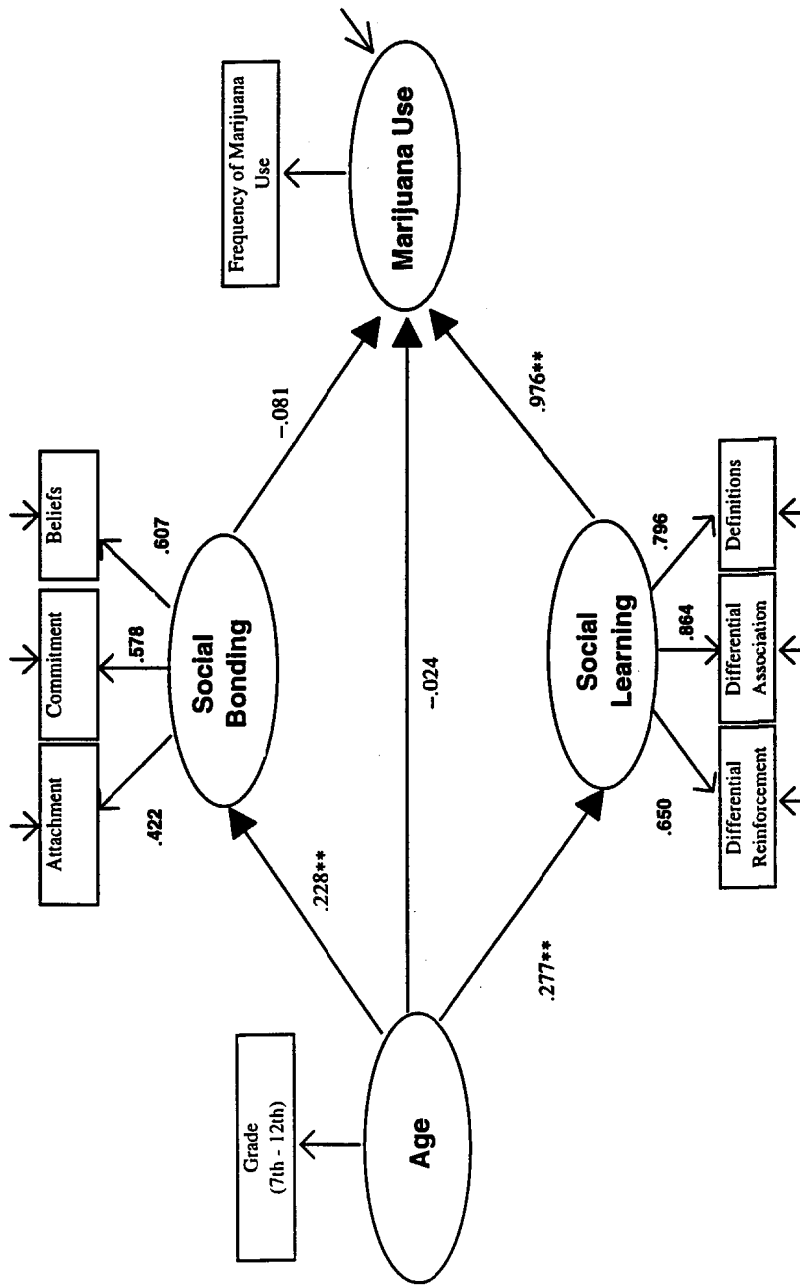


FIGURE 4 Model with Standardized Estimates for Age Effect, Adolescent Marijuana Use, Social Learning, and Social Bonding ($N = 2,521$). $\chi^2 (2, N = 2,521) = 47.60, p = .000$; goodness-of-fit index = .995; adjusted goodness-of-fit index = .986. $^{**} p < .01$.

bonding is weak and nonsignificant. The model in Figure 4 provides substantial evidence in favor of the third hypotheses that the relationship between age and frequency of marijuana use is mediated more through the cognitive-behavioral process indicated by the social learning variables than by the social bonding variables.

CONCLUSION

The findings in this study are inconsistent with the assertion that nothing can explain the age curve for crime and deviance. The overall theoretical expectation that there are significant variables intervening between the effects of age on adolescent deviance is met. The expectation that these are principally social learning variables is also met. The findings demonstrate that the relationship between age and adolescent substance use, as indexed by marijuana consumption, is nearly completely mediated by age-graded variations in the major variables of differential association, definitions, and reinforcement derived from social learning theory. The results on the mediating effects of social bonding are mixed. It appears that variables derived from social bonding theory (parental attachment, commitment, and beliefs), although correlated with marijuana use, only partially mediate the social contexts associated with changes in age from the 7th through the 12th grade. The effects of attachment, commitment, and beliefs on marijuana use by adolescents, too, seem to be contingent on their relationship to the social learning process.

The findings in this study concur with those of previous research. The age-crime relationship is not inexplicable; it can be adequately accounted for by variables that intervene between age and individual behavior. This study has expanded on previous research by providing a systematic comparison of the efficacy of two major theoretical approaches to deviance in explicating the sharp increase in adolescent deviance such as drug use in the junior high or middle school years to the end of high school. The burden is on those who continue to maintain, in the face of such findings, that the question of why changes in criminal or deviant behavior accompany changes in age is a mystery that cannot be solved by extant theory. To continue to support this position, one must show why findings such as those

reported here do not help to solve the mystery. The burden on those who claim that the relationship is quite explicable by current, empirically validated, theoretical models is to show that the age effects can be explained for a full range of criminal and deviant behavior. On the basis of the findings in this study of one form of adolescent deviance, and in previous studies on other forms of delinquency, the most likely candidates for such models are those derived from social learning theory. Nevertheless, social bonding models, although not very effective in this study with regard to age–marijuana use, remain viable candidates for explicating the relationship between age and other types of criminal or delinquent behavior.

Future research should pursue testing of the fairly complete models proposed here but without some of the limitations of the present research. One of these limitations is the cross-sectional sample, which does not permit testing sequence and reciprocal relationships. Obviously, this is not an issue with regard to age, as smoking marijuana cannot change a person's age. But it does raise the reasonable question of the extent to which age produces changes in the adolescent's marijuana use behavior for reasons unrelated to bonding or learning and that marijuana use (or abstinence), in turn, produces changes in the bonding and learning variables. This would seem to be an issue primarily with regard to parental attachment, commitment, and beliefs as significant age effects continue in the presence of these variables. It would seem to be less of an issue with regard to the social learning variables because they retain strong effects, whereas it is the age effects that are reduced to nearly zero when age and learning variables are put in the same models. Social learning theory recognizes reciprocal effects of deviant behavior on peer associations, definitions, reinforcement, and other variables (Akers 1997), with the effects depending on what stage of the ongoing learning process is examined, but this could not be examined in the present sample. It has been examined elsewhere and found to fit the theoretical expectations (see Akers and Lee 1996).

Cross-sectional designs are reasonable for testing the hypotheses of this study, and additional cross-sectional, as well as longitudinal, data should be used with primary data containing good measures of the main learning and bonding variables and variables drawn from other theoretical perspectives. Those models should be tested with both a wider range of delinquent

and criminal behavior beyond drug offenses and a wider range of age categories beyond the adolescent years. Although the changes in behavior may be most dramatic during this life stage and have effects on what changes may come later, the theoretical models should be valid for age variations in the young adult, median adult, and old adult ages. Therefore, additional research of the kind conducted by Tittle and Ward (1993), but with better measures and more complete models of social learning, social bonding, and other theories, is needed. The larger question is the one of specifying the process by which the larger social context—as indicated by not only by age, but by such indicators of social location and structure as gender, race, class, community, and economy—affects criminal and deviant behavior. The prediction from social learning theory, and from the empirical findings in this and other studies, is that the variables mediating most or substantial portions of the effects of social context on crime and deviance will be found among those implicated in the social learning process.

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