Intraindividual Variability of School Bonding and Adolescents' Beliefs About the Effect of Substance Use on Future Aspirations

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The study examines the dynamic relationship between school bonding, beliefs about the deleterious effects of substance use on future aspirations, and subsequent substance use among a sample of 1065 male and female middle school students. First, a mediation model was assessed. Adolescents' perceptions about the harmful effects of substance use on their future aspirations emerged as a salient mediator of the relationship between school bonding and subsequent substance use. Second, the intraindividual variability of school bonding and its effect on students' beliefs about the potential harm of substance use on future aspirations was assessed through random-coefficient models.[5] Students who tended to be poorly bonded to school were less likely to perceive that substance use may impede the attainment of their future goals. Furthermore, a strong intraindividual effect of school bonding was observed, indicating that as a student became more or less bonded to school his/her belief that substance use could affect future aspirations similarly changed.

KEY WORDS: school bonding; perceived risk of substance use; future aspirations; adolescence; intraindividual variability.

INTRODUCTION

The dynamic and synergistic relationship between risk and protective factors has been well documented in the adolescent drug use literature (Hawkins *et al.*, 1992; Petraitis *et al.*, 1995). This compilation of assets and liabilities may be used to both predict likelihood of substance abuse and guide efforts to prevent the onset or escalation of abuse. One consistently reported protective factor is bonding to school (Guo *et al.*, 2001; Hawkins *et al.*, 1992; Maddox & Prinz, 2003; Maguin & Loeber,

1996; McBride *et al.*, 1995; Oetting & Donnermeyer, 1998; Resnick *et al.*, 1997; Rutter, 1985). Emerging from Hirschi's (1969) social control theory, school bonding is characterized by a commitment to conventional academic and social endeavors at school. Other important characteristics of school bonding include an attachment to prosocial peers and belief in established prosocial norms (Hawkins and Weis, 1985). School bonding in general has been found to be protective against many problem behaviors, including delinquency (Cernkovich & Giordano, 1992; Free, 1994; O'Donnell *et al.*, 1995; Simons-Morton *et al.*, 1999; Zhang & Messner, 1996), school dropout (Cernkovich & Giordano, 1992; Crusto, 2000; Eggert *et al.*, 1994), teen-age pregnancy (Danzinger, 1995),

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[5]All of the random-coefficient models were also specified in HLM, Version 5.04 (Raudenbush & Bryk, 2002) in order to compare the regular standard errors to the robust standard errors. The interpretation of the results of the models with the robust standard errors was indistinguishable from those reported in this manuscript.

and, as previously mentioned, substance abuse. The extensive literature provides solid evidence that a strong bond to school is an important protective factor for many problematic adolescent behaviors.

The current paper is focused on the role of school bonding in predicting substance use in particular. The social development model (Catalano & Hawkins, 1996; Hawkins & Weis, 1985) offers a theoretical framework to describe the mechanisms by which school bonding may affect substance use. The model asserts that prosocial bonds (including bonding to school) preclude problem behavior. According to the theory, a pro-social bond to school is represented by attachment to others at the school, commitment to the pro-social norms of the school community, and belief in the pro-social values of the school community. The theory proposes that weak school bonds free adolescents from adhering to conventional norms that discourage problematic behaviors. Catalano and Hawkins (1996) offer three circumstances in which students may choose to engage in substance use rather than follow the beliefs, norms, and values held by the school community that discourage drug use. First, a student may choose to use substances during times when he/she is denied the opportunity to engage in prosocial activities, when personal skill level precludes positive reinforcement for participation in prosocial activities, or when the school environment fails to effectively reinforce prosocial behavior. Second, a student who is well bonded to school may choose to go against the prosocial norms held by the school community if the student believes that the benefits of use outweigh the consequences. Catalano and Hawkins (1996) assert that school bonding affects students' drug using behavior through their assessment of the costs and benefits of substance use. Third, students who are bonded to other entities (e.g. family, peers, etc.) that tolerate or encourage substance use may choose to use substances even when a strong bond to school exists. That is, in some instances anti-social bonds to certain entities may outweigh any potential benefit of pro-social bonds to school. Oetting and Donnermeyer's (1998) primary socialization theory offers further insight into this third circumstance. The theory emphasizes the critical importance of peers as the major factor that actually determines substance use among adolescents, but indicates that selection of deviant peers is related to school and family problems. Primary socialization theory proposes that school and family factors impact the choice of peers and that choice of peers, in turn, influences substance use. In other words, primary socialization theory suggests that selection of deviant peers may mediate the relationship between poor school bonding and substance use.

A robust bond to school may be especially important in early adolescence. School transitions (including the progression from elementary school to middle school) are often associated with heightened academic stress, increased school misbehavior, decreased academic achievement, and weakened school bonds (Eccles & Midgley, 1989; Simmons & Blyth, 1987; Wagner & Compas, 1990). The middle school years can be an especially trying and difficult experience for students who are academically deficient (Entwisle, 1990) and students who encounter particular difficulty may be less prone to follow a pro-social path through adolescence. Simons-Morton *et al.* (1999) hypothesize that these students may become apathetic or develop anti-social attitudes and behaviors (including rebelliousness, disengagement from their academic duties, treatment of teachers and students in a disrespectful manner, and destruction of school property) in order to protect themselves from feelings of inadequacy. Simons-Morton and colleagues also consider problem behavior among adolescents to be partially due to the failure of schools to foster a sense of social affiliation and provide an environment in which students can develop social competence and experience success.

In addition to assessing the relationship between school bonding and substance use, the present investigation builds on previous work through the examination of how school bonding influences a potential mediator, students' beliefs about the deleterious effects substance use could have on the achievement of future goals. While most past research has examined only general relationships between school bonding and drug use, this study was aimed at determining how within person changes in school bonding over time influenced a potential mediating attitude also shown to be related to substance use.

The first objective was to assess if the relationship between school bonding and subsequent substance use was mediated (i.e. explained) by the perceived risk of substance use on the achievement of one's goals. In order to establish a mediating effect three relationships must be established (Baron & Kenny, 1986). First, a direct effect between school bonding and subsequent substance use must exist (Path C). The theoretical foundation for this path was discussed in the beginning of this manuscript. Second, a significant relationship between school bonding and perceived risk of substance use must exist (Path A). Finally, a significant relationship

between perceived risk of substance use and subsequent use of substances must exist (Path B).

School Bonding and Students' Perceptions of the Deleterious Effect of Substance Use on Future Aspirations (Path A)

Although a paucity of research exists to specifically describe any potential relationship between school bonding and perceived risk of substance use on future aspirations, several of the modern expectancy-value theories (Eccles & Wigfield, 2002) offer insight which may be extrapolated to this specific instance. For example, students who are poorly bonded to school may lack commitment to academic pursuits, have lower expectations for their future, and place less value on academic achievement. Goodenow (1993) offers some support for this hypothesis, reporting that students' sense of school belonging is positively associated with academic performance expectations as well as grade point average. According to Eccles's (1983) expectancy-value model, students make behavioral choices based on the relative value they place on a certain outcome as well as the perceived probability of success of obtaining a certain outcome. If our hypothesis is true, a poorly bonded student who has low expectations and places little value on academic pursuits may be less likely to believe or be concerned that their future aspirations may be affected by substance use. Similarly, Heckhausen (1991) asserts that motivation to behave in a certain way is a function of the value that one places on the potential consequences of a certain action. If poorly bonded students are less likely to be concerned about achievement (presumably in the short and long-term) then they may be more likely to choose to engage in nocuous behaviors, including substance use.

Perceptions About the Deleterious Effects of Substance Use on Future Aspirations and Subsequent Substance Use (Path B)

A greater amount of research has been conducted to evaluate Path B of the mediation model, the path between perceived risk of substance use and subsequent use of substances. The risk and protection literature has identified future aspirations/perceived opportunities (Johnston et al., 1985; Kelly & Balch, 1971) and perceived harm of substance use (Como-Lesko et al., 1994; Johnston et al., 1995) as salient predictors of adolescent substance use. However, little research has been conducted to ascertain the impact of specific beliefs about the likelihood that substance use could jeopardize the achievement of one's long-term goals. The Health Belief Model (see Becker, 1974) espouses the importance of one's assessment of the risks associated with a certain behavior in determining whether an individual will engage in or abstain from that behavior. Specifically, the Health Belief Model simultaneously considers one's perception of their susceptibility (e.g. "If I use drugs I may not be able to get into college") and the severity of the consequence (e.g. "If I ruin my chances of going to college then I won't be able to lead the life that I have planned"). That is, students who perceive that substance use may have harmful effects and that those harmful effects are serious are less likely to become involved in drug use.

Summary

The purpose of this manuscript is two-fold. First, we consider student's perceptions about the deleterious effect of cigarette, alcohol, and marijuana use on the achievement of their goals as a mediator of the relationship between school bonding and subsequent substance use. We hypothesize that students who are well bonded to school are more likely to perceive that involvement in substance use will negatively impact their future goals, and, as such, are less likely to use substances. After testing the mediational hypothesis, we will turn our efforts towards a better understanding of our hypothesized mediator. Specifically, the intraindividual variability of school bonding and its effect on beliefs about the deleterious effects of cigarette, alcohol, and marijuana use over a period of 2 years will be examined. The purpose of the second set of analyses is to understand how change in school bonding over time may affect students' beliefs about the effects of substance use. The examination of intraindividual variability makes this investigation unique. An *inter* individual approach asks questions such as "Are adolescents who are poorly bonded to school less likely to perceive that substance use may jeopardize their future?" In contrast, an *intra* individual approach asks questions such as "Is an adolescent more likely to perceive that substance use will have no deleterious effects during times when his/her bonding to school has diminished?" In other words, an intraindividual approach assesses change in the variables of interest within each student in addition to differences across students. We hypothesize that changes in school bonding are associated with

reciprocal changes in attitudes about the risks associated with substance use. That is, we hypothesize that as a student's school bonds weaken, he/she will become less likely to perceive that substance use will have deleterious effects on his/her future.

METHOD

Participants

Participants in this study were 1065 male and female students from eight middle schools across the Unites States participating in a larger prevention study. These students represent the control condition and did not receive any intervention. The students were in 6th or 7th grade at the initial survey and proceeded to provide survey data on three additional occasions over a period of 2 years. All subjects obtained active parental consent to participate in the study.

Of the 1065 students considered in these analyses, 615 (57.75%) completed all four surveys, while 241 completed three of the four surveys, 158 completed two surveys, and 51 students completed just one survey. Forty-five percent of the subjects are male. The sample is 79.5% White and 9.0% Black. The remaining 11.5% of the subjects identify themselves as having an ethnic background other than White or Black, including American Indian, Asian, Mexican-American, Spanish-American, and/or Puerto-Rican. The mean age for the sample was 12.35 ($SD = .75$) at the first measurement occasion.

Measures

Nine items were used to assess the students' beliefs about the effect of substance use on future aspirations. Specifically, the students reported their agreement (1: definitely disagree, 2: disagree somewhat, 3: agree somewhat, 4: definitely agree) with the following statements. Using cigarettes/alcohol/marijuana would (1) keep me from doing the things I want to do; (2) mess up my plans for when I am older; (3) get in the way of what is important to me.

School bonding was defined by four items, including "I like school," "My teachers like me," "I like my teachers," and "School is fun." The items were measured on a four-point scale ranging from 1 (not at all) to 4 (a lot).

A substance use classification technique originated by Oetting and Beauvais (1990) was utilized to assign a value to each student's use of cigarettes, alcohol, and marijuana. The cigarette classification was based on three items that assessed lifetime use, daily use, and self-identification of use. The items were qualitatively combined to form a scale ranging from 0 (non-user) to 6 (very heavy user). The alcohol classification was based on four items that assessed lifetime use, past month use, self-identification of use, and subjective quantity of use (do not drink, just a glass or two, enough to feel it a little, enough to feel it a lot, until I get really drunk). The items were qualitatively combined to form a scale ranging from 0 (non-user) to 8 (very heavy user). Finally, the marijuana classification was based on four items that assessed lifetime use, past month use, type of use (smoked, ate, used a bong, used sinsemilla, used hashish), and self-identification as a user. The items were qualitatively combined to form a scale ranging from 0 (non-user) to 7 (very heavy user).

Analyses

Our first hypotheses stated that student's beliefs about the potential deleterious effect of substance use on their future aspirations would mediate the relationship between school bonding and subsequent substance use. We followed the Baron and Kenny (1986) approach to establish mediation through a series of structural equation models using Mplus (Muthén & Muthén, 1998). The series ended in a full model as recommended by MacKinnon *et al.* (2002). The results of a mediation model are most meaningful if a temporal ordering exists. As such, we considered school bonding at the second measurement occasion, beliefs about the deleterious effects at the third measurement occasion, and substance use at the fourth measurement occasion. Gender (coded as 1 for male and 0 for female) and age were used as control variables, as well as baseline values of both the mediator and substance use (as recommended by MacKinnon, 1994). Because of the skewed nature inherent in measures of substance use in early adolescence, robust standard errors were used for all mediation models (Satorra & Benter, 1994). The model and missing data were simultaneously estimated utilizing full information maximum likelihood.

Three separate models were tested, one each for cigarettes, alcohol, and marijuana. An a priori decision was made to correlate two pairs of residual errors in the school bonding scale: (1) the errors of liking for school and believing that school was fun, and

(2) the errors of liking teachers and the teacher's liking for the student. These correlated errors made intuitive and practical sense given the additional similarity of the variables within the pairs.

The second part of the analyses involved the examination of the intraindividual variation of school bonding and its effect on beliefs about the potential deleterious effects of substance use. We used random-coefficient (RC) modeling within a multilevel framework to assess the dynamic relationship between perceived risks of substance use on future aspirations and school bonding. A multilevel model in this framework considers measurement occasions to be nested within individuals. The measurement occasions represents level one of the hierarchy, while individuals represent level two. In addition to time, school bonding was also used as a time varying predictor of perceived risk of substance use. The following equation represented the level one (within persons) model.

$$Y_{ij} = \pi_{0j} + \pi_{1j}(\text{time}_{ij} - \overline{\text{time}_j})$$
$$+ \pi_{2j}(\text{bonding}_{ij} - \overline{\text{bonding}}) + r_{ij}$$

where i represents measurement occasions and j the individuals.

Different amounts of time elapsed between each survey administration across schools. As such, time was expressed as the amount of time that elapsed between each survey and was group mean centered to allow for a meaningful interpretation of the intercept and to avoid bias due to the age heterogeneity present at each measurement occasion (Raudenbush & Bryk, 2002, p. 184). To further aid in the interpretation of the intercept, school bonding was grand mean centered. An intercept (π_{0j}) was estimated for each individual in the sample and represented the fitted value of the dependent variable, perceived risk of substance use on future aspirations, when both time and school bonding were zero. Because of the centering, time was zero at the midpoint between the first and last measurement occasion for each student and school bonding was zero for those students at the mean level of school bonding. The coefficient associating time with the dependent variable (π_{1j}) described the amount each person's perceived risk changed per unit of time, while π_{2j} tested the extent to which additional variance in the dependent variable (after controlling for time) could be explained by the contemporaneous effect of school bonding.

In the present application the primary concern was the within persons effect of school bonding on the dependent variables. That is, we were most concerned with understanding the extent to which within person fluctuations in school bonding affected perceived risk of substance use on future aspirations. However, the impact of school bonding on perceived risk of substance use (π_{2j}) captured both differences between individuals in their average or overall level of school bonding and within person change in school bonding over time. Raudenbush and Bryk (2002) have shown that the "effect of a level 1 predictor can be biased if the aggregate of the level 1 predictor has a separate and distinct relationship with the intercept (p. 183)." Indeed, it is quite possible that the mean level of school bonding across all measurement occasions may have a unique impact on the dependent variables of interest. Any effect of school bonding on students' beliefs about the deleterious impact of substance use may be due to a characteristic of the adolescent (an adolescent who tends to be consistently bonded to school is more likely to perceive great risk of substance use) rather than within person changes (as school bonding decreases beliefs about the potential risks also decrease). Raudenbush and Bryk (2002) recommend adding the aggregated mean of the time varying covariate to the level two equation in order to disentangle the within persons effect from the between persons effect. They refer to this level two effect as the compositional or contextual effect and define it as an effect that occurs when the mean of a level one time-varying covariate across time affects the dependent variable after adjusting for the effect of the time-varying covariate. Given two students who, at a certain point in time, demonstrate the same level of school bonding, the student with a higher average level of school bonding across all measurement occasions will perceive greater risk (or less perceived risk if the result is contrary to the proposed hypothesis) if a contextual effect is present. As such, the aggregated mean of school bonding (the mean level of school bonding across all measurement occasions) was included as a level two predictor, along with age and gender (gender was coded as 1 for boys and 0 for girls). Age and gender were also specified as predictors of the slope for time. All three level two predictors were grand mean centered. The following equations represented the level two model.

$$\pi_{0j} = \beta_{00} + \beta_{01}(\text{bond}_j - \overline{\text{bond}}) + \beta_{02}(\text{age}_j - \overline{\text{age}})$$
$$+ \beta_{03}(\text{gender}_j - \overline{\text{gender}}) + u_{0j}$$
$$\pi_{1j} = \beta_{10} + \beta_{11}(\text{age}_j - \overline{\text{age}})$$

$$+ \beta_{12}(\text{gender}_j - \overline{\text{gender}}) + u_{1j}$$

$$\pi_{2j} = \beta_{20} + u_{2j}$$

The combination of the level one and level two equations allowed us to examine both the within persons and contextual effect of school bonding after controlling for the effects of time, gender, and age. By substituting the level two models into the level one model, it becomes apparent that we also examined two interactions, including age by time and gender by time. These interactions assessed the extent to which age and gender influenced the rate of change in perceived risk over time.

In order to obtain unbiased and efficient parameter estimates in the presence of missing data, multiple imputation was first performed. The imputations were created using SAS, Version 9.0. In total, 10 imputed sets were created and analyzed. All analyses were performed on each of the imputed data sets and the parameter estimates were then combined using the procedures outlined by Rubin (1987). As a result of performing the multiple imputations, each of the combined estimates had a number of degrees of freedom associated with it. The degrees of freedom varied across estimates, representing the rate of missing information for each estimate. The number of degrees of freedom was then used to determine the correct p-value for the significance tests.

RESULTS

The Mediation Model

We began by assessing the direct effect (after adjusting for age, gender, and baseline measures of substance use) of school bonding at Time 2 on cigarette, alcohol, and marijuana use at Time 4 in three separate structural equation models. The average amount of time that elapsed between Time 2 and Time 4 was 13 months (ranging from a low of 10 months and a high of 15 months). Based on these models, the direct effect of school bonding is negatively associated with use of cigarettes (standardized $\beta = -.112$, $p < .05$), alcohol ($\beta = -.157$, $p < .01$), and marijuana ($\beta = -.141$, $p < .01$). Figure 1 presents a descriptive view of these relationships. In order to clearly depict the relationship, we categorized school bonding at Time 2 into four categories ranging from not at all bonded to school to very well bonded to school (in accordance with the original scaling of the individual items). We then calculated the percentage of students in each school bonding category who had ever used cigarettes, alcohol, and marijuana at T4. The chart further elucidates the findings of the direct effect structural equation models, suggesting that bonding to school is informative of subsequent substance use.
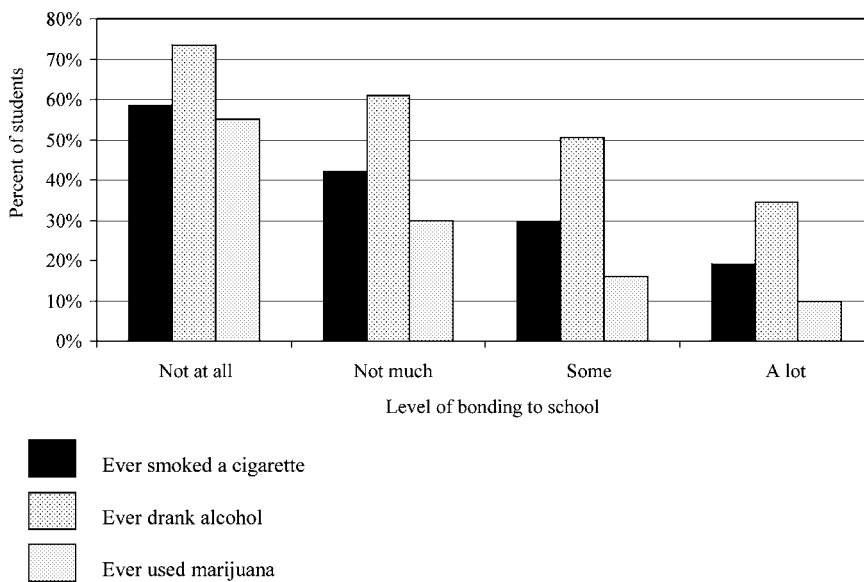

Fig. 1. Percent of students who have tried substances as a function of school bonding. Note: School bonding was measured in 6th or 7th grade and substance use was measured approximately 1 year later in 7th or 8th grade.
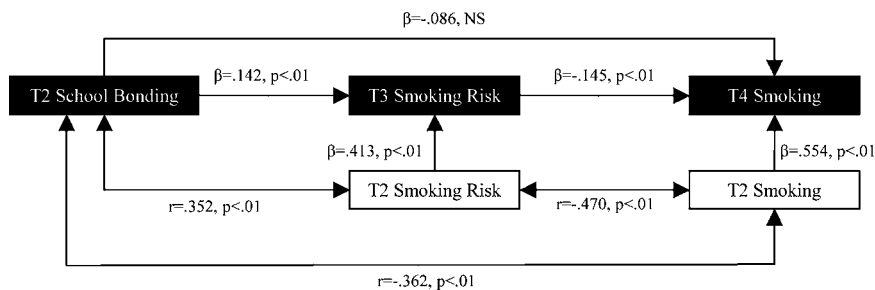
Fig. 2. Mediation model of the relationship between school bonding and cigarette use. Note: Age and gender were specified to predict T3 smoking risk and T4 smoking but were not displayed in order to present a less cluttered model. Neither age nor gender significantly predicted T4 smoking ($p < .05$); however, age did predict T3 smoking risk ($\beta = -.115, p < .01$). All estimates are standardized. Fit indices: $X^2(60) = 104.847, p < .01$, CFI $= .990$, RMSEA $= .026$.

With the direct effects established, the full mediation models were next specified. Each of the models fit the data well. The fit indices for each model along with the parameter estimates are reported in Figs. 2–4. The standardized factor loadings of the school bonding items were .753, .760, .877 and .753 in the cigarette model. Similar loadings for school bonding were observed in the alcohol model (.805, .701, .825, .804) and the marijuana model (.735, .770, .901, .737). Perceived risk of cigarette, alcohol, and marijuana use on future aspirations scales also demonstrated strong factor loadings (cigarettes: .951, .970, .943 at T2 and .945, .981, .975 at T3; alcohol: .936, .977, .951 at T2 and .925, .997, .962 at T3; marijuana: .858, .976, .949 at T2 and .915, .975, .958 at T3).

As demonstrated by the parameter estimates, school bonding is positively associated with beliefs about the perceived risk of cigarette, alcohol, and marijuana use on future aspirations. That is, adolescents who are more strongly

bonded to school are also more likely to perceive that substance use could impede their future success.

Believing that substance use may impede future aspirations is negatively associated with subsequent use of cigarettes, alcohol, and marijuana. In addition, the direct effect of school bonding on substance is reduced for use of all three substances as compared to the models without the mediator. The Sobel test (1982) was utilized to statistically assess the ability of perceived risks to mediate the relationship between school bonding and subsequent substance use. The estimates suggest that belief in the potential risk of cigarette use ($t = -2.14, p < .05$), alcohol use ($t = -2.37, p < .05$), and marijuana use ($t = -2.22, p < .05$) are all significant mediators of the relationship between school bonding and subsequent substance use. That is, perceived risk of substance use helps to explain why school bonding predicts subsequent substance use.
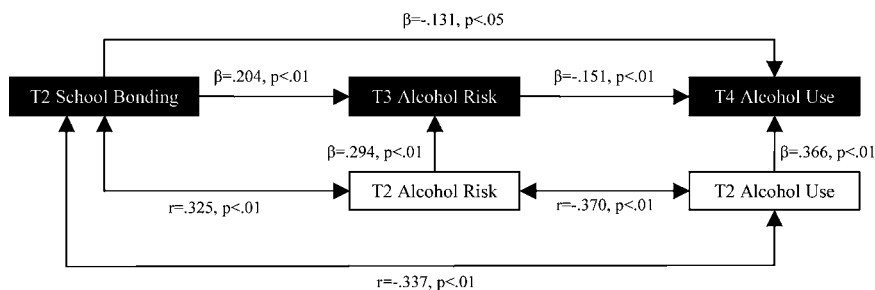

Fig. 3. Mediation model of the relationship between school bonding and alcohol use. Note: Age and gender were specified to predict T3 alcohol risk and T4 alcohol use but were not displayed in order to present a less cluttered model. Neither age nor gender significantly predicted T4 alcohol use ($p < .05$); however, age did predict T3 alcohol risk ($\beta = -.129, p < .01$). All estimates are standardized. Fit indices: $X^2(60) = 122.072, p < .01$, CFI $= .985$, RMSEA $= .031$.
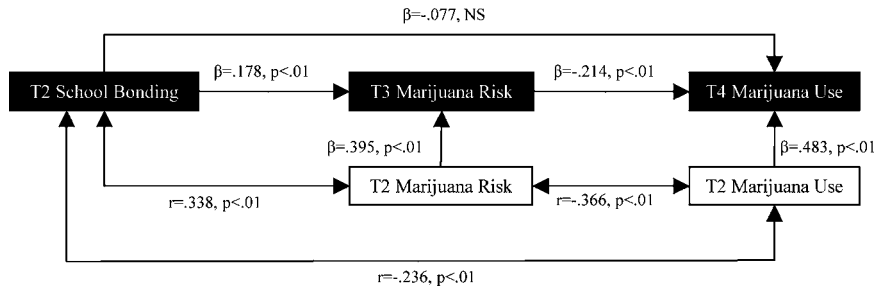
Fig. 4. Mediation model of the relationship between school bonding and marijuana use. Note: Age and gender were specified to predict T3 marijuana risk and T4 marijuana use but were not displayed in order to present a less cluttered model. Neither age nor gender significantly predicted T4 marijuana use ($p < .05$); however, age did predict T3 marijuana risk ($\beta = -.102$, $p < .01$). All estimates are standardized. Fit indices: $X^2(60) = 91.657$, $p < .01$, CFI = .990, RMSEA = .022.

The Intraindividual Variability of School Bonding

With the mediation model established, we turned our efforts towards a more in-depth understanding of the intraindividual variability of school bonding and its effect on students' beliefs about the potential risk of cigarettes, alcohol, and marijuana use. The results of the random-coefficient models are presented in Table 1. Three separate models were specified, one for each of the dependent variables. As evidenced by the large intercept values reported in Table 1, students do perceive that substance use will negatively impact their future. As expected, the average student associates less potential risk with cigarette and alcohol use than marijuana use.

Time is a significant predictor of change in beliefs about the potential deleterious effects of alcohol and marijuana use. The negative coefficients indicate that, after adjusting for the other covariates in the model, students perceive less risk as they grow older. Because of the centering of time, the main effects of age and gender represent the effect of these variables on perceived risk at the mid-point between the first and last measurement occasion. While girls on average tend to perceive less risk of cigarette smoking than boys at this point in time, the interaction of time with gender was not significant for cigarette, alcohol, or marijuana risk. That is, both boys and girls' tend to associate less risk with substance use as they grow older. It should be noted that a trend exists for the gender by time interaction for alcohol, suggesting that boys may maintain their perception that alcohol will have harmful effects over time more so than girls. Older students on average tend to perceive less risk of all three substances at the mid-point be-

tween the first and last measurement occasions, and the marginally significant time by age interactions for alcohol and marijuana indicate that the rate of change demonstrates a sharper decline among older students.

Both the within persons and contextual effect of school bonding is a significant predictor of perceived risk of cigarettes, alcohol, and marijuana. After adjusting for change in perceived risk over time, an *individual's* mean score on school bonding was predictive of perceived risk. That is, students who are characterized by a consistently lower level of school bonding are less likely to believe that substance use will have deleterious effects on their future. Furthermore, *as a student becomes less well bonded to school* his/her belief that substance use will affect future aspirations also decreases.

In a separate model we assessed the extent to which gender and age affected both the contextual effect of school bonding (the average level of school bonding across all measurement occasions) and the within persons effect of school bonding. None of these interactions was significant in any of the models, indicating that the effect of school bonding on perceived risk is similar for students of different age, and among boys and girls.

DISCUSSION

Consistent with our hypothesis, beliefs about the risks of substance use on future aspirations is a significant mediator of the relationship between school bonding and subsequent substance use. That is, adolescents' perceptions about the risks associated with substance use on future aspirations explain part of

Table 1. Random-Coefficient Regression Models of Perceived Risk of Substance Use

DV: perceived risk	Fixed effects			Random effects		
	Coef.	t	p-value	Var.	t	p-value
Cigarette use						
Intercept	3.444	173.55	<.0001	0.234	13.53	<.0001
Time	−0.023	−0.93	0.3533	0.147	4.57	<.0001
School bonding (within persons)	0.198	6.60	<.0001	0.104	5.72	<.0001
Mean school bonding (contextual)	0.194	4.47	<.0001			
Age	−0.151	−5.12	<.0001			
Gender	0.142	3.63	0.0003			
Time × age	−0.040	−1.18	0.2385			
Time × gender	0.070	1.44	0.1522			
r_{ij}				0.406	25.48	<.0001
Alcohol use						
Intercept	3.446	186.96	<.0001	0.196	11.38	<.0001
Time	−0.104	−4.04	<.0001	0.169	5.18	<.0001
School bonding (within persons)	0.167	5.01	<.0001	0.096	5.50	<.0001
Mean school bonding (contextual)	0.202	4.65	<.0001			
Age	−0.146	−5.33	<.0001			
Gender	0.062	1.61	0.1075			
Time × age	−0.077	−2.18	0.0313			
Time × gender	0.095	1.91	0.0570			
r_{ij}				0.421	22.87	<.0001
Marijuana use						
Intercept	3.612	221.35	<.0001	0.146	10.45	<.0001
Time	−0.088	−4.32	<.0001	0.113	4.77	<.0001
School bonding (within persons)	0.144	5.57	<.0001	0.128	7.94	<.0001
Mean school bonding (contextual)	0.149	4.09	<.0001			
Age	−0.106	−4.46	<.0001			
Gender	−0.002	−0.07	0.9481			
Time × age	−0.064	−2.01	0.0476			
Time × gender	0.035	0.79	0.4335			
r_{ij}				0.320	21.62	<.0001

Note. The p-value is determined by the degrees of freedom and (due to the use of multiple imputation) varies as a function of the rate of missing information.

the reason why poor school bonding predicts subsequent substance use. With the mediational effect established, the analyses next focused on describing the intraindividual variability of school bonding and its effect on the students' beliefs about perceived risk of substance use over time. Our results suggest that students who are characterized by a consistently poor bond to school are less likely to perceive that substance use will have deleterious effects on the attainment of their future goals. In addition, a strong intraindividual effect of school bonding also exists, indicating that as students become more or less bonded to school his/her belief that substance use may harm his/her future also changes in a similar fashion. These findings persist across all three substances.

Although very little research has been conducted to understand the dynamic relationship between school bonding and perceived risk of substance use on future aspirations, previous research regarding the reciprocal relationship of academic performance and substance use has been put forth. Hawkins and Weis's (1985) social development model suggests that academic failure leads to a weakened commitment to school which in turn increases the likelihood for association with delinquent peers and thus substance use. Similarly, primary socialization theory (Oetting & Donnermeyer, 1998) posits that poor bonding to school is a risk factor for all types of deviance (including substance use) and suggests that bonding with deviant peers mediates the relationship. Jessor and Jessor's (1977) problem behavior theory offers a third explanation for the relationship between substance use and school bonding, considering both poor academic achievement and substance use as indicators of problem behavior.

Finally, Eccles' (1983) expectancy-value model illustrates the saliency of considering adolescents' expectations of a certain outcome as a function of a certain course of action and the value of the outcome. Under this framework, one might posit that adolescents who are poorly bonded to school place less value on academic achievement and long-term academic success and, as a result, are less concerned about jeopardizing their lives through engagement in problem behaviors such as substance use.

Although future research would be needed to test specific hypotheses, we may extrapolate from these theories to hypothesize both within person and between person mechanisms by which school bonding affects one's perceptions of the potential deleterious effects of substance use. First, consider within persons mechanisms. Guided by the social development model and primary socialization theory, we may hypothesize that, within an individual, reduction in school bonding increases the likelihood that a student will begin to associate with delinquent peers (Hawkins & Weis, 1985; Oetting & Donnermeyer, 1998). The attitudes of the delinquent peers may in turn lead to deterioration of an adolescent's strong convictions about the dangers of substance use. Based on Eccles' expectancy-value model, we might hypothesize that as school bonding changes, apathy and level of concern about future aspirations also changes. As a result, adolescents may become more willing to engage in behaviors that could jeopardize their future. Now, we may turn to between person mechanisms. Lead by theories pertaining to the generality of deviance, we may hypothesize that adolescents who tend to be less well bonded to school are characterized by a problem behavior syndrome. These adolescents may believe that substance use will not have long-term negative effects on future plans and/or that any potential negative effects are not of particular concern. In summary, there are strong, theoretically based arguments for the mechanism by which school bonding may affect student's perception of whether or not substance use may jeopardize the achievement of their future goals.

Although the effect of school bonding persists across all three substances, it is interesting to note that the strongest within persons effect exists for cigarette smoking. Corroborating this trend, Newcomb *et al.* (2002) recently noted that tobacco use appears to have a unique impact (over other types of deviance including alcohol and illicit drug use) on poor school achievement and high school failure. Newcomb (1987) and Newcomb and Bentler

(1988a,b) and Ellickson *et al.* (1998) have illustrated the critical role of cigarette smoking in early adolescence in long-term problems throughout adolescence and into young adulthood. They stress the importance of future research aimed at understanding why cigarette smoking appears to be a more robust predictor of undesirable outcomes than other types of substance use. It is of interest then that our results suggest a particularly salient relationship between changes in school bonding and reciprocal changes in perceived risk of cigarette smoking.

Implications for Prevention

Najaka *et al.* (2002) recently utilized a meta-analytic approach to examine the effects of prevention initiatives aimed at modifying risk factors (including school bonding) on problem behavior. Although problem behavior included many different types of behaviors, substance use was among the variables considered. Across 20 prevention trials, they reported a strong positive association between improved school bonding and decreased levels of problem behavior. Furthermore, among the three risk factors assessed (school bonding, academic achievement, and social competency), the effect of improved school bonding on problem behavior was most robust.

The consistent relationship between improved school bonding and decreased incidence of problem behavior is encouraging and interventions designed to prevent and/or reduce substance use should include mechanisms to improve students' attachment to school. Indeed, many excellent evidenced-based programs designed to improve school bonding already exist. For example, the Positive Action program (see Flay & Ordway, 1999) utilizes a holistic approach to reorganize schools, affect positive change in school climate, improve teacher–student relationships, foster parental involvement, enhance instructional practices, and develop the self concepts of students, teachers, and parents alike. Similarly, the Child Development Project (Battistich *et al.*, 1996) is a comprehensive educational reform model that aims to transform schools into caring communities through the enhancement of protective factors (including school bonding) and limitation of risk factors across the individual and ecological contexts. Other programs, including Reconnecting Youth (Eggert *et al.*, 1994) and Creating Lasting Connections (Strader *et al.*, 2000) identify at-risk

youth and provide comprehensive and intensive interventions aimed at improving students' bonding to school. It is likely that these and other similar programs may have an impact on substance use partially because they are able to improve the school bond.

Summary

The results presented in this manuscript corroborate past research that has identified school bonding as an important protective factor. Furthermore, it adds to the research by considering intraindividual change in school bonding over time and examining its impact on students' beliefs about the deleterious effects of substance use on future aspirations. Our results suggest that school bonding has both an interindividual and intraindividual effect on perceived risk. That is, students who are poorly bonded to school are less likely to perceive that substance use will have deleterious effects on their future. In addition, as bonding to school changes within a student, perceived risk of substance use also changes in a similar fashion. By implementing on-going school-based programs that foster strong school bonds, adolescents may be more likely to perceive that substance use will impact the attainment of future goals, and as a result, may be less likely to abuse substances.

Limitations

Although this study adds to the literature in several important ways, it is important to recognize its limitations. The sample of youth comprised eight middle or junior high schools. While the districts were widely separated geographically, they were not sampled randomly. Rather, they were restricted to non-metropolitan school districts; therefore, there is no basis for statistical generalization to a US population. In addition, while levels of participation in the longitudinal study were reasonably high and study mortality across the 2 years of the study reasonably low, students did self-select as participants.

The study is also limited in that it only considered school bonding as it pertained to liking for school and teachers. That is, it did not address other facets of school bonding, including commitment to school, adherence to conventional/prosocial norms of the school, or attachment to prosocial peers at school. The intraindividual effect of these other types of school bonding on perceived risk of substance use is an important consideration for future research.

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