IMPACT OF PEER SUBSTANCE USE

ON MIDDLE SCHOOL PERFORMANCE IN

WASHINGTON

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ABSTRACT

This study examined the influence of peer substance use on school performance by 7th grade students in Washington State. We conducted multivariate analyses which considered the independent effects of substance use, gender, and race-ethnic group on school performance scores, as well as examines the ways that community, school, and peer variables relate to each other and to peer harmful substance use and how peer harmful substance use relates to academic achievement. We found a strong negative effect of peer substance use on school performance as measured by the state assessment at the middle school level, where peer substance use is relatively low.

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INTRODUCTION

Many adolescents in the United States and Washington experiment with alcohol or tobacco at least once before completing high school. Although experimenting with alcohol and tobacco during adolescence is typical, many of those who experiment become regular users. Previous research has shown that drug use increases throughout high school and peaks in the late teens. Data from the Washington State Survey of Adolescent Health Behaviors (WSSAHB) shows that the percentage of students reporting cigarette, marijuana, or alcohol use increases throughout adolescence. By 12th grade, more than 25 percent of the students report that they have recently smoked, used marijuana, or had 5 or more alcoholic drinks at one time. According to Brandon (1999), 1 in 10 high school students reports using alcohol on a regular basis (at least 6 times in the last month); 1 in 9 reports using marijuana on a regular basis. One to 2 percent report frequent (more than twice in the last month) use of cocaine or inhalants.

Review of selected prior studies show an inverse relationship between academic achievement and substance use among adolescents. This relationship appears to be bidirectional. Some studies have indicated that school difficulties contribute to substance use (Allison, 1992; Hawkins et al., 1992); others show that early substance use may contribute to school difficulties (Schulenberg et al., 1994; Galambos and Silbereisen, 1987).

Many factors influence the academic achievement of students. Personal characteristics such as gender and ethnicity are related to test scores. For instance, Greg Weeks' (1999) study of student performance on standardized tests in Washington indicates that gender is significantly associated with academic achievement. Thus, being a female is associated with a 4 and 7 percentile point increase on the Battery Test scores for 4th and 8th grade students in Washington, respectively. Weeks also notes that "except Asian Americans, minority status is associated with lower percentile test scores compared to white students" (Weeks, 1999: 4).

Factors external to the education environment, such as the home and community, exert a great influence on student learning. Studies have shown that factors external to the educational environment, such as parent education and family income, have the strongest influence on student performance. For example, Grissmer and his associates (1994) found that family income, parental education, age of mother at child's birth, and number of siblings all have statistically significant effects on student achievement. Weeks' (1999) findings also indicate a positive relationship between test scores and mother's education.

In sum, the Joint Legislative Audit and Review Committee (1999) found that districts and schools with students from families with lower socioeconomic status, lower parent education, limited English proficiency, and higher mobility have lower student performance. Conversely, districts and schools with higher student performance have fewer families with low-income students, greater levels of students with higher parent education levels and English proficiency, and less mobility.

Studies have also found that individual family poverty, as indicated by participation in the federal free/reduced-price lunch program, has a small, independent negative effect on academic achievement. According to Caldas and Bankston (1994), an individual's family social status has an even greater positive effect on academic achievement. The authors note that "the effect of schoolmates' family social status on achievement is significant and substantial, and only slightly smaller than an individual's own family background status" (Caldas and Bankston, 1994: 275.) That is, independent of his or her own socioeconomic background, a student's academic achievement tends to increase when he or she attends school with classmates from higher socioeconomic backgrounds. On the other hand, a student from a privileged background may be disadvantaged by attending a school with many poor students.

In addition to personal characteristics and external factors, various education-related factors also affect student performance. The Joint Legislative Audit and Review Committee's study[1] (1999) found that higher levels of teacher education and experience are associated with higher test scores. They also found that smaller student-teacher ratio is associated with higher student test scores at the elementary and middle school levels, but has little effect at the high school level. Smaller schools are associated with higher test scores in the primary grades; however, this relationship does not hold for high schools. Larger schools are associated with higher test scores in high schools, but the relationship between school size and test scores are mixed for middle schools.[2] District spending patterns had little or no effect on student scores.

Studies have also shown that peer groups have significant impact on behavior and attitudes (Hops et al., 1999; Dishion et al., 1995; Evan et al., 1992; Galambos et al., 1992). Because adolescents spend many of their waking hours together, the peer group has been generally identified as one of the most important influences on individual achievement. Peer group drug use has been found to be strongly correlated with increased adolescent drug use and decreased academic achievement. In their study, Caldas and Bankston (1997) reported that substance abuse within one's peer group is one of the strongest predictors of individual substance abuse and academic achievement. In fact, peers may exert more powerful influence on substance use than parents. For example, Jessor and his colleagues (1980) noted that frequent users of marijuana have a greater orientation towards their friends than parents. Similarly, Swadli (1989) found that 24 percent of solvent and/or illicit drug users compared to 3 percent of the nonusers report that their best friend used "drugs."

This study has two components. The first examines the relationship of substance use to school performance and explores other factors affecting school performance. The second examines the ways that community variables (poverty, size of community, community instability/disorganization), school variables (poverty level in school, size of school, pro-social opportunities in the school), and peer variables (negative and positive peer attributes and behaviors) relate to each other and to harmful substance use.

DATA AND METHODS

Our analysis of the effect of peer, social, and school factors on substance use and test scores is based on data from two sources collected for the same schools for the same cohorts of students in 1998 and 1999. The Washington State Survey of Adolescent Health Behaviors (WSSAHB) was administered in Spring 1998 to 6th, 8th, 10th, and 12th graders in Washington state; criterion-referenced test scores were determined by the Washington Assessment of Student Learning (WASL) for 7th grade students in 1999. Because the standardized tests are given at different times and individual-level matching of the two databases at the student level was not possible, we took the approach of matching at the school peer group level.

A database was constructed, containing building-level data (mean responses on the WSSAHB items/scales of all students in that peer group at that school) from the 1998 WSSAHB for 6th graders and the 1999 WASL for 7th graders in schools that have both 6th and 7th grade of the same gender and race/ethnic group in the same building. Additional school demographic and resource data were included in the same database. To assure confidentiality and statistical stability, school-level data from the AHS were only included when there were more than 30 responses.

Our database incorporates individual-level test scores, linked to variables about the conditions in school districts and buildings. It also includes school resource variables, such as level of spending per student in district, percent of minority students, school size, percent of students on free/reduced lunch programs, student/teacher ratio, and community status variables, such as city size and child poverty in the relevant school district. In addition, the database includes the means of harmful substance use by peer[3] groups and various risk and protective factors, such as attitudes favoring antisocial behavior, early antisocial behavior, and opportunities to participate in school activities. These risk and protective factors were developed by Developmental Research and Programs, Inc. A technical report about the scale construction by RMC Research Corporation is referenced in the Appendix.

Description of variables

Table 1 displays the definitions and measurements for all variables used in this research; Table 2 presents the descriptive statistics. The seven background variables in our path model include school size, levels of spending per student in district, percent of minority students, percent of students on free/reduced lunch programs, student/teacher ratio, city size and district poverty. In our sample, about one in four (24.5%) students is a member of a minority group. On average, the schools in our sample are larger than average, and the district's average yearly expenditure per student is $5,773. While the state's student/teacher ratio is 20 to 1, the student/teacher ratio in our sample is 17 to 1. Approximately 13 percent of the children (ages 5 to 17) in the district live in poverty; about 1 in 3 participates in a free/reduced lunch program.

Research has shown that characteristics of the individual, family, school, and community have an influence on negative behaviors, such as violence, alcohol, tobacco, and drug use. Researchers have categorized these characteristics as either risk or protective factors in four domains: community, family, school, and peer/individual. The risk and protective factors reflect students' perceptions about their school and community environment as reflected by responses on the AHS, rather than some external measures of environmental conditions. While less "objective," their perceptual measures are directly linked to students. These factor scores are means for relevant school/peer group.

Our path model includes 4 risk and 2 protective factors from the community, school, and peer/individual domains. These risk and protective scales were constructed using standard Likert scaling practice. For risk scale items, a higher factor score means an undesirable attitude or condition. For protective scale items, a high value reflects a desirable attitude or condition. Except for one of the scales in the community domain, the Cronbach's Alpha, which calculates the internal consistency reliabilities, indicates that the scales are quite reliable. The community transition/mobility scale is composed of only one item; therefore, its internal consistency reliability could not be calculated. Table 3 presents the risk and protective scales used in this research.

Table 1: Definition of Variables

Variable name on paths	Source	Measurement
Poverty in district	US Census Bureau School district files	Percentage of 5 to 17 years old living in poverty
City size	WA Office of Financial Management	Total population within city boundaries
Percent of students in school free/reduced lunch	OSPI	Percent of school's student body receiving free or reduced lunch
School size	OSPI	October enrollment count, 1997-98
Student/teacher ratio in building	OSPI	Number of students divided by FTE for instructional personnel
Dollars per student in district	OSPI	Dollars expended per student in district
Percent of minority students	OSPI	Percent of enrolled students who are Asian, Hispanic, Native American, Black or "Other"
Community disorganization	AHS: factor from Risk 12	Factor score: higher scores mean higher levels of disorganization
Community transition/mobility	AHS: factors from Risk17	Factor score: higher scores mean higher levels of community/individual mobility
Opportunities for prosocial involvement	AHS: factors from Risk18	Factor score: higher scores mean higher levels of prosocial support in school
Attitudes favoring antisocial behavior	AHS: factors from Risk44	Factor score: higher scores mean higher level of attitudes favoring antisocial behavior in school
Early antisocial behavior	AHS: factors from Risk42	Factor score: higher scores mean higher level of early antisocial behavior
Positive social skills	AHS: factors from Risk51	Factor score: higher scores mean higher levels of positive student traits
Harmful substance use	Mean alcohol and drug use computed	Mean of scale scores, where higher score means more substance use
Math score	Mean of individual WASL math scale scores	Mean scale score for individuals
Reading score	Mean of individual WASL reading scale scores	Mean scale score for individuals

Table 2: Descriptive Statistics of Variables

	N	Minimum	Maximum	Mean	Standard Deviation
% students on free/reduced lunch in school	57	6.6	85.5	33.1	20.8
Percent of minority students in school	57	2.4	73.8	24.5	17.6
School size	57	167	1109	610.5	218.9
District yearly expenditure per student	57	4759	6717	$5,773	$501
Student/teacher ratio in school	56	11.3	21.8	16.8	2.6
Percent of children 5-17 in poverty in district	58	3.8%	25.3%	12.8	5.4%
City size	57	99	185,600	46,413	61,565
Community disorganization (Mean 12)	55	.13	1.02	.4878	.1704
Community transition/mobility (Mean 17)	56	.57	1.61	1.1001	.1524
Opportunities for prosocial involvement (Mean 18)	55	1.65	2.57	2.0800	.2056
Attitudes favoring antisocial behavior (Mean 44)	55	.1	.92	.3988	.1275
Early antisocial behavior (Mean 42)	56	.39	2.04	1.0271	.3601
Positive social skills (Mean 51)	53	1.84	2.55	2.2027	.1485
Average alcohol use score	58	1.31	1.85	1.55	.13
Average drug use score	58	1.07	1.54	1.24	.11
Average harmful substance use score	58	1.19	1.67	1.40	.08
Individual math scale score	9950	148	609	360.4	20.3
Individual reading scale score	9826	297	475	391.5	7.4
Male	56	44.0	56.7	50.9	2.5
Female	56	43.3	56.0	49.1	2.5
Asian	58	00.0	27.0	7.2	6.7
Native	58	00.1	23.4	2.6	4.1
Black	58	00.0	37.7	6.0	9.1
Hispanic	58	00.5	65.8	9.1	12.4
Caucasian	58	25.8	97.1	75.1	17.9

Table 3: Characteristics of Risk and Protective Factor Scales

Scale	Name	Type	No. of items	Alpha
Community Factors				
Community disorganization	Risk12	Risk	5	.8
Community transition and mobility	Risk 17	Risk	1	na
School Factor				
Opportunities for prosocial involvement	Risk33	Protective	5	.63
Peer/Individual Factors				
Early antisocial behavior	Risk42	Risk	8	.75
Attitudes favoring antisocial behavior	Risk44	Risk	5	.83
Social skills	Risk51	Protective	4	.62

Source: Development Research and Programs, Inc., 1999

Because the environment of a student is an important influence on behavior, we included two risk factors from the community domain: community disorganization and community transition and mobility. Community disorganization focuses on the extent to which people in the community take part in important decisions or processes that affect their lives. This scale was measured from the responses of five items:

- Crime and/or drug selling in neighborhood
- Fights in neighborhood
- Lots of empty or abandoned buildings in neighborhood
- Lots of graffiti in neighborhood
- Feel safe in neighborhood

Thus, a higher factor score means higher level of disorganization. Similarly, community transition and mobility focuses on the degree of mobility observed in the neighborhood. This scale was constructed from the responses of only one item: people often move in and out of the neighborhood. Thus, a higher factor score means higher level of community/individual mobility.

School also plays an important role in the lives of adolescents. In the school domain, we included a protective factor: opportunities for prosocial involvement. This factor scale measures the opportunities that students were given to involve themselves in meaningful school activities. This scale was determined from the responses of five items:

- Ample opportunity to help decide class activities and rules
- Ample opportunity to talk with a teacher one-on-one
- Teacher asks students to work on special classroom projects
- Ample opportunity to get involved in sports, clubs, and other activities outside of class.
- Ample opportunity to be part of class discussions or activities

Thus, a higher score means higher level of prosocial support in the students' peer groups.

Attitudes and behavior are also important. In our model, we included two risk and one protective factor from the peer/individual domain: early antisocial behavior, attitudes favoring antisocial behavior, and social skills.

Research shows that early use of alcohol, tobacco, illegal drugs or engaging in violent behavior often leads to antisocial behavior in adolescence. The early initiation of antisocial behavior scale focuses on the initiation of antisocial behavior among adolescents. This level was determined from the responses of eight items.

- Age when the student first smoked marijuana.
- Age when the student first smoked, even just a puff.
- Age when the student first had more than a sip or two of beer, wine, or hard liquor.
- Age when the student first began drinking alcoholic beverages regularly, that is, at least once or twice a month.
- Age when the student first was suspended from school.
- Age when the student first was arrested.
- Age when the student first carried a handgun
- Age when the student first attacked someone with the idea of seriously harming them.

Thus, a higher factor score on this scale means higher level of antisocial behavior at an early age. For our study, which uses the mean of each of those scales for students' relevant school/peer group, the scales reflect the average level of early antisocial behavior among peers. In a similar vein, the attitudes favorable toward antisocial behavior scale measures the accepting and condoning attitudes toward antisocial behavior by young people. This scale was determined from the responses of five items:

- Believe that it's wrong for a student to take a handgun to school
- Believe that it's wrong to steal anything worth more than $5
- Believe it's wrong to pick a fight with someone
- Believe it's wrong to attack someone with the idea of seriously harming them
- Believe it's wrong to stay away from school all day when their parents think they are at school.

Thus, a higher factor score on this scale means higher average level of attitudes favoring antisocial behavior among peers in the students' school. Lastly, the protective factor, social skill, measures the average level of competence and ability to engage in positive interpersonal relations with their peers. This level was determined from the responses to four items:

- What would the student do if he witnesses his friend stealing a CD in a music store?
- What would the student do if he wants to go to a friend's house to "hang out" but his mother forbids him to do so?
- What would the student do if another kid deliberately picks a fight?
- What would the student do if his friend offers him an alcoholic drink?

These risk and protective factors serve as intervening variables between the background variables, peer use of harmful substances, and academic achievement. Thus, these risk and protective factors were hypothesized to predict peer harmful use of substances.

In our model, one of the most important predictors of math and reading scale scores is peer use of harmful substances. Peer use of harmful substances is a combined alcohol and drug variable with an ordinal scale. Thus, a student who has not used a substance at all was coded as "1", a student with prior drug use was coded as "2"; "3" indicates recent use of harmful substance, and "4" indicates frequent use. The mean for all students in the school/peer group was calculated. The range of the mean peer harmful substance use variable ranges from 1.12 to 1.73 with a standard deviation for every peer group. In our analysis, we recomputed the scale so that "no use" equals 0, "some drug/alcohol use but not in the past 30 days" equals 1, "substance use at least once in the past 30 days" equals 2, and "frequent use" equals 3. The new range in the peer harmful substance use ranges from .12 to .73. Thus, no peer group was in a situation where, on average, all the peers had used drugs and/or alcohol.

The dependent variable in our analyses is the 1999 WASL test scores for 7th graders. The WASL tests are criterion-referenced, measuring the degree to which students have learned the target skills identified as appropriate for a given grade or developmental level. The state currently tests all students in grades 4, 7, and 10 in reading, math, listening, and writing. In 1998, the tests were only administered at grades 4 and 7, which is why we have not included 10th graders in our analysis. In this study, we considered only the reading and math scores.

Table 4 presents the reading and math scale scores by ranges and levels. The reading scores range from 297-475, and the WASL math scores range from 148-609. The difference between the average student at reading level 2 (not meeting standard) and level 3 (meeting standard) is 18 points, while the difference between an average student at math level 2 (not meeting standard) and level 3 (meeting standard) is 27 points. The cut-off points on the scores at different levels are important, because our model predicts that drug use by peers in a school could easily drop a student below the cut-off point for passing the standard, thus affecting the school's standing on the WASL tests.

Table 4: Reading and math scale scores by ranges and levels
(Levels 1 & 2: Below Standard; Level 3: Meets Standard; Level 4: Exceeds Standard)

Reading Scale Score	**Ranges**	**Mean**	**S.D.**	**N**
Level 1	297-374	361.42	10.96	12,170
Level 2	375-399	387.45	6.58	29,222
Level 3	400-414	405.23	4.12	20,213
Level 4	415-475	423.27	9.02	10,205
Total		393.17	20.20	71,810
Math Scale Score				
Level 1	148-374	329.61	33.49	41,617
Level 2	375-399	385.53	7.20	12,961
Level 3	400-429	412.29	8.81	10,294
Level 4	430-609	455.22	24.28	7,726
Total		364.68	51.99	72,598

Table 5 (following page) shows that our matching produced a sample of schools whose demographics are similar to the overall distribution in the state. Schools are somewhat larger than average, due to the 30 response criterion. The level of substance use is lower; and we did not observe any peer group where, on average, most peers have used drugs and/or alcohol. Compared to the overall distribution in the state, the percentage of students meeting math and reading standards is slightly higher, but mean test scores slightly lower, than the average in our sample. We are therefore reporting on the impact of substance use on school performance in schools with relatively lower use and performance scores; our results are likely to be conservative estimates.

Table 5: Buildings analyzed in DASA School Performance Project

Characteristics	6th/7th			
School buildings tested by WSSAHB	183			
School buildings matched to test results	57			
Total building enrollment	34,448			
Total 6th grade students in 1998 (WSSAHB)	7,954			
Total 7th grade students in 1999 (WASL)	10,000			
	Sample		**Washington Population**	
	Mean	***S.D.***	***Mean***	***S.D.***
Building enrollment	610.5	218.9	482.67	357.75
Percent free/reduced lunch	33.7	21.1	31.4	
Percent minority students	24.5	17.6	24.4	21.6
District yearly expenditure per student	$5,773	$501	$5,877	$1,200
Percent of children 5-17 in poverty	12.8	5.4	14.3	7.3
Average alcohol use score**(1=Never used; 2=Prior use; 3=Recent use; 4=Frequent use)*	1.55	.13	2.02	.96
Average drug use score* (*1=Never used; 2=Prior use; 3=Recent use; 4=Frequent use)*	1.24	.11	1.61	.93
Math scale score **	360.4	20.3	372.5	48.0
Reading scale score**	391.5	7.4	396.5	18.0
Percent meeting math standard	22.5	12%	21.6	14.5
Percent meeting reading standard	39	14.3	36.5	18.2

* Average alcohol and drug use are for all 6th grades including in the 1998 sample; WASL scores are for all 7th grades in 1999.

** Individual level scores

Methodology

The methods of statistical analysis used in this study are multiple linear regression and hierarchical multiple regression within the framework of path analysis.[4] Dozens of variables were available to explain the linkages between substance use and academic achievement. The specific variables used in the final path models were chosen because of their ability to explain academic achievement in previous research. Regression/path models cannot ultimately determine causality. However, we have specified variables and paths with a strong theoretical and research base suggesting causality.

The conceptual path model includes intervening variables (opportunities for pro-social involvement, attitudes favoring antisocial behavior, early antisocial behavior, community disorganization, community transition/mobility, harmful substance use) between the background variables (district spending, student/teacher ratio, poverty in community, city size, individual family poverty, school size, and percent of minority students in school building) and academic achievement.

Path analysis was performed using ordinary least squares regression on each of the dependent variables. The dependent variables in our path include: community disorganization, community transition/mobility, opportunities for prosocial involvement, attitudes favoring antisocial behavior, harmful substance use, and WASL math and reading scores. Thus, the model we have suggests that peer harmful substance use, race, and gender are the most important predictor of academic achievement, and other variables have a secondary role in this process.

FINDINGS

Appendix 1 provides the Pearson bivariate correlation coefficients used in this analysis. Some of the Pearson correlations are high; any regressions that include highly correlated independent variables runs the risk of multicollinearity and large standard errors for the regression coefficients. We therefore selected among potential collinear independent variables, including those with the best conceptual linkage and predictive value.

Table 6 presents the unstandardized regression weights for the total sample of $6^{th}/7^{th}$ graders. All variables are statistically significant at the .01 level, and the adjusted R-Square of .14 for both regressions is the same as that found in Greg Weeks' analysis of student performance on standardized tests in Washington in 1999. The results in Table 6 show that there is a strong relationship between peer group substance use and individual WASL test scores, even when other factors such as gender and race are controlled. Thus, even a low level of peer substance use depresses individual WASL test scores.

Table 6: Unstandardized regression weights of independent personal, peer group, and school factors affecting individual 7^{th} grade WASL scale scores

Student, peer group and school factors	**Reading (Adj. R^2=.10) Constant= 410.5**	**Math (Adj. R^2=.142) Constant= 389.4**
Female	4.9	2.9
Native American	-5.5	-9.3
African American	-6.3	-21.1
Asian	2.0	14.1
Hispanic	-7.7	-18.9
Caucasian	6.2	18.3
Harmful substance use by closest peer group	**-18.1**	**-44.6**

Relationship of school/peer substance use to school performance

Figure 1 shows that when we control for the demographic characteristics of individual students, we find that students whose peers have near-zero substance use have:

- average WASL reading scores that are 18 points higher, and
- average WASL math scores that are 44 points higher

than for the same students in a comparable school whose peers have, on average, moderate levels of substance use (defined in the survey as "prior use, but not within 30 days.") That is, any amount of prior substance use by peers measurably depresses achievement scores for individual students. For example, the average difference between a student at reading level 2 (below standard) and level 3 (meeting standard) is 18 points. Thus:

- the difference between no and low substance use by peers accounts for the *entire difference* between meeting the reading standard or not doing so.

The impacts are even greater for math scores. Each level of peer substance[5] accounts for 45 points on the math WASL, and the difference between an average level 2 (below standard) and level 3 (meet standard) math score is 27 points. Thus:

- the difference between no and low substance use by peers accounts for one and a half times the difference between meeting the math standard and not doing so.

Other factors affecting individual WASL scores

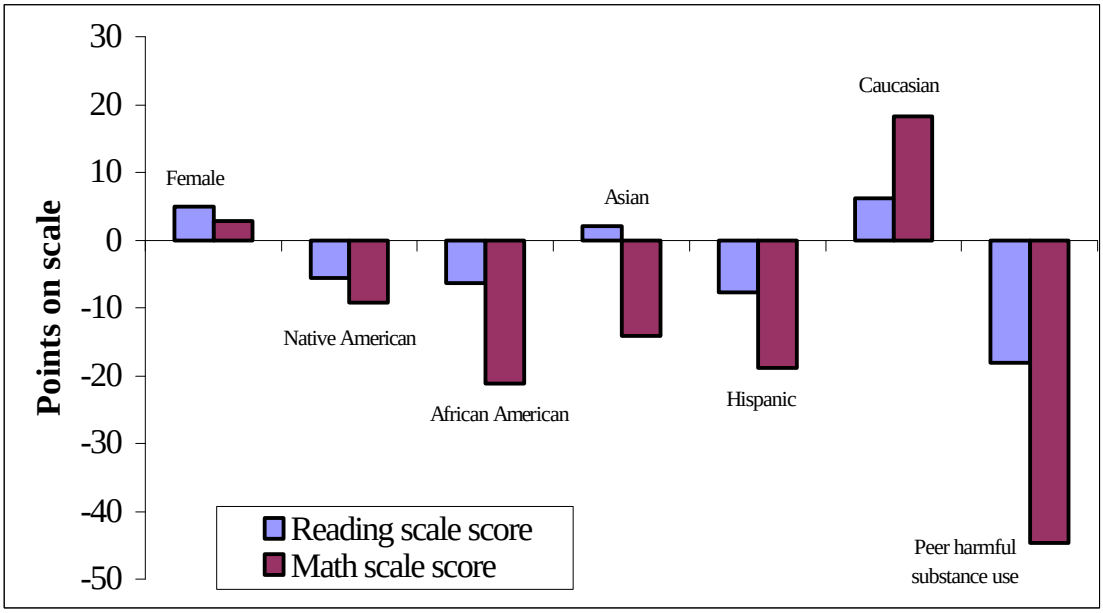
While we successfully answered our initial question about the relationship between substance use and school performance, we also wanted to explore other factors that affect school performance. When key variables are held constant, we also found:

- Except for Asian American and Caucasian, minority groups are associated with a decrease in reading and math scores compared to the "other" category.

- Being female is associated with a 4.9 point increase in reading scores and a 2.9 point increase in math scores.

Figure 1, below, shows the relative impact of gender, race-ethnic group, and peer substance use on WASL performance.

Figure 1: Independent personal and peer factors affecting individual 7th grade WASL scores (1999)



While we used multiple regression to explore the impact of substance use on test scores, we also conducted hierarchical multiple regressions within the framework of a path analysis. Our purpose was to understand the factors associated with harmful substance use in schools in order that we can help target and design prevention efforts. Although the availability of data such as parental education and family income at the individual level would have allowed us better predictions of academic achievement, this information is not asked of students taking the WASL tests. We therefore adopted a strategy of using the available data to test a path model that estimates the relationships among school and community variables, peer attitudes/behaviors, substance use, and test scores. Dozens of variables were available to use in the linkages between substance use and academic achievement. The specified variables in the path models were chosen because of their theoretical basis and demonstration in previous research to predict academic performance. We present the relevant findings here.

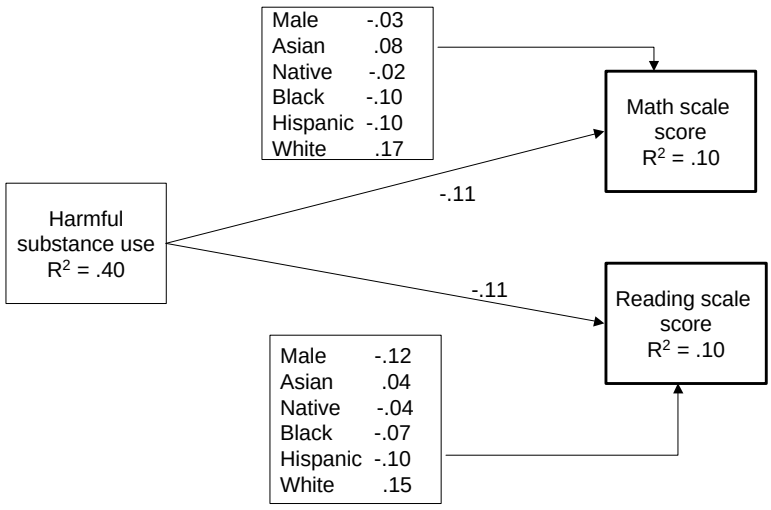
Substance use by peer groups is strongly correlated with increased substance use and decreased academic achievement among adolescents. Figure 2 shows that three factors are associated with a decline in test scores: gender, race/ethnic group, and peer harmful substance use. Our analysis shows:

- Peer harmful substance u*se* is an important predictor of math and reading test scores. Thus, the higher the level of the student's peer harmful substance use, the lower the math and reading test scores.

- Gender is another important predictor of test scores, especially in reading. Being male is associated with a decrease in math and reading test scores. The effect is stronger for reading.

- Except for Asian and Caucasian groups, belonging to a minority group (African American, Hispanic, and Native American) is associated with a decrease in math and reading scores.

Figure 2: Path from substance use to WASL Reading and Math scores



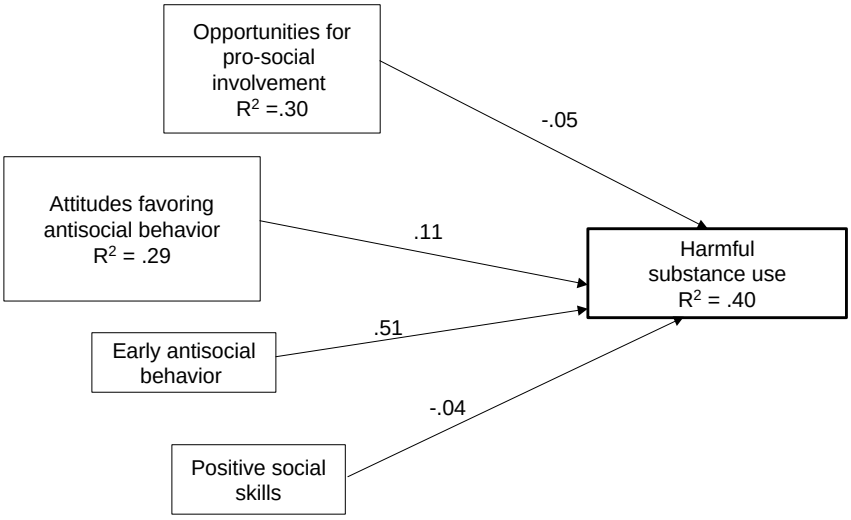
Certain behaviors serve as either risk or protective factors among adolescents. Some of these factors are important predictors of peer harmful substance use. For example, early use of alcohol, tobacco, illegal drugs or engaging in violent behavior often leads to antisocial behavior in adolescence. Thus, *early antisocial behavior* is a strong predictor of harmful substance use among peer groups. Figure 3 shows the relative strength (regression coefficients) of the four risk and protective factors in predicting peer harmful substance use. Our analysis shows:

- *Early antisocial behavior* is the most important predictor (.5) of peer harmful substance use. A student's early initiation of antisocial behavior is more likely to develop into antisocial behavior in adolescence. Thus, early antisocial behavior is associated positively with peer harmful substance use.

- *Attitudes favoring antisocial behavior* is the second most important predictor (.11) of harmful substance use among peer groups. The presence of students who accept and condone attitudes toward antisocial behavior is positively related to peer harmful substance use.

- Protective factors, such *opportunities for prosocial involvement* (-.05) in school and *positive social skills* (-.04), are negatively related to peer harmful substance use in their peer group.

Figure 3: Path predicting peer use of substances



A total 40 percent of the variance in school/peer harmful substance use was explained by these four risk and protective factors.

Various education-related factors influence student performance. For instance, at the school and district level, higher levels of teacher education and experience are associated with higher test scores (Joint Legislative Audit and Review Committee, 1999). In addition, smaller student-teacher ratios are found to affect test scores at the elementary and middle school levels. It should be noted that some of the relationships reported in this section are counter-intuitive, and some are inconsistent with the literature. We do not believe that we were able to obtain sufficient data on the allocation of resources at the school building level to place great confidence in the results. We have therefore reported the findings but caution the reader against drawing conclusions about the relationship of school resources to risk and protective factors, attitudes or behavior. Figure 4 presents the five school resource variables (percent of minority students in school, school size, percent of students on free/reduced lunch program, district yearly expenditure per student, and student/teacher ratio in building) and the influence of each on the scale factor *opportunities for prosocial involvement* that serves as a protective factor against peer harmful substance use. These five variables account for 30 percent of the variance in the scale factor, *opportunities for prosocial involvement.* Our results show:

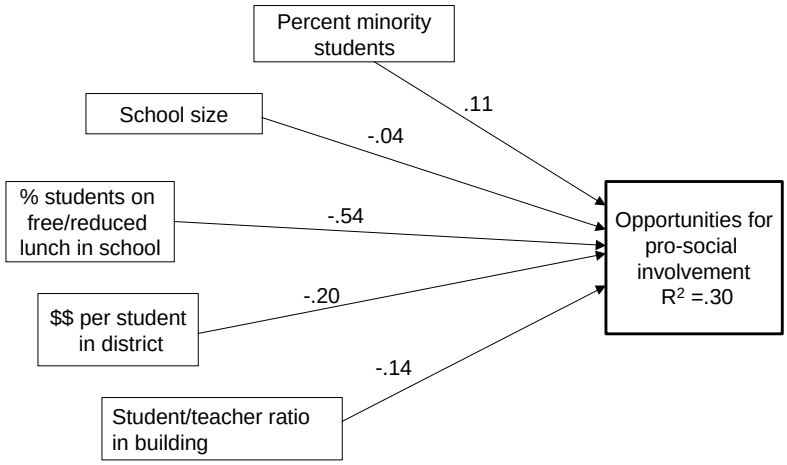
- School poverty rate as measured by the percent of students in free/reduced lunch programs is the most important predictor of opportunities for prosocial involvement. Thus, participation in the federal free/reduced-price lunch program is negatively related to opportunities for prosocial involvement in school.

- Student/teacher ratio in the building is negatively related to the opportunities for pro-social involvement. The higher the number of students to teachers, the lower the opportunities for prosocial involvement in school.

- Level of spending per student in the district is also negatively related to the opportunities for prosocial involvement. The lower the spending per student, the lower the rate of prosocial support in school. It should be noted that pro-social is a relatively minor predictor on peer harmful substance use, and that while school resources inputs are significantly related, they are ultimately a minor factor in predicting school peformances in this path analysis.

- Holding key variables constant, percent of minority students in school is positively related to opportunities for prosocial involvement. The larger the percentage of minority students in the school, the higher the rate of prosocial support.

Figure 4: School resource inputs affecting pro-social involvement



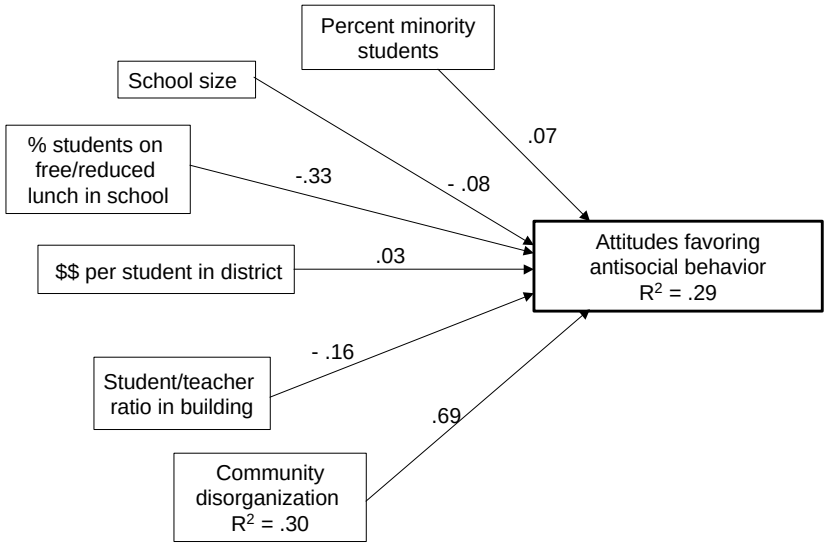
Similarly, Figure 5 shows the five school resource variables and a scale factor called *community disorganization* predicting another scale factor, *attitudes favoring antisocial behavior*. *Community disorganization* is the most important predictor (.69) of *attitudes favoring antisocial behavior*. The more disorganized a community, the higher the level of attitudes favoring antisocial behavior. The total variance in *attitudes favoring antisocial behavior* explained by these predictors is 29 percent. Our analysis shows:

- School poverty rate as measured by the percent of students on free/reduced lunch in school is the second most important predictor (-.33) of attitudes favoring antisocial behavior. When other factors are held constant, schools with a higher percent of students participating in free/reduced price lunch programs in school have a lower rate of attitudes favoring antisocial behavior.

- Percent of minority students in school is positively related (.07) to attitudes favoring antisocial behavior. That is, the higher the percent of minority students in school, the greater the antisocial attitudes among their peers.

- Student/teacher ratio in the school building is negatively related (-.16) to attitudes favoring antisocial behavior. The larger the number of students per FTE instructional employee, the lower the level of attitudes favoring antisocial behavior. School size, too, is negatively related to the scale factor, *attitudes favoring antisocial behavior*. The larger the school, the less the attitudes favoring antisocial behavior.

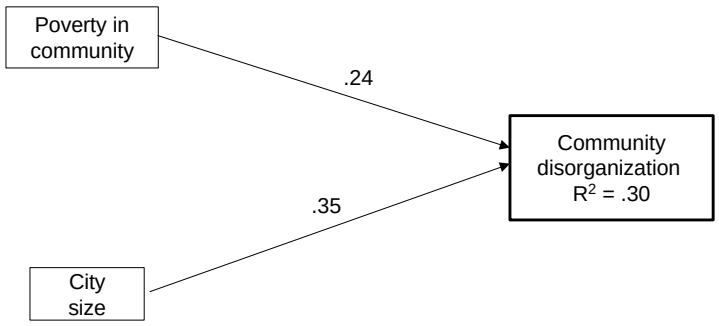
Figure 5: Path predicting attitudes favoring antisocial behavior



Studies have shown that home and community environments influence student performance. The State of Washington Joint Legislative Audit and Review Committee (1999) found that test scores on the state's norm-referenced tests for 4th, 8th, and 11th grades decline as the school's percentage of lower-income students increases. In addition, the committee found a strong correlation between a district's rate of lower-income students and its percentage of low-performing students. Other sources show that family poverty influences individual level achievement. Figure 6 shows the two community variables, poverty in community and city size, predicting the scale factor called *community disorganization*. These two variables account for 30 percent of the variance among schools in *community disorganization*. Our results show:

- City size is the most important predictor (.35) of community disorganization. The larger the city, the greater the chance that students will report that they and their neighborhoods are part of a disorganized community.
- Poverty in community is also positively related (.24) to the scale factor called *community disorganization*. The higher the level of poverty in the community, the higher the level of community disorganization.

Figure 6: Path predicting community disorganization

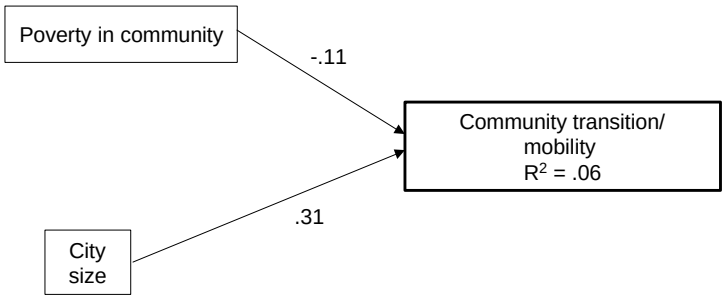


Similarly, Figure 7 presents the same community variables, city size and poverty in community, predicting the scale factor called *community transition and mobility*. The total percentage of variance in this scale factor, *community transition and mobility*, explained by these predictors is only .06%. Our model shows:

- City size is the most important predictor of community transition/mobility. Again, the larger the city size, the greater the chance that students will report that they and their neighborhoods are in transition much of the time.

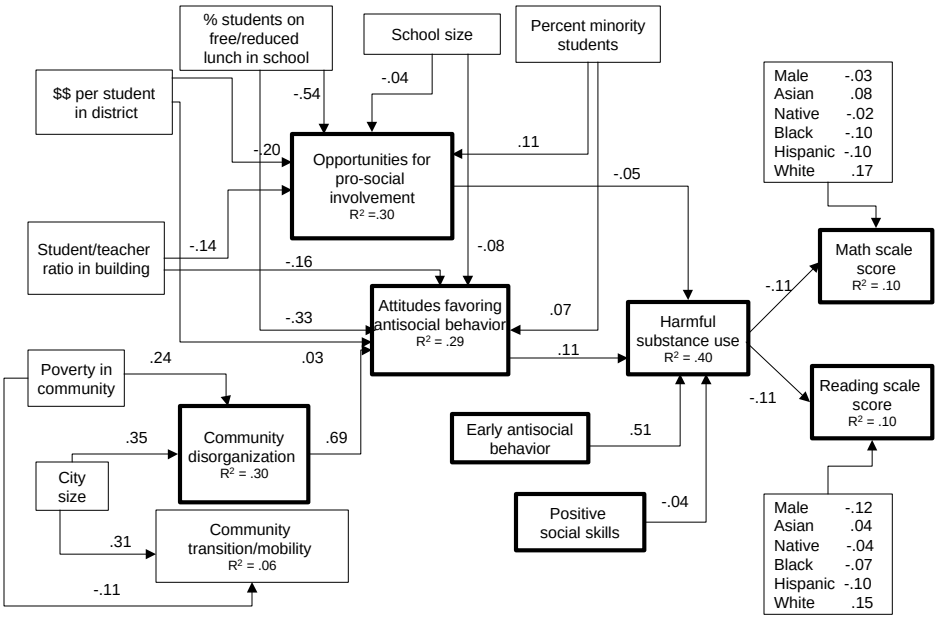
- Poverty in community is negatively related to community transition/mobility. The higher the poverty rate in the community, the lower the degree to which the community is in transition.

Figure 7: Path predicting community transition



The full path model is shown in Figure 8. This model indicates our estimates of the degree to which community variables, school variables, and peer variables relate to each other and to school/peer harmful substance use, and how the substance use relates to individual academic achievement. Overall, harmful substance use among peer groups, gender, and race/ethnic groups account for 10 percent of the variance in math and reading scores. Other factors such as parental education and family income would have allowed us better predictions of academic achievement; however, we do not have access to such data at this time. Although other variables may allow us better predictions of peer harmful substance use, the total percentage of variance (40%) explained in peer substance use by these four risk and protective factors is an important finding. We have seen that certain factors in the education, home, and community environments directly affect adolescents' attitudes and behaviors. Adolescents with high risk factors are *at-risk* of exhibiting undesirable attitudes or behaviors; adolescents with high protective factors exhibit attitudes that may protect them from at-risk behaviors. These risk or protective factors directly influence harmful substance use among the adolescent's peer group, which will indirectly affect the adolescent's school performance scores.

Figure 8: Exploratory path model for All 6th graders



CONCLUSION

Numerous studies have shown an inverse (and bidirectional) relationship between academic achievement and substance use (alcohol and drugs) among adolescents. Furthermore, peer group substance use has been found to be strongly correlated with increased drug use and decreased academic achievement. The primary goal of this study was to examine the relationship of substance use among school/peer groups to school performance and explore other factors affecting school performance. A related goal was to examine the ways that community factors (poverty, size of community, community instability/disorganization), school factors (poverty level in school, size of school, prosocial opportunities in the school), and individual/peer factors (early antisocial behavior, attitudes favoring antisocial behavior, and social skills) relate to each other and to peer harmful substance use and how substance use relates to academic achievement.

The attitudes, knowledge, and skills of Washington's children will determine whether they succeed individually, and whether our society fares well or poorly . Upgrading skills through excellent education is one of the most important ways that Washington can successfully compete in the global economy of the twenty-first century. To meet this goal, in 1997 the state instituted an accountability structure, with clear learning goals and an appropriate way of measuring progress – the Washington Assessment Student Learning tests.

Because many factors influence academic achievement, educators and policy makers need to understand which are the most significant so that they can design programs and policies to help students achieve. In addition to socio-economic factors (family income, parental education), school reources (student/teacher ratio, quality and

percentages of teachers, school and classroom environment), and community factors (poverty in community, community disorganization, community transition and mobility), school/peer substance use among adolescents is a predictor of middle school student performance.

Our findings show a strong relationship between peer group substance use and individual WASL test scores, when factors such as gender and race-ethnic group are controlled. Higher levels of peer substance use depress individual WASL test scores. Our study also shows that the difference between low and near-zero drug/alcohol use among the student's peer group in middle school is associated with the loss of 18 points on the WASL reading test and 44 points on the math test, when other variables are held constant. It is dramatic that we found such a strong impact among middle school students, where substance use is low. It follows that one way to increase student performance would be to design programs that decrease substance use among adolescents. Moreover, the path model shows that certain behaviors serving as either risk or protective factors account for 40 percent of the variance in peer harmful substance use. The most important predictor of peer harmful substance use is a scale factor called *early antisocial behavior*. Early initiation of antisocial behavior is more likely to develop into adolescent antisocial behavior, and early antisocial behavior is positively associated with peer harmful substance use.

Although other factors may allow us better predictions of peer harmful substance use, the finding that 40 percent of the variance in peer substance use can be explained by these four risk and protective factors is important. Understanding that early initiation of antisocial behavior often leads to antisocial behavior in adolescence and that it is an important risk factor for peer substance use can help educators and policy makers design prevention programs aimed at providing prosocial role models for potential at-risk adolescents. Effective prevention programs aimed at facilitating prosocial school culture may help decrease deviant behavior, thereby effectively contributing to a decline in substance use and an increase in academic achievement.

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NOTES

[1] The data used in this analysis was developed by staff at the Legislative Evaluation and Assessment Program (LEAP) from district, school buildings, and student databases maintained by The Office of Superintendent of Public Instruction (OSPI). The database used in the 4th grade analysis contained 65,798 student records for reading, 65,935 for mathematics, 65,784 for language, and 64,453 for the weighted average battery score. The database used in the 8th grade analysis contained 65,929 student records for reading, 65,719 for mathematics, 65,804 for language, and 64,169 for the weighted average battery score. The database used in the 11th grade analysis contained 51,014 student records for English, 50,270 for mathematics, 50,533 for science, and 51,234 for the history/social studies scores.

[2] According to the Joint Legislative Audit and Review Committee, the results for middle schools depend on the type of analysis conducted. The results from hierarchical modeling show that larger middle schools have higher test scores. However, the results from multiple linear regression analyses show that larger middle schools have lower scores.

[3] In our study, the peer group is always the closest one available to the individual student. Sometimes, data was available by race and gender within a school. Sometimes, data was available by race but not by gender. Sometimes, they were available only by gender and only for the school itself.

[4] Path analysis provides the opportunity to causally order the effects of each of the independent variables hypothesized to predict the specified variable. In general, path analysis proceeds by solving a series of regression equations in which each of the previously independent variables becomes the dependent variable for the new equation. The results are then assessed using multiple regression procedures in which the standardized partial regression coefficients are used to measure the impact of each of the independent variables upon the specified criterion variable. The standardized partial regression coefficient or path coefficient represents a measure of change that would occur in the dependent variable given one unit of change in the independent variable. It may be viewed as the direct effect of the independent variable, controlling for the effects of all other variables in the regression equation.

[5] The peer substance use variable is not a continuous variable. We do not want to imply that we can measure the exact amount of alcohol or drug use by these peer groups or that the difference between what we are calling “low” and “high” is measured on a continuous scale. All of the available peer groups are clustered below what we are calling low use, with “no” being 0 on the revised scale; “low” being 1 (prior use, but not in the last 30 days); “moderate” being 2 (once in the last 30 days) and “high” being 3 (frequent use, including binges).

Appendix 1

Bivariate correlation coefficients for variables used in path analysis: 6th and 7th grade total

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Poverty in community	1.0000															
2. City population	**0.667**	1.000														
3. Community disorganization	**0.470**	**0.503**	1.000													
4. Community transition/mobility	**0.120**	**0.243**	**0.436**	1.000												
5. School enrollment	**0.169**	**0.292**	**0.183**	**0.243**	1.000											
6. Poverty in school	**0.647**	**0.415**	**0.807**	**0.168**	**0.120**	1.000										
7. Student/teacher ratio	**-0.378**	**-0.395**	**-0.163**	**0.164**	**0.141**	**-0.162**	1.000									
8. District expenditure per student	**0.779**	**0.885**	**0.436**	**0.105**	**0.232**	**0.488**	**-0.468**	1.000								
9. Percent minority in school	**0.636**	**0.411**	**0.615**	**0.287**	**0.333**	**0.818**	**0.047**	**0.484**	1.000							
10. Opportunities for prosocial involvement	**-0.384**	**-0.401**	**-0.534**	**-0.178**	**-0.315**	**-0.648**	**-0.059**	**-0.443**	**-0.620**	1.000						
11. Early initiation of antisocial behavior	**0.315**	**0.276**	**0.727**	**0.243**	**-0.076**	**0.630**	**-0.241**	**0.298**	**0.401**	**-0.469**	1.000					
12. Attitudes favorable to antisocial behavior	**0.172**	**0.292**	**0.490**	**0.198**	0.009	**0.318**	**-0.254**	**0.269**	**0.205**	**-0.473**	**0.741**	1.000				
13. Social skills	**-0.116**	**-0.080**	**-0.415**	**-0.138**	**0.150**	**-0.367**	**0.090**	**-0.062**	**-0.236**	**0.232**	**-0.542**	**-0.367**	1.000			
14. Math scale score	**-0.208**	**-0.149**	**-0.261**	**-0.028**	**-0.064**	**-0.307**	**0.059**	**-0.171**	**-0.251**	**0.232**	**-0.239**	**-0.131**	**0.116**	1.000		
15. Reading scale score	**-0.169**	**-0.122**	**-0.255**	**0.040**	**-0.054**	**-0.299**	0.053	**-0.147**	**-0.248**	**0.230**	**-0.234**	**-0.141**	**0.153**	**0.787**	1.000	
16. Average drug and alcohol use by nearest peer group	**0.107**	0.025	**0.407**	**0.133**	**-0.084**	**0.338**	**-0.077**	**0.040**	**0.184**	**-0.315**	**0.624**	**0.518**	**-0.345**	**-0.172**	**-0.187**	1.000
17. Other race (dummy var)	-0.010	**-0.043**	-0.006	**0.051**	-0.007	-0.010	0.008	-0.016	0.002	0.021	**0.035**	-0.012	0.015	**-0.059**	**-0.051**	**0.097**

18. Asian (dummy var)	**0.055**	**0.144**	**0.110**	**0.101**	**0.094**	**0.077**	0.016	**0.114**	**0.132**	**-0.123**	**0.030**	**0.047**	-0.006	0.021	-0.014	0.011
19. Native American (dummy var)	**0.034**	0.004	0.024	0.010	**-0.071**	0.013	**-0.028**	**0.044**	0.011	0.022	**0.063**	**0.047**	-0.016	**-0.066**	**-0.077**	**0.064**
20. African American (dummy var)	**0.146**	**0.233**	**0.199**	**0.121**	**0.113**	**0.186**	0.026	**0.208**	**0.243**	**-0.231**	**0.128**	**0.105**	**-0.049**	**-0.176**	**-0.135**	**0.051**
21. Hispanic (dummy var)	**0.203**	**-0.061**	**0.116**	**-0.035**	**0.087**	**0.268**	0.002	0.010	**0.273**	**-0.120**	**0.086**	0.019	**-0.094**	**-0.196**	**-0.190**	**0.211**
22. White (dummy var)	**-0.244**	**-0.163**	**-0.253**	**-0.127**	**-0.147**	**-0.313**	-0.020	**-0.197**	**-0.385**	**0.260**	**-0.177**	**-0.108**	**0.087**	**0.251**	**0.246**	**-0.226**
23. Male (dummy var)	0.010	0.020	0.006	0.016	0.002	-0.009	**-0.028**	0.016	-0.012	0.006	-0.013	0.003	-0.001	-0.032	**-0.132**	**0.143**
24. Female (dummy var)	-0.011	-0.020	0.003	-0.017	-0.002	0.006	**0.028**	0.017	0.008	-0.003	0.009	-0.005	0.005	0.035	**0.135**	**-0.146**

Appendix 2: Standardized regression coefficients for variables for 6th graders in the path diagram

	Total 6th graders (N=10,446)	Community disorganization (Mean12)	Community transition/moibility (Mean17)	Opportunities for pro-social involvement (Mean18)	Attitudes favoring antisocial behavior (Mean44)	Harmful substance use (avdralt)	WASL Math scale score (mscale)	WASL Reading scale score (rscale)
	Adjusted R square:	**0.30**	**0.06**	**0.30**	**0.29**	**0.40**	**0.10**	**0.10**
1	Poverty in district (dppv5t17)	**0.24**	**-0.11**					
2	City size (citypp97)	**0.35**	**0.31**					
3	Community disorganization (mean12)				**0.69**			
4	Community transition/mobility (mean17)				-0.02			
5	School size (schlsize)			**-0.04**	**-0.08**			
6	% of free/reduced lunch (bfrlunch)			**-0.54**	**-0.33**			
7	Teacher/student ratio in building (bstratio)			**-0.14**	**-0.16**			
8	$$ per student in district (dexpend)			**-0.20**	**0.03**			
9	% of minority students (bpminor)			**0.11**	**0.07**			
10	Opportunities for pro-social involvement (mean18)					**-0.05**		
11	Early antisocial behavior (mean42)					**0.51**		
12	Attitudes favoring antisocial behavior (mean44)					**0.11**		
13	Positive social skills (mean51)					**-0.04**		
14	Harmful substance use (avdralt)						**-0.11**	**-0.11**
15	Asian						**0.08**	**0.04**
16	Native						**-0.02**	**-0.04**
17	Black						**-0.10**	**-0.07**
18	Hispanic						**-0.10**	**-0.10**
19	White						**0.17**	**0.15**
20	Male						**-0.03**	**-0.12**

Bold = $p < .001$