8-2009

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## ABSTRACT

*Education-only interventions produce little change in drinking behaviors; but, multi-component prevention programs, which include alcohol information as one feature, can decrease drinking. This study examined the role of alcohol knowledge in a multi-component intervention previously found to reduce first-year female college students' alcohol consumption. Intervention and control group students completed pre and postintervention assessments of drinking behaviors, and a postintervention assessment of alcohol-knowledge. Intervention students outperformed control students on the measure of alcohol knowledge. However knowledge did not predict drinking outcomes for this group, and it was positively correlated with drinking behaviors for control students. The findings suggest that, although learning took place through the intervention, it was not the mechanism by which the intervention reduced drinking behaviors.*

College drinking continues to be a national public health concern with alcohol-related negative consequences ranging from poor academic performance to sexual assault, to vandalism, and even death (Hingson, Heeren, Winter, & Wechsler, 2005; Wechsler et al., 2002). As a result, a variety of interventions has been implemented on college campuses to prevent and reduce excessive drinking and associated negative consequences. One of the most common responses to student drinking by colleges and universities has involved education/information-based prevention methods (Darkes & Goldman, 1993; Flynn & Brown, 1991; Garvin Alcorn, & Faulkner, 1990; National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2002; Ziemelis, 1998). This approach has stemmed from the belief that a lack of knowledge or awareness of alcohol-related health risks contributes to problem drinking; thus if students understood the risks involved in heavy drinking, they would reduce their drinking. However, education-only (or knowledge-based) interventions fail to consider the complexity of motives for drinking; and, although they are effective in changing alcohol-related *attitudes* and *knowledge* (Hingson, Berson, & Dowley, 1997), they have been found to produce little measurable change in drinking *behaviors* (Larimer & Cronce, 2002; 2007; Maddock, 1999).

In contrast, the NIAAA Task Force on College Drinking, which examined prevention efforts aimed at reducing excessive alcohol use on college campuses, has found much stronger evidence for the efficacy of multi-component intervention programs (NIAAA, 2002). These programs may also contain education/information components; however, unlike education-only interventions, multi-component interventions combine alcohol information with features such as expectancy challenges, skills-based techniques, normative feedback, and motivational enhancement. These interventions emphasize alcohol information in relation to situations and decisions that are highly self-relevant for intervention recipients. For instance, factual information about the effects of alcohol may be used to challenge erroneous alcohol expectancies held by many college students -- expectancies that are known to predict their drinking (Christiansen, Smith, Roehling, & Goldman, 1989). In contrast to education-only interventions, multi-component interventions have been found to reduce drinking among college students (Dimeff, Baer, Kivlahan, & Marlatt, 1999; LaBrie, Huchting, Tawalbeh, et al., 2008; Marlatt et al., 1998; Baer et al., 1992; Kivlahan, Marlatt, Fromme, Coppel, & Williams, 1990).

Although it is reasonable to assume, given findings on education-only interventions, that knowledge about alcohol is not related to students' drinking, to our knowledge no research exists that directly examines this relationship in multi-component interventions. It is possible that in motivational-enhancement or skills-based context knowledge about alcohol serves to reduce drinking behavior in a way that it does not in the absence of these additional components. Examining this relationship is an important step in understanding the mechanisms by which multi-component interventions produce their effects. Thus, the current study seeks to directly examine the relationship between alcohol knowledge and drinking behaviors in a multi-component intervention previously found to reduce college students' drinking (LaBrie, Huchting, Tawalbeh et al., 2008; LaBrie, Huchting, Lac, et al., in press).

Different research literatures in psychology suggest alternative hypotheses about the potential relationship between knowledge and drinking. First, social-cognitive research suggests a means by which an inverse relationship between knowledge and drinking might exist. Specifically, research on social influence has found that information can be persuasive; that is, it can change attitudes when individuals are sufficiently motivated to use the information (Chaiken, 1980; Petty & Cacciopo, 1986). Generally, although research on persuasion has focused on attitude rather than behavior change, other social psychological research has found that attitudes do predict behavior if the former are specifically about behaviors in question (Fishbein & Ajzen, 1975). Thus drawing on these findings, it is possible that in a sufficiently self-relevant, compelling context – for example, in an effective multi-component intervention -- information *persuades* drinkers to change their drinking behaviors. In this case, one would expect a negative correlation between alcohol-related knowledge and drinking; in other words, more knowledge would be associated with less drinking.

Alternatively, cognitive psychology research suggests mechanisms by which a correlation between drinking behaviors and knowledge, if it existed, would be *positive* instead of negative. First, research from this field has demonstrated that information that is attended to is more likely to be remembered (Craik, Govoni, Naveh-Benjamin, & Anderson, 1996); given the relevance of alcohol-related information to themselves, heavier drinkers would likely attend to and thus remember it more than light/non-drink-

ers. Second, a well-documented phenomenon, referred to as the self-reference effect, has demonstrated that individuals remember information better when they relate it to themselves (Symons & Johnson, 1997). One explanation for this effect is that relating information to oneself causes the learner to organize and elaborate on the information, conditions that promote recall. If these influences were at play, alcohol information may serve to augment the skills and motivational aspects of multi-component interventions (e.g. it could be used to challenge students' expectancies about alcohol's effects) without necessarily serving a persuasive role. Instead, the knowledge acquired by participants could be an artifact of the intervention that does not predict *reductions* in drinking behavior; in other words, knowledge might merely be a by-product of individuals' information processing tendencies.

## OVERVIEW OF THE CURRENT STUDY

To examine the relationship between alcohol knowledge and drinking behaviors in a multi-component intervention, we turned to the *HeadsUP* intervention (LaBrie, Pedersen, Lamb, & Bove, 2006). *HeadsUP*, like other multi-component interventions, uses information about drinking in the context of skills training, normative feedback, and Motivational Interviewing in a group setting (MI; Miller & Rollnick, 2002). Intervention students participate in group discussions where they generate positive and negative outcomes of alcohol use, share their personal reasons for drinking or not drinking, and generate discussion points from their own experiences and observations. The "teaching" that takes place through the intervention has what the education literature would call many "constructivist" elements (Pressley et al. 2003); that is, information is built on and takes into account students' existing knowledge, beliefs, and experiences, and students actively generate some of this knowledge in the course of group discussions. A number of cognitive and educational psychologists have argued that participants learn more when instruction is consistent with constructivist principles (Bransford, Brown & Cocking, 1999, Pressley et al. 2003).

LaBrie, Huchting, Tawalbeh, et al., (2008) found that *HeadsUP* successfully reduced first-year female college students' drinking three months post-intervention in comparison to an assessment-only control group. The intervention targeted female college students, in particular, because these women are at increased risk

for experiencing alcohol-related negative consequences. The number of women labeled as heavy binge drinkers has increased significantly over the past decade (O'Malley & Johnston, 2002; Wechsler et al., 2002). Furthermore, inherent physiological differences cause women to experience intoxicating effects at lower levels of alcohol than men (Perkins, 2000; Jones & Jones, 1976; NIAAA, 2002). This increase in drinking, coupled with women's physiological vulnerability to alcohol, has created the need for universities to provide effective interventions that target college women.

In a replication to LaBrie, Huchting, Tawalbeh, et al. (2008), implemented on a second cohort of women, we added a 6-month follow-up component. The current study was part of the 6-month follow-up, which, in addition to assessing drinking behaviors, also assessed alcohol-related learning that might have occurred through the intervention. Findings from the efficacy study were reported in LaBrie, Huchting, Lac and colleagues (in press), and reaffirmed that women who received the intervention drank less and had fewer alcohol consequences at 3 months post-intervention than women in the control condition. However, at the new 6-month follow-up period, the differences in drinking and consequences had attenuated. The current paper examines, first, whether learning occurred as a result of the intervention; and second, if knowledge predicted drinking behaviors. We hypothesized that, because of the constructivist fashion in which information was presented, students' in the *HeadsUP* condition would demonstrate greater knowledge about drinking than control students; in other words, learning would take place through the intervention. We also hypothesized that, given weak findings in the literature on education-only interventions and robust cognitive psychological findings that attention and self-referencing augment memory, if a correlation existed between drinking behaviors and alcohol-related knowledge, it would be positive rather than negative.

## METHOD

Data collection procedures and the *HeadsUp* intervention have been described in detail elsewhere (LaBrie, Huchting, Tawalbeh, et al., 2008; LaBrie, Huchting, Lac, et al., in press). Therefore, the method used in this study is only briefly reproduced here, with more attention given to components that are relevant to this paper's focus on drinking behaviors and alcohol-related knowledge.

*Participants*

First-year female college students (N = 285) from a mid-size private university in Southern California participated in the study. Participants had a mean age of 17.93 years ($SD = 0.31$) and came from diverse ethnic backgrounds with 57.5% ($n$ =164) Caucasian, 13.0% ($n$ = 37) Hispanic/Latino, 10.5% ($n$ = 30) Asian/Pacific Islander, 5.3% ($n$ = 15) Black/African American, 10.2% ($n$ = 29) indicated more than one race, and 3.5% ($n$ = 10) reported other or declined to state. The majority (96.1%, $n$ = 274) of these women lived in on-campus housing.

*Design and Procedure*

The current study consisted of a pre-intervention online questionnaire, quasi-random assignment of participants into an intervention or control group, a group session (intervention or control) held within the first few weeks of their first semester in college, and online follow-up assessments of drinking behaviors and alcohol knowledge approximately 6-months after the group session.

*Initial Questionnaire and Assignment of Students to Conditions.* All incoming female students ($N$ = 755) were invited to participate in this study. Students who elected to participate completed an online initial (pre-intervention) questionnaire (IQ), which included questions about demographic (age, ethnicity, and family income) variables as well as questions on drinking, drinking intention, drinking motives and alcohol consequences. At the end of this questionnaire, they selected one of 26 groups to attend. These groups had previously been randomly assigned to either intervention or control conditions, and participants selected which group to attend blind to condition status. There were no baseline differences between intervention and control participants on any demographic, drinking behavior, drinking motives, or drinking intention variables (all $p > .05$) suggesting randomization had created equivalent groups (LaBrie, Huchting, Lac, et al., in press).

Enrollment occurred on a first-come, first-serve basis and ended after the allotted spaces in the groups were taken. Participants received a stipend of $40 for completing the initial online questionnaire and attending their scheduled group. At the 6-month follow-up, participants received $20 for completing the online questionnaire.

*Group Sessions.* Intervention groups, comprised of 8-12 first-year female students, were held near the end of the first month of the academic year. The groups were led by a doctoral-level clinician and co-facilitated by a research assistant. Both facilitators had extensive training in MI and followed an intervention script. The sessions lasted approximately two hours and consisted of several components: A Timeline Followback (TLFB), described below; discussions about alcohol expectancies and female-specific reasons for drinking; normative feedback; and completion of decisional balance and personalized-behavioral-goals measures.

In the context of group discussions, intervention group participants were provided with alcohol-related information. Information was presented in a highly interactive format, drawing and building on participants' existing knowledge and beliefs. For example students self-generated examples of positive and negative consequences of alcohol use, and these ideas were tied into alcohol-information and research. Alcohol-related information provided to students included: research on alcohol expectancies and specifically the role that social expectancies play in alcohol consumption during college (Hull & Bond, 1986; Marlatt & Rohsenow, 1981; Rohsenow & Marlatt, 1981); the inherent physiological differences between males and females and the resulting differential affects of alcohol on each; and the physiological and psychological effects of alcohol, including the biphasic effects of alcohol, with facilitators highlighting the point of diminishing returns (Dimeff et al., 1999). Participants were also provided with personalized blood alcohol concentration (BAC) cards and the effects of several BAC levels were discussed, as were symptoms of alcohol poisoning.

Control group students attended sessions that lasted approximately 30 minutes during which they also completed the TLFB assessment. These sessions, in contrast to intervention sessions, did not include any facilitated group discussions. *HeadsUP* was also involved throughout the year in campus-wide alcohol risk-reduction information dissemination through posters, brochures, and social events. Thus, control students by virtue of being on campus might have been exposed to alcohol-related information.

*Measures*

*Baseline Drinking Behaviors.* For both intervention and control groups, baseline drinking behaviors were assessed during group sessions with the Timeline Followback (TLFB, Sobell & Sobell, 1992) procedure, or calendar of drinking behaviors. Each participant completed a TLFB assessment where personal "marker" days (e.g., birthdays, sporting events, parties) and drinking patterns aided recall as participants filled out their daily calendar, recording the number of drinks consumed on each day. A group setting for collecting individual students' TLFBs has been shown to be as reliable and valid as the previously validated one-on-one TLFB procedure (LaBrie, Pedersen, & Earleywine, 2005; Pedersen & LaBrie, 2006). Although administered during group sessions, students were discouraged from interacting with each other while completing their TLFBs; this was done to prevent students from influencing each other's reports. TLFB reports were used to compute baseline drinking measures, specifically, maximum number of drinks, drinks per month, and heavy episodic events (defined as 4 or more drinks in a row), for the month prior to the group meeting.

*Post-Intervention Drinking Outcome Variables.* Six months after entering the study, intervention and control participants completed a follow-up assessment that asked them to report the number of drinks consumed on each day of the past week. These reports were used to calculate the 6-month post-intervention outcome measures of drinks per week, maximum drinks and heavy episodic drinking events.[1]

*Index of Alcohol-related Learning.* A 17-item, true-false test was developed to examine learning of informational content provided during the intervention. See Appendix. This measure specifically assessed alcohol-related information provided through the intervention rather than alcohol knowledge in general. To improve content validity relative to the intervention, the standardized *HeadsUP* MI script for facilitating group sessions was used to generate test items which addressed the behavioral, psychological, physiological, and legal effects of BAC, as well as differential effects of alcohol on females compared to males. The number of items students answered correctly served as a summative index of students' knowledge.

## RESULTS

We first examined differences in learning at 6 months post-intervention. An independent-samples t-test yielded a medium-to-large effect of group on learning, with treatment group ($M$ = 11.89, $SD$ = 2.36) outperforming the control group ($M$ = 10.29, $SD$ = 2.03) on the learning assessment, $t(245) = 5.64$, $p < .001$, $d$ = .73. Although we did not have a baseline measure of alcohol-related knowledge, given the two groups' equivalence on other variables, there was no reason to expect that they had differed on their existing knowledge about alcohol.

Linear regressions were used next to examine the degree to which performance on the learning measure predicted drinking outcomes at six months post-intervention. Three outcome variables (maximum number of drinks, number of drinks per week, and heavy episodic drinking events) were examined. Baseline reports of maximum number of drinks, drinks per month, and heavy episodic events, gathered through the TLFB, were used as covariates for each of the corresponding dependent variables. Regression results are reported in Table 1. For both treatment and control groups, the overall regression models predicted a significant proportion of the variance in all three drinking outcomes. However, after controlling for baseline drinking, learning did not predict any of the three outcome variables for intervention group participants (all $p$s > .05). In contrast, for control group participants, students' score on the learning assessment predicted all three drinking outcomes; higher scores on the learning assessment were associated with a greater maximum number of drinks, more drinks per week, and more heavy episodic drinking events, even after controlling for baseline drinking (all $p$s $\leq$ .001).

## DISCUSSION

The current study examined the relationship between alcohol-related knowledge and drinking behaviors within a multi-component intervention previously found to reduce female college students' alcohol consumption. Our hypotheses were supported: First, as expected, intervention students demonstrated greater knowledge than control students at 6 months post-intervention. Second, the correlation between alcohol knowledge and drinking at the 6-month follow-up was positive for the control group (those who drank more also had more knowledge about alcohol), while

there was no observed relationship between these two variables in the intervention group. Most importantly, negative associations between knowledge and drinking were not found.

With regard to differences between the two groups on the learning assessment, the effect size observed was medium to large, despite a number of circumstances that could plausibly have attenuated this difference. First, information dissemination was only one small piece of this multi-component intervention; in fact, in accordance with recommendations by the NIAAA (2002), the intervention itself was quite brief -- two hours in length, allowing for large numbers of students to experience it at low cost to the university. Second, learning effects were found fully *6-months* after the group intervention sessions, a long retention period. Third no aspect of the intervention would have suggested to students that they would have to reproduce this information, so any learning that took place was likely not deliberate; in other words, it is unlikely that students attempted to rehearse this information as they might in formal learning environments. Finally, recall that *HeadsUP* had various information-dissemination efforts (e.g., posters, social events) on campus that control students would have been exposed to during the course of their semester at the university; the learning effects that were documented occurred despite control students' likely exposure to these dissemination efforts. Thus, it is noteworthy that the *HeadsUP* multicomponent intervention produced sizeable learning effects, even under these circumstances.

With regard to the relationship between drinking and knowledge, the positive associations observed for the control group -- even after controlling for baseline drinking -- suggest that in the "normal" course of events, students who drank more were also the ones who were more likely to acquire knowledge about alcohol. This normal course of events might reflect cognitive mechanisms, for example, greater attention to alcohol related information on the part of drinkers (Craik et al., 1996) or the self-reference effect (Symons & Johnson, 1997); although, as we discuss below, this study did not attempt to test these mechanisms directly. In contrast, the lack of correlation observed for the intervention group coupled with their greater knowledge suggests that, although students acquired information through the intervention, this learning did not reduce their drinking behaviors. Instead other aspects of this multi-component intervention seem to have produced the

drinking reduction effects that have previously been documented (LaBrie, Huchting, Lac, et al., in press). These other aspects also appear to have mitigated the positive relationship between knowledge and drinking behaviors that might otherwise have been observed.

Results from this study, particularly the finding that control participants with more alcohol knowledge also drank more, suggest an explanation for the lack of effects that have been documented for education-only interventions. For example, the primarily education-based Drug Abuse Resistance Education (DARE) Program, which was widespread in the 1980s and 1990s, had almost no impact on drug use despite increased knowledge among program participants (Ennett, Tobler, Ringwalkt, & Flewelling, 1994). A meta-analysis of evaluation studies conducted by Ennett and colleagues (1994) reported that, across studies, the average knowledge effect was .42 for DARE students relative to their control-group counterparts while drinking effects were merely .06. Our findings, consistent with those from DARE efficacy studies, suggest that education-based interventions engage heavier users more than non or light users, but that knowledge rather than serving a persuasive or preventative role, might instead be an artifact of the former group's interest in the behavior. Indeed, in the area of drug prevention in general, Earleywine (2002) has written that these programs have simply allowed some participants to become "more knowledgeable users" (p. 61).

Do findings from this study suggest that information is of *no* use in multi-component interventions? Not necessarily. Some information included in these interventions may serve to augment its other components; for example, as described above, information can be used to challenge students' erroneous alcohol expectancies, which do predict drinking behaviors. At the same time, the findings suggest that other aspects of multi-component interventions may be more important. For example, studies have documented the independent effects of some features of multi-component interventions, including expectancy challenges (Hull & Bond, 1986; Marlatt & Rohsenow, 1981; Rohsenow & Marlatt, 1981), decisional balance procedures (LaBrie, Pedersen, Earleywine, & Olsen, 2006), and normative feedback (Lewis, Neighbors, Oster-Aaland, Kirkeby, & Larimer, 2007; Neighbors, Larimer, & Lewis, 2004). In the absence of this evidence for informational aspects of interventions, even as is the case here

in the context of a multi-component intervention, if colleges and universities only have the resources to provide a brief multi-component intervention, informational pieces can be among the first to be trimmed or cut.

While these findings benefit the field by beginning to "unpack" the role that alcohol-knowledge plays in multi-component interventions, the study's limitations include the following: First, the measure of knowledge was developed after the intervention had already begun; thus no baseline measure of knowledge was available to test differences in alcohol-related knowledge pre and post-intervention. However, given that randomization checks established that control and treatment groups were equivalent on other variables -- including multiple alcohol-consumption variables, intention-to-drink variables, a number of demographic variables, and drinking motives variables (see LaBrie, Huchting, Lac, et al., in press) -- it seems unlikely that there would be a difference on alcohol-related knowledge between the two groups at baseline. Future research can empirically establish this equivalence by including learning measures in baseline data collection. In addition, these measures, coupled with statistical techniques such as structural equation modeling, would allow for more sophisticated examination of the relationship between knowledge and drinking behaviors. Second, although the research literatures from social-cognitive and cognitive psychology provided frameworks for thinking about the nature of the relationship between knowledge and drinking behavior, this study does not claim to have examined these hypotheses (that is, the role of persuasion models, attention, and the self-reference effect) directly. Third, the test of learning was itself limited. It was developed specifically to assess the knowledge presented in the intervention. Had this assessment included other alcohol-related information, such as alcohol policies, findings may have been different. Extensions of the present study can address these limitations by expanding test items and directly assessing the role of cognitive mechanisms such as attention, just as others' research has examined the independent effects of various components of MI.

These limitations notwithstanding, to our knowledge this study was among the first to attempt to isolate the relationship between knowledge acquired through a multi-component intervention and students' drinking behavior. The difficulty of "unpacking" the role of various features of multi-component interventions

is that these features are likely to interact; in other words, the whole is probably more than the sum of the parts. Thus, traditional experimental methods that manipulate single aspects of multi-component interventions to examine their effects may not serve their intended purpose and may pose ethical dilemmas by delivering potentially diluted interventions to vulnerable populations. Nonetheless, given the relative efficacy and complexity of multi-component interventions compared to education-only interventions, it is important to understand *how* various features of the former influence students' drinking behaviors.

## AUTHOR NOTE

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This research was supported by grant U18 AA015451-01 from the National Institute of Alcohol Abuse and Alcoholism (NIAAA). Further, we would like to thanks Savannah Migliuri, Summer Tawalbeh, and Alysha Thompson, as well as all members of the Heads UP Team for their work in conducting interventions and supporting this research.

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## FOOTNOTES

[1] Similar measures were collected weekly during the three months following the intervention. Findings from these post-intervention assessments are reported in LaBrie, Huchting, Lac, et al. (in press).

# REFERENCES

Baer, J. S., Marlatt, G. A., Kivlahan, D. R., Fromme, K., Larimer, M. E., & Williams, E. (1992). An experimental test of three methods of alcohol risk reduction with young adults. *Journal of Consulting and Clinical Psychology, 60,* 974-979.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.). (1999). How People Learn: Brain, Mind, Experience, and School. Washington, DC: National Academy Press.

Chaiken, S. (1980). Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology, 39,* 752-766.

Christiansen, B. A., Smith, G. T., Roehling, P. V., & Goldman, M. S. (1989). Using alcohol expectancies to predict adolescent drinking behavior after one year. *Journal of Consulting and Clinical Psychology, 57,* 93-99.

Craik, F. I. M., Govoni, R., Naveh-Benjamin, M., & Anderson, N. D. (1996). The effects of divided attention on encoding and retrieval processes in human memory. *Journal of Experimental Psychology: General, 125,* 159-180.

Darkes, J. & Goldman, M.S. (1993). Expectancy challenge and drinking reduction: Process and structure in the alcohol expectancy network. *Experimental Clinical Psychopharmacology, 6,* 64-76.

Dimeff, L. A., Baer, J. S., Kivlahan, D. R., & Marlatt, G. A. (1999). Brief Alcohol Screening and Intervention for College Students (BASICS): A Harm Reduction Approach. New York: Guilford Press.

Earleywine, M. (2002). Understanding Marijuana: A new look at the scientific evidence. New York: Oxford University Press.

Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. Reading, Mass.: Addison-Wesley.

Ennett, S. T., Tobler, N. S., Ringwalt, C. L., Flewelling, R. L. (1994). How effective is drug abuse resistance education? A meta-analysis of Project DARE outcome evaluations. *American Journal of Public Health, 84,* 1394-1401.

Flynn, C. A., & Brown, W. E. (1991). The effects of a mandatory alcohol education program on college student problem drinkers. *Journal of Alcohol and Drug Education, 37,* 15-24.

Garvin, R. B., Alcorn, J. D., & Faulkner, K. K. (1990). Behavioral strategies for alcohol abuse prevention with high-risk college males. *Journal of Alcohol and Drug Eduction, 36,* 23-24.

Hingson, R., Berson, J., & Dowley, K. (1997). Interventions to reduce college student drinking and related health and social problems. In: Plant, M., Single, E., and Stockwell, T. (Eds.) Alcohol: Minimizing the Harm: What Works? New York: Free Association Books, pp. 143-170.

Hingson, R., Heeren, T., Winter, M.R., & Wechsler, H. (2005). Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18-24: Changes from 1998 to 2001. *Annual Review of Public Health, 26,* 259-279.

Hull, J. G., & Bond, C. F. (1986). Social and behavioral consequences of alcohol consumption and expectancy: A meta-analysis. *Psychological Bulletin, 99,* 347-360.

Jones, B. M. & Jones, M. K. (1976). Women and alcohol: Intoxication, metabolism and the menstrual cycle. In M. Greenblatt & M. A. Schuckit (Eds.), *Alcoholism Problems in Women and Children* (103-136). New York: Grune & Stratton.

Kivlahan, D. R., Marlatt, G. A., Fromme, K., Coppel, D. B., & Williams, E. (1990). Secondary prevention with college drinkers: Evaluation of an alcohol skills training program. *Journal of Consulting and Clinical Psychology, 58,* 805-810.

LaBrie, J. W., Huchting, K., Tawalbeh, S., Pedersen, E. R., Thompson, A., Shelesky, K., Larimer, M., & Neighbors, C., (2008). A Randomized Motivational Enhancement Prevention Group Reduces Drinking and Alcohol Consequences in First

Year College Women. *Psychology of Addictive Behaviors, 22,* 149-155.

LaBrie, J. W., Huchting, K., Lac, A., Tawalbeh, S., Thompson, A., & Larimer, M. (in press). Producing less risky drinking trajectories in first year college women: Further validation of a female-specific motivational enhancement group intervention. *Journal of Studies on Alcohol and Drugs.*

LaBrie, J.W., Pedersen, E.R., & Earleywine, M. (2005). A group-administered Timeline Followback assessment of alcohol use. *Journal of Studies on Alcohol, 66,* 693-697.

LaBrie, J. W., Pedersen, E.R., Earleywine, M., & Olsen, H. (2006). Reducing heavy drinking in college males with the decisional balance: Analyzing an element of Motivational Interviewing. *Addictive Behaviors, 31,* 254-263.

LaBrie, J.W., Pedersen, E.R., & Lamb, T., Bove, E. (2006). *Heads UP!* A nested intervention with freshmen male college students to promote responsible drinking. *Journal of American College Health, 54,* 301-304.

Larimer, M. E. & Cronce, J. M. (2002). Identification, prevention and treatment: A review of individual-focused strategies to reduce problematic alcohol consumption by college students. *Journal of Studies on Alcohol Supplement, 63,* 148-164.

Larimer, M. E., & Cronce, J. M., (2007). Identification, prevention, and treatment revisited: Individual-focused college drinking prevention strategies 1999-2006. *Addictive Behaviors, 32,* 2439-2468.

Lewis, M. A., Neighbors, C., Oster-Aaland, L., Kirkeby, B. S., Larimer, M. E. (2007). Indicated prevention for incoming freshmen: Personalized normative feedback and high-risk drinking. *Addictive Behaviors, 32,* 2495-2508.

Maddock, J. E., (1999). Statistical power and effect size in the field of health psychology, Ph.D. dissertation, Kingston, RI: University of Rhode Island, 1999.

Marlatt, G. A., & Rohsenow, D. J. (1981). The think-drink effect. *Psychology Today, 15,* 60-93.

Marlatt, G.A., Baer, J. S., Kivlahan, D. R., Dimeff, L. A., Larimer, M. E., Quigley, L. A., et al. (1998). Screening and brief intervention for high- risk college student drinkers: Results from a 2-year follow-up assessment. *Journal of Consulting & Clinical Psychology, 66,* 604-614.

Miller, W.R. & Rollnick, S. (2002). *Motivational interviewing: Preparing people for change (2nd ed.).* New York: Guilford Press.

National Institute on Alcohol Abuse and Alcoholism. (2002). A call to action: Changing the culture of drinking at U.S. colleges (NIH Publication No. 02-5010). Rockville, MD: National Institute on Alcohol and Abuse and Alcoholism.

Neighbors, C., Larimer, M. E., & Lewis, M. A. (2004). Targeting misperceptions of descriptive drinking norms: Efficacy of a computer-delivered personalized normative feedback intervention. *Journal of Consulting and Clinical Psychology, 72,* 434-447.

O'Malley, P.M. & Johnston, L.D. (2002). Epidemiology of alcohol and other drug use among American college students. *Journal of Studies on Alcohol, 14,* 23-39.

Petty, R. E., & Cacioppo, J. (1986). Communication and persuasion: Central and peripheral routes to attitude change. New York: Springer-Verlag.

Pedersen, E. R. & LaBrie, J. W. (2006). A within-subjects validation of a group administered Timeline Followback. *Journal of Studies on Alcohol, 67,* 332-335.

Perkins, W. H. (2000). Research on women's drinking patterns: Q&A with Wes Perkins. *Catalyst, 6,* 6-7.

Pressley, M., Roehrig, A. D., Raphael, L., Dolezal, S., Bohn, C., Mohan, L., et al. (2003). Teaching processes in elementary and secondary education. In W. M. Reynolds & G. E. Miller

(Eds.), *Handbook of psychology: Vol. 7. Educational psychology* (pp. 153–175). Hoboken, New Jersey: Wiley & Sons.

Rohsenow, D. J., & Marlatt, G. A. (1981). The balanced placebo design: Methodological considerations. *Addictive Behaviors*, 6, 107-122.

Sobell, L. C. & Sobell, M. B. (1992). Timeline followback: A technique for assessing self-reported alcohol consumption. In R. Z. Litten & J. P. Allen (Eds.), *Measuring alcohol consumption: Psychosocial and biological methods* (pp. 41-72). Totowa, NJ: Humana Press.

Symons, C. S., & Johnson, B. T. (1997). The self-reference effect in memory: A meta-analysis. *Psychological Bulletin, 121,* 371-394.

Wechsler, H., Lee, J.E., Kuo, M., Seibring, M., Nelson, T.F., & Lee, H.P. (2002). Trends in college binge drinking during a period of increased prevention efforts: Findings from four Harvard School of Public Health study surveys, 1993-2001. *Journal of American College Health, 50,* 203-217.

Ziemelis, A. (1998). Drug prevention in higher education: Efforts, evidence, and promising directions. Paper presented at the Higher Education Center for Alcohol and Other Drug Prevention Annual Meeting, Charleston, SC, January 1998.

# APPENDIX

*Assessment Of Alcohol-Related Learning*
*(Correct Answers Indicated In Parentheses)*

Instructions: For each statement below, select True if you think the statement is true and False if you think it is false.

1. Tolerance affects the amount of alcohol that becomes absorbed into your blood. (False)

2. Men have more of a stomach enzyme that helps them break down alcohol. (True)

3. Alcohol is a stimulant. (False)

4. Someone who is given an alcoholic beverage, but believes (s)he is drinking a non-alcoholic beverage, will still feel the physical effects (e.g., feeling warmer) of alcohol. (True)

5. The same quantity of alcohol will have a stronger effect on women than men. (True)

6. Women are more susceptible to the effects of alcohol when their estrogen levels are elevated. (True)

7. Slowed pulse and cold, clammy skin are symptoms of alcohol poisoning. (True)

8. Once someone loses the buzz (that "up" feeling that comes while drinking), (s)he cannot get it back during that drinking occasion. (True)

9. You're more likely to feel the effects of alcohol if you mix it with a carbonated beverage. (True)

10. Women's tendency to have more fatty tissue than men affects the amount of alcohol that is absorbed into their blood. (True)

11. The only reason that alcohol affects women more than men is that men are larger on average than women. (False)

12. Alcohol poisoning can occur at blood alcohol content (or BAC) of .20 and above. (True)

13. In California, a 19 year old can get a DUI if (s)he has a blood alcohol content (or BAC) less than .08. (True)

14. A lethal dose of alcohol is associated with a BAC of .08. (False)

15. Someone who drinks several alcoholic drinks in a short period of time will first experience a "buzz" (that "up" feeling that comes while drinking), and then experience a "down," and then an "up" again as (s)he continues to drink. (False)

16. Men's bodies have less water than women's bodies. (False)

17. Up to a BAC of .05 a person is more likely to experience the negative effects of alcohol than the positive effects. (False)

# TABLE 1

*Drinking Outcomes as a Function of Learning Scores (Baseline Drinking Entered As Covariate)*

| | Maximum Number of Drinks | | Drinks per Week | | Heavy Episodic Drinking Events | |
|---|---|---|---|---|---|---|
| | β | *t* | β | *t* | β | *t* |
| Treatment | | | | | | |
| Baseline Drinking (Covariate) | .59 | 8.42* | .58 | 8.18* | .48 | 6.21* |
| Learning Score | .07 | .94 | .08 | 1.13 | .05 | .61 |
| Total model: | $R^2 = .37$ $F(2, 134) = 38.71$* | | $R^2 = .36$ $F(2, 134) = 37.69$* | | $R^2 = .24$ $F(2, 134) = 21.26$* | |
| Control | | | | | | |
| Baseline Drinking (Covariate) | .65 | 8.98* | .59 | 7.73* | .59 | 7.68* |
| Learning Score | .26 | 3.56* | .28 | 3.70* | .26 | 3.40* |
| Total model: | $R^2 = .45$ $F(2, 107) = 43.86$* | | $R^2 = .39$ $F(2, 107) = 34.17$* | | $R^2 = .38$ $F(2, 107) = 33.18$* | |

*$p \leq .001$