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Substance-Related Knowledge, Attitude, and Behavior among College Students: Opportunities for Health Education

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Abstract

Objective—To examine substance-related attitudes and behaviors among college students across an academic semester.

Design—Pre-post quasi-experimental survey design.

Setting—A large Midwestern University.

Method—Surveys were completed by 299 undergraduates enrolled in three courses: drugs and behavior, abnormal psychology, and normal personality theories.

Results—Although students enrolled in the drug course were not more knowledgeable about drugs than others at baseline, their knowledge increased by semester's end, while the others' did not. Perceived prevalence of alcohol use was more accurate and became increasingly accurate among drugs and behavior students. Class enrollment, gender, and baseline substance use were associated with baseline attitudes and behaviors as well as changes over time.

Conclusion—This study offers implications for substance use education opportunities on college campuses.

Keywords

Drug and alcohol education; substance use prevention; college students

Drug and alcohol use and abuse among college students is a major concern. Sixty-eight percent of college students admitted to drinking alcohol at least occasionally in a 2007 study by Columbia University's National Center on Addiction and Substance Abuse¹. The study also found that almost half of the 5.4 million full-time college students in the United States abuse drugs or drink alcohol on binges at least once per month¹. Approximately 23% of college students met the medical definition for alcohol or substance abuse or dependence¹. Furthermore, the study indicated that use rates for many substances increased between 1993 and 2005. Use of any illicit drug in the past year was up from 31% in 1993 to 37% in 2005; marijuana use in the past year was up from 28% in 1993 to 33% in 2005; cocaine use in the past year was up from 3% in 1993 to 6% in 2005; and use of prescription painkillers in the past year was up from less than 1% in 1993 to 3% in 2005¹.

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Research has demonstrated that campus-wide prevention campaigns focusing on information or awareness tend to have minimal effect on actual alcohol or drug use behaviors². Several studies have even demonstrated an increase in maladaptive drug-related attitudes and/or drug use with non- classroom prevention programming. This is more often the case for didactic, informational, or general skills-based programs using abstinence-oriented approaches with high-risk (i.e., currently drug using) populations²⁻⁶. While it is hoped that academic health courses (e.g., drug use, nutrition and exercise, sexuality, etc.) increase knowledge, awareness, and interest in these topics among undergraduates, little research has been conducted to examine the effects of academic substance use courses on college student attitudes and actual health behaviors.

In a review of the literature, we located one study that found reduced alcohol use after an undergraduate nursing course; however, campus-wide prevention efforts occurred simultaneously⁷. A second study reported reduced drug use and related negative consequences after a semester-long course based on abnormal and health psychology among students who had violated campus drug regulations⁸. A general health awareness course at the American University of Beirut found improvements in stage of change for several areas including smoking, fruit and vegetable intake, and exercise⁹. Another study saw improvements in cancer prevention attitudes and behaviors in a course called “The Nature of Cancer”¹⁰. No other studies evaluating general academic drug education courses were located in our review of the literature. However, Norton and colleagues found that introductory psychology students reported more positive attitudes toward smoking than a general sample of college students¹¹.

The rationale for the current exploratory study was to determine the effects (positive, negative, or neutral) of an academic drug education course on drug-related attitudes and behaviors among college students. Such courses could provide a valuable opportunity to inform and supplement drug prevention programming. It is important to first identify existing effects of drug and alcohol course curricula on student attitudes and behaviors given the possibility that such courses may increase knowledge while also encouraging maladaptive attitudes and harmful drug use behaviors. To examine the effects of drug course content on attitudes and behaviors, the current study utilized a quasi-experimental design comparing pre-post drug and alcohol knowledge, attitudes, and behaviors among students in a drugs and behaviors course and two other psychology courses.

The current study focused on several hypotheses:

1. Students enroll in courses that address personal issues they have experienced or are experiencing. In other words, the classes will differ by drug knowledge, drug use, and mental health at the start of the semester, with a) students in the drugs and behavior class being more experienced with drugs and their consequences than students enrolled in the other two classes and b) students in abnormal psychology having poorer mental health than students in the other two classes.
2. Males and substance users will report greater baseline pro-substance attitudes and behaviors than females and non-users; especially those enrolled in the drug course.
3. Change across the semester in substance-related knowledge, attitudes (e.g., drug prototype), and behaviors will vary by class enrollment (with more positive attitudes and perceptions in the drugs and behavior course vs. others), gender, and baseline substance use. The purpose of this study is to examine potential differential changes across these subgroups.

Methods

Participants

All procedures were approved by the university IRB. Participants were consenting volunteers from three upper-level psychology courses at a Midwestern state university: psychology of normal personality (146 students were enrolled in the course), abnormal psychology (101 students), and drugs and behavior (91 students). Completed pre-test surveys were received from 299 students (85% of enrolled students) during the first week of class, and post-test surveys were received from 211 students (70% of the original sample) during the last week of class 16 weeks later. The typical participant was a white (93%), female (70–76% across courses), upperclassman, with a mean age of 21.26 ($SD = 2.71$), psychology major or minor, with a mean GPA of 3.10 out of 4.00 ($SD = .55$), living off campus with roommates (65%). Twenty-six percent of the sample reported having a family member with an alcohol problem, and 29.3% reported having a family member who uses drugs. Demographics are reported in Table 1.

Measures

Individual Differences

Demographics: A brief demographics questionnaire consisted of items regarding sex, race, age, year in school, major, estimated GPA, enrolled course(s), and use/abuse of alcohol or drugs by a family member.

Physical and Mental Health: Physical and mental health were measured using a modified 24-item version of the Short-Form-36 Health Survey (SF-36)¹², which is a 36-item, self-report questionnaire widely used to measure general health status during the past month. Scales include a physical composite scale, a mental health composite scale, and subscales include physical functioning, physical role limitations, emotional role limitations, energy/fatigue, emotional well-being, social functioning, pain, and general health. For the purposes of this study, the scales less relevant to college students (physical functioning and pain) were not administered. The health subscales were scored from 0 to 100 with higher scores representing better health, in accordance with the SF-36 instructions from RAND Corporation. There exists a multitude of reliability and validity evidence for the SF-36 including factor structure, associations with severity/type of health conditions, as well as convergent and discriminant validity evidence¹³. In this study, reliabilities of the subscales ranged from .68 to .84 at pre-test and from .69 to .83 at post-test.

Sexual Risk-Taking—The sexual risk-taking scale was created by summing responses to the six risky sexual activities items from the Cognitive Appraisal of Risky Events scale (CARE)¹⁴. At post-test, participants were asked to write the number of times they had participated in several risky sex behaviors (e.g., unprotected sex, sex with multiple partners) during the past semester. The authors of the CARE report internal reliability scores ranging from .64–.90¹⁴. Validity evidence includes factor analysis as well as criterion and convergent validities¹⁴.

Substance-Related Knowledge, Attitudes, Beliefs, and Intentions

Drug Knowledge: A 15-item true-false quiz on material discussed in the drugs and behavior class was developed and administered at pre- and post-test. Sample items include: “A liquor that is 90 proof is 90% alcohol” and “Taking a drug by mouth is more effective than inhaling it”. Students received a score of “1” for each correct answer and “0” for each incorrect answer; item scores were summed to create the overall quiz score. Reliability of the quiz was good at both time points, ($\alpha = .85$ and $.96$, respectively).

Perceived Drug Use Prevalence/Vulnerability Estimates: Participants were asked to estimate the perceived *prevalence* (percentage) of their peers using various substances (e.g., alcohol, marijuana, inhalents, tobacco)^{15–17} both within the relevant psychology class (post-test only) and among their college-aged peers in general. Participants were also asked to rate (0 = not at all likely to 6 = definitely) their likelihood of developing any of eight possible problems (e.g., getting arrested, suffering health damage) as a result of drinking, using tobacco, and other drug use. Scores on these eight items were averaged separately for each substance to create overall measures of perceived *vulnerability*.

We were also able to obtain results from an online survey of randomly selected students from the general population of the same university that was conducted at the mid-point of the same semester. Of the 2468 students with correct active email addresses, 1352 (55%) returned completed surveys. Where similar data were available, we compare our findings to data from the general student sample. This includes alcohol use prevalence and perceived alcohol use.

Alcohol and Marijuana Expectancy Questionnaires: The version of the *Alcohol Expectancy Questionnaire* (AEQ)¹⁸ used for this study was the 27-item version developed by Vik, Carrello, and Nathan (1999)¹⁹. The items were assessed on a five point scale (1 = Disagree Strongly, 5 = Agree Strongly). Sample items include “A few drinks makes me feel less shy” and “Alcohol makes me worry less.” The authors report internal consistency reliability scores ranging from .82–.87 for the subscales¹⁹; the reliability of the overall scale was .95 for both pre-and post-test in the current study. The scale developers have demonstrated construct as well as convergent and divergent validity evidence¹⁹.

The Marijuana Effects Expectancy Questionnaire (MEEQ)²⁰ is a 78-item measure. Sample items include “Marijuana slows thinking and actions” and “Marijuana makes me calm”; the items were assessed with the same 5-point scale as the AEQ. The authors of the MEEQ report internal reliability scores ranging from .59–.76, immediate test-retest reliability of .66, and evidence of validity in terms of the questionnaire’s usefulness in distinguishing marijuana using from non-marijuana using individuals²⁰. In the current study, the reliability was .91 at pre-test and .87 at post-test.

Prototypes, Willingness, and Behavioral Intention: To assess participant *prototypes* or their subjective images of the typical drug-using and alcohol-using person, participants rated the extent to which each of six positive and negative attributes (e.g., cool, careless) described the images. The negative adjectives were reverse-scored so that higher values indicated a more favorable image, then averaged ($\alpha = .75$ for drinker and .83 for drug user^{15–17, 21, 22}). In addition, participants were asked how similar (0 = not at all, 6 = extremely) they were to the “typical” person their age who: 1) uses drugs and 2) frequently drinks a lot.

Willingness to risk drug use and alcohol use were assessed by asking participants to imagine themselves in high risk situations (e.g., “You are with some friends at a party, and one of them offered you drugs [alcohol] ...”). Participants were then asked how willing they would be to do each of several options of increasing riskiness (e.g., “say no,” “take some,” “take enough to get high, etc.”), which were aggregated to form a willingness index (alphas consistently $> .70$ ^{15–17, 21, 22}). *Behavioral intention*: Students were also asked to rate their intention of using several substances in the next six months from 0 = definitely not to 6 = definitely yes^{14, 15, 17, 21, 22}. The responses to five substances (marijuana, inhalents, heroin, hallucinogens, and stimulants) were averaged to create the measure of drug intentions. Intention to use alcohol was examined separately.

Substance Use—Students were asked to note whether they had ever used the following drugs and the number of times they had used them during the past month: alcohol, hallucinogens/club drugs, heroin, inhalents, marijuana, tobacco, stimulants, and other^{15,17}.

Procedures

A project staff member not affiliated with the academic courses explained the study to the students in each of the three classes on the first day of class. Interested students provided written informed consent. Participants spent 30–45 minutes completing the survey in the classroom and returned them to project staff. Students received extra credit for their participation. The post-test survey was completed during the last week of the semester using a similar procedure.

Course structure and content

The drugs and behavior course was an academic psychology course taught by the first author and was not intended to be a drug prevention program. The course met for 75 minutes twice per week for sixteen weeks. The content included the major classes of recreational drugs: alcohol, other depressants, inhalants, nicotine, marijuana, stimulants, opioids, hallucinogens, and club drugs. An attempt was made to present current research neutrally in terms of positive and negative drug effects. There were also units on general neurophysiology and psychopharmacology, drug/medication research and development, drug regulation/enforcement, addiction, as well as prevention and treatment. The class format included lectures using powerpoint slides, videos, and a few guest panels (e.g., members of Alcoholics Anonymous). The material covered for each drug class generally consisted of the history, nature of the drugs, pharmacology, psychotropic effects, health effects, addiction, treatment, and current issues (e.g., legalization of medicinal marijuana). Students read from a textbook²³, took three multiple-choice exams, and wrote a term paper on a controversial topic (e.g., nature versus nurture in addiction etiology), and several reaction papers to videos and guest speakers. Extra credit was given for class participation as well as for attending a peer support group (e.g., Al-Anon) and writing a reaction paper.

The structure of the abnormal psychology course was similar to the drugs and behavior course and was also taught by the first author. It was a survey course of the major classes of psychological disorders (e.g., mood, anxiety, etc.) including readings, lectures, discussions, written assignments, exams, and videos. The psychology of normal psychology course was a similarly structured survey course of the major theories of personality including psychodynamic, behavioral and cognitive, as well as humanistic theories consisting of lectures, discussion, exams, as well as in-class and homework exercises. One week of the abnormal psychology course was devoted to substance use disorders, but the psychology of normal personality did not formally address the topic of addictions.

Analytic Strategy

Analyses were conducted on the pre-test data to see if the classes differed on demographic variables at the beginning of the semester. The only significant demographic difference among the classes was year in college ($\chi^2(12) = 32.64, p = .001$). Follow-up *t*-tests revealed that students in the drugs and behavior class were, on average, at a higher grade level than those in abnormal psychology ($t(152) = 2.13, p < .04$), who were in turn at higher grade level than students in normal personality, $t(194) = 2.42, p < .02$. These analyses translate into more seniors in the drugs and behavior class than in abnormal psychology, and more sophomores in normal psychology than in abnormal psychology. Only participants who completed surveys at both time points were included in all analyses. Students who completed the post-test measure at the end of the semester did not differ significantly on demographics from those who did not complete the survey.

Because differences were predicted for the students in the drugs and behavior course as compared to students in the other courses, the normal personality and abnormal psychology courses were combined for the majority of analyses, except for the comparisons of abnormal psychology and the other classes on emotional health (see Hypothesis 1). This simplification led to a 2 (course: drug course vs. not drug course) $\times$ 2 (time: pre-test vs. post-test) $\times$ 2 (gender: male vs. female) design. General Linear Models (GLM), controlling for year in school, were conducted for each of the dependent variables except where noted below; pre-test values are presented in Table 2.

Results

Individual Differences

Physical and Emotional Health—Contrary to prediction, scores on the SF-36 mental health subscales did not differ by class (abnormal personality vs. others) or gender at pre-test ($ps > .26$). Emotional well-being decreased over the course of the semester regardless of class enrollment or gender, $F(1, 195) = 3.12, p < .08$. A significant increase over time for emotional role limitations ($F(1,195) = 4.96, p < .03$) was qualified by a significant interaction of time, gender, and course enrollment, $F(1,193) = 4.84, p < .03$. Among male students, those in the abnormal class reported an increase in role limitations from pre-test ($M = 84.45, SE = 7.36$; higher values correspond to better functioning) to post-test ($M = 63.01, SE = 7.51$), $t(16) = 2.86, p < .02$. Reported role limitations did not change across the semester for males not in the abnormal class or for females, $ps > .30$. Scores on the general health scale did not differ by class or gender at pre-test ($ps > .12$), nor was there change over the semester, $ps > .61$.

Sexual Risk-Taking—The summed scores of the sexual risk-taking scale were highly skewed; 69% of participants had a summed score of zero, meaning they reported not engaging in any of the sexually risky behaviors, even one time, during the semester. In addition, the amount of risk-taking varied greatly among participants who did report risky behavior. To accommodate for the highly skewed data, responses were dichotomized into 0 (“no sexual risk taking”) and 1 (“any sexual risk taking”). A Pearson chi-square test was conducted to see if the proportion of participants who had engaged in risky sexual behavior varied by course enrollment (in the drugs course or not). The test was marginally significant ($\chi^2(1, N = 190) = 3.11, p < .08$), suggesting a non-random relationship between course enrollment and sexual risk-taking. Almost 38% of participants enrolled in the drugs and behavior course reported engaging in risky sexual behavior, compared with only 25.4% of students enrolled in the other courses.

Knowledge, Attitudes, Beliefs, and Intentions—Table 2 includes mean scores by gender and course.

Knowledge—Contrary to the prediction in Hypothesis 1, students enrolled in the drugs and behavior class ($M = 11.98, SD = .27$) did not score higher on the drug knowledge pre-test quiz than students in the other classes ($M = 11.41, SD = .22$), $p > .10$. However, there was a significant interaction between time and course enrollment, $F(1,159) = 8.97, p < .01$. A paired-samples t -test revealed that scores on the drug knowledge quiz increased significantly over the course of the semester for students in the drugs and behavior class, $t(62) = 2.58, p < .02$. In contrast, scores decreased across the semester for students in the other courses, $t(102) = 2.14, p < .04$.

Perceived Prevalence and Vulnerability—There were no gender or class differences at pre-test or across time for perceived prevalence of drug use, $ps > .15$. There was a

marginally significant main effect of class at pre-test on perceived prevalence of alcohol use such that students in the drugs and behavior course thought that more of their peers were using alcohol, $F(1, 165) = 3.34, p < .07$. In predicting change in perceived prevalence of alcohol use across time, there was a significant class by time interaction, $F(1, 160) = 9.37, p < .01$. Follow-up analyses revealed a significant decrease in perceived prevalence for students in the drug class, $t(62) = 5.7, p < .001$. The decrease was not significant for students in the other courses, $p > .20$. Overall, study students slightly overestimated alcohol use by their college-aged peers at baseline (78% perceived use, 73% actual use), but became slightly more accurate over time (72%), whereas students from the general population who took the university-wide survey under-estimated alcohol use in the last 30 days (52%).

There were no gender or class differences at pre-test for perceived vulnerability to either drugs or alcohol, $ps > .13$. There were also no differences across time by either class or gender, $ps > .15$. As shown in Table 2, on average, participants reported a moderate level of vulnerability (e.g., near 3 on a 0–6 scale). Perceived vulnerability to negative consequences was higher, on average, for drugs than for alcohol.

Substance Use Expectancies—Alcohol expectancy scores did not differ at pre-test across the classes or gender or change significantly over time, ($ps > .48$). Marijuana expectancy scores did not differ across class or gender at pre-test ($ps > .32$), but they did become less favorable over time, $F(1, 154) = 5.66, p < .02$. The main effect of time was qualified by a significant Class $\times$ Time $\times$ Gender interaction, $F(1, 154) = 7.61, p < .01$. The analysis was repeated separately by gender, and the interaction of time and class was marginally significant for both males ($F(1, 37) = 3.09, p < .09$) and females, $F(1, 116) = 3.44, p < .07$. Follow-up t -tests comparing marijuana expectancies at pre and post test were not significantly different for females or males in the drug course, $ps > .27$. However, the analysis revealed a marginally significant change for males in the other courses; marijuana expectancies became more negative (mean = 184 at pre-test versus 175 at post-test) among males not enrolled in the drugs and behavior class, $t(21) = 1.72, p = .10$. The failure to reach the conventional level of significance ($p < .05$) may have been due in part to the further reduction of the already small sample of male participants by analyzing separately by class.

Prototypes, Willingness, and Behavioral Intention—At pre-test, there were no class or gender differences in favorability ratings for the drug-user prototype, $ps > .16$. There was a significant Class $\times$ Time interaction for drug user prototype ($F(1, 157) = 6.71, p = .01$), with decreased favorability among students not in the drugs and behavior course ($F(1, 99) = 4.04, p < .05$) and marginally significant increase in favorability among students in the drugs course, $p < .10$.

As hypothesized (Hypothesis 2), males reported marginally greater intention to use substances at pre-test ($F(1, 165) = 3.07, p < .09$) than females did, but there were no differences by class or for alcohol use intention, $ps > .14$. There were also no differences by class or interactions with class or gender over time for these two variables. Furthermore, there were no statistically significant pre-test differences by class or gender, nor were there differences over time for: willingness to drink, willingness to use drugs, alcohol user prototype, or perceived similarity of oneself to the drinker prototype, $ps > .09$. The interaction of gender and time for one's perceived similarity to the drug-user prototype was significant, however, $F(1, 157) = 4.46, p < .04$. The increase in similarity over time was marginally significant for females, $t(148) = 1.69, p = .09$; the change in similarity was not significant for males, $p = .27$. However, the difference in mean scores for men was larger than the difference for women and may have been statistically significant if we had had a larger sample of male students.

Substance Use

It was hypothesized (Hypothesis 1) that students enrolled in the drugs and behavior course would report more substance use at pre-test than other students. For pre-test drug use, there was a marginally significant main effect of class such that students enrolled in the drugs and behavior course used more drugs at pre-test than did students in the other courses, $F(1,158) = 3.49, p < .07$. There was also a significant main effect of gender: males used drugs more than females did, $F(1,158) = 5.91, p < .02$. These main effects were qualified by a significant Class by Gender interaction, $F(1,158) = 4.04, p < .05$. Males in the drugs and behavior course used drugs significantly more than did females in the same course ($F(1,59) = 5.36, p < .03$), but pre-test drug use did not differ by gender for students enrolled in the other courses ($p = .69$). There were no differences in tobacco use or alcohol consumption as a function of class enrollment ($ps > .53$). There was a marginally significant main effect of gender on pre-test alcohol use such that males consumed more alcohol than females, $F(1,162) = 3.62, p < .06$.

Repeated-measures analyses were conducted to assess change in substance use over time as a function of class and gender. Self-reported use of alcohol decreased over time ($F(1,158) = 6.22, p < .02$), with no differences across the classes. The significant main effect of time was qualified by a significant Gender $\times$ Time interaction, $F(1,158) = 6.97, p < .01$. Males decreased their use of alcohol ($F(1,40) = 4.48, p < .05$), whereas use among females did not change significantly over time, $p > .20$. The Gender $\times$ Time interaction ($F(1,154) = 3.46, p < .07$) for tobacco use was marginally significant, but follow-up analyses by gender were not significant, $ps > .20$. Despite the small sample of men and thus low power that did not allow detection of statistically significant differences, an examination of the means suggests that there was a trend for males to increase their use of tobacco during the semester: the standardized mean was -0.06 at pre-test versus 0.41 at post-test. There were no differences by class or gender for change in drug use, $ps > .30$.

A second set of GLMs were conducted to determine whether there were differences among students who used substances as compared with students who did not use substances at pre-test, regardless of course enrollment. To create the substance use variable, first an index was created by averaging pre-test past month use of tobacco, marijuana, hallucinogens, and stimulants. Alcohol had been consumed in the past month by 95% of participants, so it was not included in the index. No participants reported using heroin or inhalants in the past-month assessment, so these substances were also not included in the index. For the GLMs, the pre-test substance use index was made dichotomous by coding 0 if participants had not used any of the substances in the index and 1 if they had used at least one substance. Among women, 75 (35%) were categorized as substance users and 137 (65%) non-users; among men, there were 40 (47%) substance users and 46 (53%) non-users. Finally, 2 (use status) $\times$ 2 (time) $\times$ 2 (gender) GLMs were run for each of the dependent variables, controlling for year in college.

Five of the analyses revealed a significant or marginally significant interaction involving pre-test substance use status. Table 3 includes mean scores by gender and substance use status. There was a significant three-way interaction of Time $\times$ Gender $\times$ Use for drug use intention, $F(1, 194) = 6.44, p < .02$. Intention to use decreased for female users as compared to female non-users, $F(1, 146) = 4.38, p < .04$. There were no differences for males regardless of use status, $p > .10$. For substance use, there was a marginally significant Time $\times$ Use interaction such that pre-test substance users increased their use by post-test follow up compared with non-users, $F(1, 165) = 3.72, p < .06$. In predicting changes in tobacco use, there was a significant interaction of use status and time: substance users increased their tobacco use, $F(1,187) = 5.36, p = .02$. This interaction was qualified by a significant three-way interaction involving gender, $F(1, 187) = 4.28, p = .04$. Male substance users increased

their tobacco use over time, $F(1,44) = 4.08, p < .05$. There was also a marginally significant interaction of Time $\times$ Gender $\times$ Use for drug-user prototype, $F(1, 176) = 3.65, p < .06$. Prototype favorability increased for female substance users $t(48) = 3.01, p < .01$. Change in prototype favorability did not differ significantly among males as a function of substance use status, $p > .34$.

Finally, a Pearson chi-square test was conducted to see if the proportion of participants who had engaged in risky sexual behavior (none vs. any) varied by pre-test substance use (had used substances or not). The test was significant ($\chi^2(1, N = 202) = 20.50, p < .001$), suggesting a non-random relationship between substance use and sexual risk-taking. Of the participants who had reported engaging in sexually risky behavior, 64.4% were substance users and 35.6% were non-users.

Discussion

Academic substance use courses are commonly available to university undergraduates and may attract high risk students. These courses offer a natural laboratory for understanding the impact of course content on student attitudes and behavior, such as misperceptions of drug abuse, misunderstandings about risky behavior, and potential changes in risky or unhealthy behaviors. While substance use survey courses are neither designed nor intended to prevent nor treat substance abuse problems, describing their impact could inform components of university prevention programs designed to reduce risky behaviors associated with substance abuse. Evaluating course effects on attitudes known to be associated with substance behaviors could help guide campus intervention efforts. Moreover, inclusion of curricula shown to be effective in modifying attitudes and behavior could extend the impact of broader prevention programming in a self-selected sample of students interested in learning more about substance use, abuse, and treatment.

The current research was a quasi-experimental study following students in three academic courses across a semester. Students in all three classes were equally emotionally and physically healthy at baseline. Across the entire sample, students reported a decrease in emotional well-being throughout the semester, as might be expected due to academic pressures. Additional assistance for students in coping with academic pressures could help maintain emotional well-being and potentially stave off increases in substance use across the semester²⁴. Males in abnormal psychology experienced greater increases in emotional role limitations than females over the course of the semester. It is possible that exposure to the abnormal psychology course made men more aware of emotional issues than they would have been otherwise. Exposure to such courses could be helpful in funneling distressed men into psychological counseling, since they are typically less likely to enroll in counseling than women²⁵. Additionally, drugs and behavior students and drug users were more likely than others to have had risky sex during the semester. Risk behaviors tend to cluster together²⁶; thus, preventing substance use could reduce risky sex and sexual assault among college students. Combined prevention programming could be beneficial among this population.

As hypothesized, students in the drugs and behavior class reported slightly higher levels of substance use at baseline than did other students, perhaps reflecting the attraction to such courses among more high risk individuals. While drugs and behavior students did not know more about substances than students in other courses at the start of the semester, they did learn more about them over the duration of the class, suggesting that substance use courses could be viable opportunities for prevention efforts, given appropriate course content.

Gender was also a clear determinant of self-reported substance use. Men reported greater levels of substance use at baseline than did women in the drugs and behavior class. Across

the entire sample, there was a trend toward higher levels of alcohol use at baseline among men than women, as would be expected from the literature²⁷. Thus, college men are in greater need of substance prevention and treatment efforts than women. An academic substance use course may be a non-threatening outlet for substance use programming among this population.

Perceived prevalence of alcohol use was higher at baseline among students in the drugs and behavior course and became slightly more accurate over time than the estimates of students in the other classes. In this particular regard, students in the drugs and behavior class were more knowledgeable than other students, and course material on substance use prevalence appeared to increase their knowledge somewhat regarding alcohol use prevalence. Perceived norms is one of the best predictors of college alcohol consumption²⁸. Several studies have found normative reeducation to be effective for alcohol prevention among college students². One study also found that normative perceptions of protective behavioral strategies for alcohol consumption were related to actual use of these protective strategies²⁹. In addition to campus-wide efforts at normative reeducation, the college classroom could be another venue for such interventions.

Perceived vulnerability to the consequences of hypothetical regular substance use did not vary across class, gender, or time-point, however. On average, students in this study reported a moderate level of concern about negative consequences from using drugs or alcohol. In several prior studies, young adults have reported that they are less likely to experience negative health consequences than are their peers^{30, 31}. Realistic consequences of substance use could easily be incorporated into course content, hopefully resulting in an increase in perceived vulnerability. However, even when perceived vulnerability increases among young people, this increase may not always be associated with a decrease in risky behaviors such as drinking and smoking³². For example, one study found that negative perceptions of and motives for alcohol consumption predicted alcohol-related problems but not alcohol consumption per se²⁸. More research on perceived vulnerability, its relationship to substance use behaviors, and strategies for designing interventions accordingly is needed in order to inform course content.

Across the entire sample, marijuana expectancies became less favorable over time. While positive expectancies for marijuana remained stable for males in the drugs and behavior class, they tended to decrease for males in the other classes. It is possible that this difference is accounted for by the fact that students in the drugs and behavior class were exposed in some depth to several other classes of drugs (e.g., heroin) that were perceived to be more harmful than marijuana. Alcohol expectancies did not vary across class, gender, or time-point, however. Prior studies have found alcohol expectancies to be predictive of college alcohol use and night clubbing^{26, 33}. Studies have also found alcohol expectancy challenges to reduce alcohol use even among heavy drinking college students³⁴. Alcohol expectancy challenges involve demonstrating pseudo-intoxication after being given placebo alcohol, thus demonstrating some of the psychosocial and contextual factors involved in alcohol use. Some form of an alcohol expectancy challenge (or even a video of an expectancy experiment) may be able to be utilized effectively in the college classroom. The differences in expectancies between marijuana and alcohol may partially be a function of familiarity and personal experience – as reported earlier, over 95% of all participants had used alcohol recently. In contrast, 40% had ever used marijuana, and 33% had used marijuana within the last month at post-test.

Across the entire sample, there was a trend toward an increase in the perceived similarity of oneself to the prototypical drug user, particularly among females. However, students' positive perceptions of the prototypical drug user decreased among those not in the drugs

and behavior class. It is possible that as students become increasingly exposed to substance use throughout their college experience, they become more aware of the negative consequences of drug use. Interventions targeting drug user prototypes among young people may be helpful in reducing actual substance use^{16, 35, 36}. If college students develop a negative perception of drug users as a result of their experiences in and out of the classroom, they might be motivated to reduce their own drug use.

Men reported greater expectation of using substances than did women at pre-test, and women's expectations decreased over time but were low at both time points. However, male students' self-reported behavior throughout the semester varied by type of substance. Across the entire sample, self-reported alcohol use decreased throughout the semester, with this decrease being statistically significant among male but not female students. There was a trend toward an increase in tobacco use across the semester, particularly among men. Binge drinking is common among college students, particularly men³⁷, yet the novelty of this behavior may wear off over the course of a semester. However, nicotine is highly addictive, so tobacco users may become more tolerant of its effects, thus tending to increase its use over the same timeframe. Furthermore, the post-test assessment coincided with the end of the semester – a potentially stressful time. It is conceivable that male tobacco users increased their smoking in response to this stress whereas female smokers employed other stress-reducing strategies. This is entirely speculative, however; motives for substance use were not assessed.

The CASA study found prevalence rates of 33% for marijuana and 6% for cocaine use in 2005¹. In the current study, 39.5% of students self-reported marijuana use, and 7.5% reported using stimulants, including cocaine, at pre-test. Thus the overall rates of use in this study are similar to those in other studies. However, whereas the proportion of males who reported using marijuana was roughly equal to the proportion of females (44% vs. 38%), males were almost four times more likely to report using stimulants than were females, 16% compared to 4.7%. Although males (non-significantly) increased their tobacco use during the semester, suggesting a potential target for intervention, it is encouraging that males decreased their alcohol consumption and that drug use among both genders did not increase. Moreover, females did not increase their alcohol consumption or smoking, and their expectancies for using substances decreased. Almost all college students have used alcohol, and at least a third of our sample had used other drugs. The characteristics of students who have and have not used drugs other than alcohol likely differ from one another. This suggests the potential benefit of using different intervention approaches for these groups. For example, harm reduction would be more appropriate than abstinence-only programs for those who have already used drugs³⁸.

Strengths of this research include the use of a pre-post design, the inclusion of students from three different courses which varied greatly in content, and the measurement of many different variables and constructs related to health, substance use, attitudes, and behavioral precursors such as behavioral intention and willingness. Results suggest that exposure to the substance use curriculum did not increase use. It did result in increased knowledge and more accurate normative perceptions of the prevalence of alcohol use. Normative reeducation is one of the approaches that has demonstrated some success in substance use prevention programming². Limitations include the quasi-experimental design, reliance on self-report, and limited diversity of the sample, including the unequal proportions by gender.

While the primary goal of an academic drug education course may not be drug use prevention per se, it may be worthwhile to consider how course content can overlap with broader, empirically-validated prevention efforts on campus, or be feasibly incorporated into such efforts. This is especially important given that some studies have demonstrated harmful

effects on substance-related attitudes and behaviors among high risk populations with the use of certain approaches (e.g., didactic, informational, or general skills-based programs using abstinence-oriented approaches) that are employed currently in college classrooms^{2–6}. To further examine the potential synergistic influence of blending substance use-related course content with drug prevention efforts, future researchers should use prospective, experimental methods prior to implementation in the classroom, perhaps using randomization to compare the impact of isolated vs. blended prevention components on operationally-defined behaviors among groups of students. For example, further examination of how substance-related attitudes influence behaviors should be conducted in controlled settings before testing components in the classroom. Also, using well-defined theoretical frameworks (e.g., The Prototype/Willingness Model¹⁵) to guide experimental studies could facilitate understanding of how best to implement and interpret effects of blending drug prevention education in the classroom with broader prevention efforts.

Inclusion of curricula shown to be effective in modifying substance-related attitudes and behavior, such as normative education and interactive programming could extend the impact of broader prevention programming in a self-selected sample of students interested in learning more about substance use, abuse, and treatment. Well-designed courses could include more skills-based, interactive, and personalized elements shown to be effective in prior research, such as values clarification, cognitive-behavioral interventions, and motivational feedback², particularly within small group settings or homework assignments. Existing academic courses with substance use content may be a currently untapped resource for prevention research and intervention. Although the goal of academic courses is primarily to impart knowledge, unhealthy student attitudes and potentially even behaviors may be able to be changed for the better or at least not made worse. If the power of the classroom were systematically harnessed to convey lessons learned from decades of research, low-cost, effective preventive interventions could be widespread, potentially having a major impact on the public health.

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References

1. CASA. The National Center on Addiction and Substance Abuse at Columbia University. 2007. [cited 2009 June 24, 2009]; Available from: <http://www.casacolumbia.org/>
2. Larimer ME, Counce JM. Identification, prevention and treatment: a review of individual-focused strategies to reduce problematic alcohol consumption by college students. *Journal of Studies on Alcohol*. 2002; Suppl 14:148–163.
3. Fearnow-Kennedy M, Hansen WB, McNeal RB. Comparison of psychosocial influences on substance use in adolescents: Implications for prevention programming. *Journal of Child and Adolescent Substance Abuse*. 2002; 11:1–24.
4. Resnicow K, Botvin G. School-based substance use prevention programs: why do effects decay? *Preventive Medicine*. 1993; 22:484–490. [PubMed: 8415498]
5. Tobler NS, Roona MR, Ochshorn P, Marshall DG, Streke AV, Stackpole KM. School-based adolescent drug prevention programs: 1998 meta-analysis. *Journal of Primary Prevention*. 2000; 20:275–336.
6. White D, Pitts M. Educating young people about drugs: a systematic review. *Addiction*. 1998; 93:1475–1487. [PubMed: 9926552]

7. Riley JB, Durbin PT, D'Ariano M. Under the influence: taking alcohol issues into the college classroom. *Health Promotion and Practice*. 2005; 6:202–206.
8. Miley WM. Use of abnormal and health psychology as topics in a classroom format to reduce alcohol and other drug abuse among college students at risk. *Psychological Reports*. 2001; 89:728–730. [PubMed: 11824744]
9. Afifi Soweid R, El Kak F, Major S, Karam D, Rouhana A. Changes in health-related attitude and self-reported behaviour of undergraduate students at the American university of Beirut following a health awareness course. *Education and Health (Abingdon)*. 2003; 16:265–278.
10. Torabi MR, Seffrin JR. Evaluation of the effects of cancer education on knowledge, attitude, and behavior of university undergraduate students. *Journal of Cancer Education*. 1989; 4:39–47. [PubMed: 2641507]
11. Norton TR, Lazev AB, Schnoll RA, Miller SM. The impact of email recruitment on our understanding of college smoking. *Addictive Behavior*. 2009; 34:531–535.
12. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Medical Care*. 1992; 30:473–483. [PubMed: 1593914]
13. McDowell, I.; Newell, C. *The Rand Mental Health Inventory. Measuring Health: A Guide to Rating Scales and Questionnaires*. 2. New York: Oxford University Press, Inc; 1996. p. 213–219.
14. Fromme K, Katz EC, Rivet K. Outcome expectancies and risk-taking behavior. *Cognitive Therapy and Research*. 1997; 21:421–442.
15. Gibbons FX, Gerrard M. Predicting young adults' health risk behavior. *Journal of Personality and Social Psychology*. 1995; 69:505–517. [PubMed: 7562392]
16. Cleveland HH, Wiebe RP, Rowe DC. Sources of exposure to smoking and drinking friends among adolescents: a behavioral-genetic evaluation. *Journal of Genetic Psychology*. 2005; 166:153–169. [PubMed: 15906929]
17. Gibbons FX, Helweg-Larsen M, Gerrard M. Prevalence estimates and adolescent risk behavior: Cross-cultural differences in social influence. *Journal of Applied Psychology*. 1995; 80:107–121. [PubMed: 7706189]
18. Brown SA, Goldman MS, Inn A, Anderson LR. Expectations of reinforcement from alcohol: their domain and relation to drinking patterns. *Journal of Consulting and Clinical Psychology*. 1980; 48:419–426. [PubMed: 7400427]
19. Vik PW, Carrello PD, Nathan PE. Hypothesized simple factor structure for the Alcohol Expectancy Questionnaire: confirmatory factor analysis. *Experimental and Clinical Psychopharmacology*. 1999; 7:294–303. [PubMed: 10472518]
20. Schafer J, Brown SA. Marijuana and cocaine effect expectancies and drug use patterns. *Journal of Consulting and Clinical Psychology*. 1991; 59:558–565. [PubMed: 1918560]
21. Gibbons FX, Gerrard M, Cleveland MJ, Wills TA, Brody G. Perceived discrimination and substance use in African American parents and their children: a panel study. *Journal of Personality and Social Psychology*. 2004; 86:517–529. [PubMed: 15053703]
22. Gibbons FX, Gerrard M, Vande Lune LS, Wills TA, Brody G, Conger RD. Context and cognitions: environmental risk, social influence, and adolescent substance use. *Personality and Social Psychology Bulletin*. 2004; 30:1048–1061. [PubMed: 15257788]
23. Hanson, GR.; Venturelli, PJ.; Fleckenstein, AE. *Drugs and society*. 7. Sudbury, MA: Jones and Bartlett; 2002.
24. Karwacki SB, Bradley JR. Coping, drinking motives, goal attainment expectancies and family models in relation to alcohol use among college students. *Journal of Drug Education*. 1996; 26:243–255. [PubMed: 8952209]
25. Yu JW, Adams SH, Burns J, Brindis CD, Irwin CE Jr. Use of mental health counseling as adolescents become young adults. *Journal of Adolescent Health*. 2008; 43 :268–276. [PubMed: 18710682]
26. Reingle J, Thombs DL, Weiler RM, Dodd VJ, O'Mara R, Pokorny SB. An exploratory study of bar and nightclub expectancies. *Journal of American College Health*. 2009; 57:629–637. [PubMed: 19433401]

27. Keyes KM, Grant BF, Hasin DS. Evidence for a closing gender gap in alcohol use, abuse, and dependence in the United States population. *Drug and Alcohol Dependence*. 2008; 93:21–29. [PubMed: 17980512]
28. Neighbors C, Lee CM, Lewis MA, Fossos N, Larimer ME. Are social norms the best predictor of outcomes among heavy-drinking college students? *Journal of Studies on Alcohol and Drugs*. 2007; 68:556–565. [PubMed: 17568961]
29. Benton SL, Downey RG, Glider PJ, Benton SA. College students' norm perception predicts reported use of protective behavioral strategies for alcohol consumption. *Journal of Studies on Alcohol and Drugs*. 2008; 69:859–865. [PubMed: 18925344]
30. Prokhorov AV, Warneke C, de Moor C, et al. Self-reported health status, health vulnerability, and smoking behavior in college students: implications for intervention. *Nicotine and Tobacco Research*. 2003; 5:545–552. [PubMed: 12959792]
31. Wild TC, Hinson R, Cunningham J, Bacchiochi J. Perceived vulnerability to alcohol-related harm in young adults: independent effects of risky alcohol use and drinking motives. *Experimental and Clinical Psychopharmacology*. 2001; 9:117–125. [PubMed: 11519627]
32. Gerrard M, Gibbons FX, Benthin AC, Hessling RM. A longitudinal study of the reciprocal nature of risk behaviors and cognitions in adolescents: what you do shapes what you think, and vice versa. *Health Psychology*. 1996; 15:344–354. [PubMed: 8891713]
33. Burden JL, Maisto SA. Expectancies, evaluations and attitudes: prediction of college student drinking behavior. *Journal of Studies on Alcohol*. 2000; 61:323–331. [PubMed: 10757144]
34. Lau-Barraco C, Dunn ME. Evaluation of a single-session expectancy challenge intervention to reduce alcohol use among college students. *Psychology of Addictive Behaviors*. 2008; 22:168–175. [PubMed: 18540714]
35. Gibbons FX, Gerrard M, Lane DJ, Mahler HI, Kulik JA. Using UV photography to reduce use of tanning booths: a test of cognitive mediation. *Health Psychology*. 2005; 24:358–363. [PubMed: 16045371]
36. Gibbons FX, Houlihan AE, Gerrard M. Reason and reaction: the utility of a dual-focus, dual-processing perspective on promotion and prevention of adolescent health risk behaviour. *British Journal of Health Psychology*. 2009; 14:231–248. [PubMed: 19026095]
37. Courtney KE, Polich J. Binge drinking in young adults: Data, definitions, and determinants. *Psychological Bulletin*. 2009; 135:142–156. [PubMed: 19210057]
38. Marlatt GA, Witkiewitz K. Harm reduction approaches to alcohol use: health promotion, prevention, and treatment. *Addictive Behaviors*. 2002; 27:867–886. [PubMed: 12369473]

Table 1**Baseline Demographics**

Variable	N	%
Female	212	71.1
Caucasian	239	93.4
Year in College		
First/other	18	6.0
Second	75	25.2
Third	109	36.6
Fourth	96	32.2
Living Situation		
Dormitory	55	18.5
Off campus w/roommates	193	64.8
Greek house	20	6.7
Other (e.g., family)	30	10.0
Socioeconomic Status		
Lower	56	18.7
Middle	161	53.8
Upper	82	27.4
Family Problems		
Mental Illness	83	28.5
Alcohol Problem	76	25.8
Drug Use	84	29.3
Hometown Region		
Iowa	203	77.5
Midwest	44	16.8
Other	15	5.7
Hometown Locale		
Rural	111	42.0
Urban	75	28.4
Suburban	78	29.5
Major		
Psychology major/minor	201	78.2
Non-psychology	56	21.8
Variable	Mean	SD
Age in years	21.26	2.71
Grade Point Average	3.74	1.03

N = sample size, SD = standard deviation

Table 2

Mean scores by Gender and Course

	Females		Males	
	Not Drug Course	Drug Course	Not Drug Course	Drug Course
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
T1 emotional role limitations	79.91 (33.26)	82.96 (31.48)	90.67 (24.57)	83.33 (32.84)
T2 emotional role limitations	75.64 (37.09)	74.81 (37.03)	81.33 (32.03)	86.27 (33.46)
Standardized T1 tobacco use	0.18 (1.97)	−0.07 (0.04)	−0.07 (0.02)	−0.05 (0.04)
Standardized T2 tobacco use	−0.03 (0.55)	−0.21 (0.18)	0.31 (2.16)	0.49 (2.02)
Standardized T1 tobacco use	0.18 (1.97)	−0.07 (0.04)	−0.07 (0.02)	−0.05 (0.04)
Dichotomized T2 sexual risk behavior	0.26 (0.44)	0.33 (0.48)	0.28 (0.46)	0.39 (0.50)
<u>Drug Variables</u>				
T1 knowledge	11.50 (1.96)	12.09 (1.52)	11.32 (2.50)	11.89 (1.68)
T2 knowledge	11.09 (1.89)	12.60 (1.03)	10.84 (2.59)	12.35 (1.22)
T1 perceived prevalence	20.17 (14.34)	19.15 (12.02)	17.40 (11.54)	14.36 (6.23)
T2 perceived prevalence	16.18 (9.62)	13.49 (7.46)	14.02 (7.67)	12.12 (5.80)
T1 perceived vulnerability	3.99 (1.31)	3.63 (1.67)	3.96 (1.38)	3.60 (1.66)
T2 perceived vulnerability	4.45 (1.27)	4.04 (1.17)	4.36 (1.05)	4.30 (1.26)
T1 MEQ	182.08 (22.41)	182.11 (24.34)	183.17 (24.76)	175.50 (29.98)
T2 MEQ	184.26 (21.83)	179.89 (21.15)	174.77 (21.45)	180.00 (19.72)
T1 prototype	1.98 (0.94)	2.09 (1.06)	2.22 (0.94)	1.79 (1.23)
T2 prototype	1.90 (0.87)	2.37 (0.89)	2.08 (0.95)	2.12 (1.05)
T1 behavioral expectations	0.20 (0.45)	0.17 (0.33)	0.25 (0.60)	0.48 (0.76)
T2 behavioral expectations	0.17 (0.48)	0.18 (0.32)	0.18 (0.55)	0.52 (0.91)
T1 willingness	0.50 (1.06)	0.67 (1.18)	0.67 (1.35)	0.93 (1.09)
T2 willingness	0.38 (0.81)	0.59 (1.00)	0.53 (1.04)	1.00 (1.41)
T1 similarity to prototype	0.96 (1.38)	1.02 (1.18)	1.48 (1.78)	1.39 (1.65)
T2 similarity to prototype	1.04 (1.43)	1.13 (1.14)	1.08 (1.56)	1.12 (1.36)
T1 drug use	0.14 (0.62)	0.12 (0.31)	0.19 (0.56)	0.71 (1.59)
T1 drug use	0.27 (1.68)	0.15 (0.44)	0.58 (2.48)	1.13 (2.62)
<u>Alcohol Variables</u>				
T1 perceived prevalence	77.50 (19.47)	80.26 (15.79)	76.16 (18.67)	82.56 (12.92)
T2 perceived prevalence	75.79 (14.98)	66.73 (18.29)	72.60 (17.39)	70.94 (15.00)
T1 perceived vulnerability	3.15 (1.22)	3.04 (1.40)	3.25 (1.50)	3.21 (1.35)
T2 perceived vulnerability	3.15 (1.24)	3.09 (1.28)	3.25 (1.37)	3.11 (1.48)
T1 AEQ	74.06 (21.17)	72.50 (18.92)	69.24 (20.84)	72.67 (23.14)
T2 AEQ	79.68 (21.25)	78.68 (19.32)	75.00 (22.62)	81.89 (15.93)
T1 prototype	2.47 (0.84)	2.54 (0.92)	2.52 (0.99)	2.39 (0.59)
T2 prototype	2.49 (0.83)	2.79 (1.00)	2.39 (0.89)	2.45 (0.69)
T1 behavioral expectations	4.72 (1.76)	5.07 (1.59)	4.72 (2.19)	4.78 (2.07)
T2 behavioral expectations	4.92 (1.66)	5.09 (1.73)	4.72 (2.03)	5.06 (1.73)
T1 willingness	2.88 (1.36)	3.17 (1.33)	3.60 (1.55)	3.39 (1.49)

	Females		Males	
	Not Drug Course	Drug Course	Not Drug Course	Drug Course
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
T2 willingness	2.91 (1.33)	3.06 (1.40)	3.61 (1.59)	3.54 (1.46)
T1 similarity to prototype	3.06 (1.51)	3.11 (1.37)	3.44 (1.50)	2.94 (1.63)
T2 similarity to prototype	3.12 (1.55)	3.34 (1.33)	2.88 (1.62)	3.06 (1.34)
Standardized T1 alcohol use	-0.17 (0.74)	-0.07 (0.80)	0.34 (1.10)	0.06 (1.01)
Standardized T2 alcohol use	-0.13 (0.96)	-0.04 (1.09)	-0.13 (0.76)	-0.07 (0.96)
Standardized T1 tobacco use	0.18 (1.97)	-0.07 (0.04)	-0.07 (0.02)	-0.05 (0.04)
Standardized T2 tobacco use	-0.03 (0.55)	-0.21 (0.18)	0.31 (2.16)	0.49 (2.02)

SD = standard deviation, T1 = pretest, T2 = posttest, MEQ = Marijuana Expectancy Questionnaire, AEQ = Alcohol Expectancy Questionnaire

Table 3

Mean scores by Gender and Substance Use Status

	Females		Males	
	Not Drug User	Drug User	Not Drug User	Drug User
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
T1 emotional role limitations	81.05 (32.85)	80.61 (33.75)	85.90 (30.07)	87.50 (29.17)
T2 emotional role limitations	76.14 (35.95)	67.88 (42.05)	73.61 (39.29)	90.28 (25.02)
Standardized T1 tobacco use	-0.08 (0.00)	0.29 (2.32)	-0.08 (0.00)	-0.05 (0.03)
Standardized T2 tobacco use	-0.26 (0.02)	0.15 (0.61)	-0.26 (0.01)	0.93 (2.65)
Dichotomized T2 sexual risk behavior	0.15 (0.36)	0.45 (0.50)	0.27 (0.45)	0.50 (0.51)
<u>Drug Variables</u>				
T1 knowledge	11.60 (1.78)	12.09 (1.93)	11.31 (2.49)	12.29 (2.03)
T2 knowledge	11.56 (1.91)	11.89 (1.55)	10.81 (2.53)	12.09 (1.41)
T1 perceived prevalence	16.86 (12.27)	21.89 (13.17)	14.30 (9.29)	17.52 (9.50)
T2 perceived prevalence	14.04 (8.05)	15.18 (9.63)	11.73 (7.46)	15.89 (6.74)
T1 perceived vulnerability	4.04 (1.35)	3.49 (1.65)	3.51 (1.80)	3.90 (1.42)
T2 perceived vulnerability	4.42 (1.19)	4.03 (1.48)	4.15 (1.36)	4.30 (1.31)
T1 MEQ	183.87 (27.36)	174.06 (19.09)	188.83 (23.48)	172.21 (26.54)
T2 MEQ	186.09 (20.13)	173.24 (20.22)	184.92 (20.78)	169.87 (19.05)
T1 prototype	1.96 (1.02)	2.13 (0.96)	1.87 (0.89)	2.33 (1.36)
T2 prototype	1.95 (0.93)	2.42 (0.70)	2.08 (0.84)	2.22 (1.22)
T1 behavioral expectations	0.05 (0.18)	0.51 (0.62)	0.08 (0.25)	0.67 (0.89)
T2 behavioral expectations	0.06 (0.17)	0.41 (0.72)	0.00 (0.00)	0.83 (1.11)
T1 willingness	0.22 (0.59)	1.25 (1.55)	0.21 (0.60)	1.43 (1.41)
T2 willingness	0.30 (0.65)	0.86 (1.30)	0.21 (0.63)	1.49 (1.46)
T1 similarity to prototype	0.88 (1.21)	1.33 (1.52)	0.81 (1.13)	2.08 (1.84)
T2 similarity to prototype	0.92 (1.11)	1.81 (1.65)	0.67 (1.01)	1.96 (1.72)
T1 drug use	0.00 (0.00)	0.55 (1.09)	0.00 (0.00)	0.86 (1.51)
T1 drug use	0.01 (0.07)	0.64 (2.19)	0.00 (0.00)	1.50 (3.32)
<u>Alcohol Variables</u>				
T1 perceived prevalence	76.83 (18.46)	80.69 (15.14)	79.85 (16.85)	76.42 (16.00)
T2 perceived prevalence	71.15 (18.54)	72.40 (14.83)	71.62 (13.56)	73.13 (18.05)
T1 perceived vulnerability	3.02 (1.31)	3.30 (1.22)	2.94 (1.50)	3.40 (1.32)
T2 perceived vulnerability	3.18 (1.31)	3.15 (1.14)	3.13 (1.30)	3.23 (1.49)
T1 AEQ	69.94 (19.98)	81.20 (18.77)	71.38 (20.04)	69.75 (21.10)
T2 AEQ	77.41 (21.24)	82.67 (17.62)	78.73 (16.48)	77.54 (22.45)
T1 prototype	2.40 (0.90)	2.61 (0.72)	2.51 (0.78)	2.63 (1.11)
T2 prototype	2.46 (0.92)	2.87 (0.78)	2.45 (0.55)	2.49 (1.06)
T1 behavioral expectations	4.57 (1.81)	5.49 (1.15)	4.54 (2.16)	4.96 (2.01)
T2 behavioral expectations	4.75 (1.86)	5.51 (1.03)	4.77 (1.82)	5.04 (1.88)
T1 willingness	2.70 (1.24)	3.65 (1.24)	3.23 (1.44)	3.78 (1.46)
T2 willingness	2.67 (1.23)	3.55 (1.19)	3.27 (1.41)	3.85 (1.66)

	Females		Males	
	Not Drug User	Drug User	Not Drug User	Drug User
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
T1 similarity to prototype	2.85 (1.30)	3.64 (1.41)	2.92 (1.41)	3.75 (1.75)
T2 similarity to prototype	2.88 (1.32)	3.94 (1.39)	2.64 (1.44)	3.36 (1.50)
Standardized T1 alcohol use	-0.27 (0.66)	0.29 (0.93)	-0.02 (1.06)	0.39 (0.95)
Standardized T2 alcohol use	-0.33 (0.68)	0.41 (1.24)	-0.15 (0.96)	0.06 (0.87)

SD = standard deviation, T1 = pretest, T2 = post-test, MEQ = Marijuana Expectancy Questionnaire, AEQ = Alcohol Expectancy Questionnaire