(The Method & Results Summaries below are drawn from a Doctoral Thesis to be defended this Spring:

Sivasithamparam, J. (2011). Evaluation of the Effectiveness of the Expectancy Challenge Alcohol Literacy Curriculum (ECALC) in Reducing Alcohol Use Among High School Students. Unpublished manuscript. Final dissertation defense before end of April 2011. First results to be presented November 2011.)

METHOD

Participants

Data was collected from 433 students enrolled primarily in the 9th and 12th grades from three public high schools in the Central Florida area. These grades were selected to allow this study to demonstrate effectiveness of the ECALC at both ends of the secondary spectrum. In the 9th grade, students are typically beginning to associate alcohol with positive and arousal-based expectancies which are predictive of the development of risky drinking practices. Although a longitudinal study to determine the impact of the ECALC on their eventual drinking behavior is not immediately feasible due to the inordinate costs associated with such a venture, 9th grade students are likely to demonstrate expectancy changes which correspond to anticipated drinking initiation (Dunn & Goldman, 2000). Those enrolled in the 12th grade are likely to exhibit both the expectancy processes and risky drinking practices to demonstrate cognitive and behavioral change over time.

Students were recruited from Lake Mary High School, Winter Springs High School, and Crooms Academy of Information Technology. These schools were chosen to include a broad range of students including those from both high and low socio-economic backgrounds. Within each school, all students enrolled in the Health Education course were recruited for the study. The Health Education course was chosen for a multitude of reasons. First, it is required of all

high school students. Second, Health Education serves as an ideal subject for infusion of the ECALC. Topics regularly covered within Health Education courses include substance use and media literacy, and thus the ECALC is easily infused into the existing high school curriculum with minimal disruption to instructors.

Measures

Anonymous participant code.

An anonymous reporting procedure was used to encourage honest reporting of potentially sensitive information such as beliefs about and use of alcohol. All participants were instructed to refrain from writing their names on the measures, and were instead asked to complete a code page (Appendix A) attached to each of the baseline, post-test, and follow-up survey packets. The code is comprised of a series of seemingly irrelevant questions such as a participant's zodiac sign and height. Responses to these questions are designed to generate a unique identifier for each participant that allow multiple surveys administered over time (i.e. baseline, post-test and follow-up) to be linked without allowing the connection of a survey to a specific participant. This method of ensuring anonymity has been used successfully in previous ECALC studies (Schreiner, 2010; Sivasithamparam, 2008).

Demographic information.

Participants were asked to provide information on gender, age, educational status, ethnicity/race, and extra-curricular involvement (Appendix B).

Alcohol expectancies.

Alcohol expectancies were assessed using the Comprehensive Effects of Alcohol questionniare (CEOA; Fromme, et al., 1993; Appendix C). The CEOA was developed in response to criticisms of previously developed and validated measures such as the Alcohol

Expectancy Questionnaire. The CEOA possesses excellent psychometric characteristics and was found to demonstrate adequate internal consistency, temporal stability, and construct validity (Fromme et al., 1993). The CEOA assesses both positive and negative anticipated effects of alcohol use through ratings on a 5-point value scale ranging from 1 *(disagree)* to 5 *(agree)*. The CEOA consists of seven subscales, four of which the authors describe as positive (Sociability, Tension Reduction, Liquid Courage, and Sexuality) and three as negative (Cognitive and Behavioral Impairment, Risk and Aggression, and Self-Perception). This measure has been used successfully to measure significant changes in expectancies in previous Expectancy Challenge studies (Dunn et al., 2000; Schreiner, 2010).

Alcohol consumption.

A timeline follow-back procedure (Appendix D; Sobell & Sobell, 1992) was used to establish a typical alcohol consumption pattern for the 30-day period immediately prior to receiving the ECALC presentation, as well as for the 30-day period immediately following the presentation. Participants recorded their drinking on a calendar with self identified historical reference points to enhance recall. This method has well-established psychometric properties, and allows for the collection of exact drinking data over a specified period of time as opposed to a less useful categorization of estimated drinking patterns.

Implementation

This study consisted of a 2 (condition) x 3 (time) x 2 (gender) design in which the effects of the ECALC and an attention-matched control condition will be compared before and after treatment. Gender will be included in all analyses due to the emergence of gender differences in the findings of previous Expectancy Challenge evaluations as well as in alcohol research more generally (Darkes & Goldman, 1993, 1998; Schinke, Fang, & Cole, 2008; Schreiner, 2010). Both

the ECALC and the control presentation were implemented in a regular classroom setting during regularly scheduled Health Education classes for all students enrolled in that course. Each class consisted of approximately thirty students. Presenters were primarily trained graduate and undergraduate research members of the Substance Use Research Group. All personnel were extensively trained by the experimenter and followed an established protocol in order to maintain treatment integrity throughout the implementation.

An active consent procedure was used for this study. Parents of all students enrolled in Health Education were informed of the research and asked to provide permission for their child to participate (Appendix E). Additionally, students themselves were asked to provide assent to participate in the research (Appendix F). Only those students who returned signed parental consent forms and who provided assent were permitted to participate in the study. Remaining students were given an alternate assignment that was completed in the school library while research sessions were taking place.

Session 1.

The first visit to all students occurred two weeks prior to presentation delivery. All students were introduced to the project and handed informed consent forms to deliver to parents. Students were instructed to return signed parental consent forms to their Health Education instructor. In anticipation of potential problems with low response rates that are often associated with active consent procedures in high schools, students were offered an incentive in the form of a pizza party for the one class section in each school that most quickly returned the highest percentage of forms (signed or unsigned). This visit used approximately five minutes of class time.

Session 2.

The second class visit occurred approximately two weeks following the first. During this session, parental consent forms were collected and child assent obtained. Baseline survey measures were completed by all participants (demographic measure, Comprehensive Effects of Alcohol questionnaire, Timeline Follow-Back measure). This visit used approximately fifteen minutes of class time.

Session 3.

This visit occurred during the class session immediately following the second class visit. All class sections were randomly assigned to receive either the ECALC or an attention-matched control presentation. This visit used a full, fifty-minute class period.

Participants in the treatment condition received the fifty-minute ECALC program. The program typically begins with the two trained presenters introducing themselves and initiating a discussion on the expected effects of alcohol. Students are presented with media clips depicting commonly televised advertisements and asked to identify the expectancy effects promoted in each video clip. Each clip is deconstructed as a class by discussing the realism of messages portrayed in each clip and their appropriateness to the target audience. The presentation then goes on to discuss the pharmacological realities of alcohol as a depressant and some common misconceptions about its effect on individuals. Students are asked to identify some effects consistent with this fact and taught to differentiate between the ‘real’ and ‘expected’ effects of alcohol.

Upon completion of the presentation, students were divided into four teams for the Expectancy Challenge game. The teams are asked to view a series of video clips showcasing effects of alcohol and are then given 30 seconds to write down as many alcohol-related effects as they can think of, as portrayed in the video clip. They are also asked to identify whether the

video clip was portraying expected or pharmacological effects of alcohol. Each team then reads their list aloud. If a competing team wishes to 'challenge' an item on the list, they may do so, arguing that the particular word is an expectancy effect as opposed to a real effect of alcohol, or vice-versa. The challenge allows for discussion during the game about the effects of alcohol and of how to differentiate between alcohol expectancies and true effects of drinking. The two teams not involved in the challenge decide, by vote, which of the teams involved in the challenge presented the best argument during the discussion. The winner of the challenge is granted the points associated with the word in question. Each word earns a team one point, and correctly identifying whether the clip promotes a real or expectancy effect earns two points. The team at the end of the game with the most point wins. Due to the educational nature of this presentation, the winning team is not given a prize, but is congratulated on having demonstrated superior understanding of concepts presented in the program.

Participants randomly assigned to the attention-matched control condition received a fifty-minute presentation on body image. This presentation topic was chosen for its salience to the adolescent population and the ease with which it is also infused into the regular course curriculum. The control presentation is equally interactive and contains a media literacy component similar to the ECALC, but with a focus on expectancies related to body image. Therefore, the main difference between the two presentations is expected to be content alone.

Immediately following both presentations, participants completed post-test survey measures (demographics and Comprehensive Effects of Alcohol questionnaire).

Session 4.

This final session occurred approximately thirty days following presentation delivery (Session 3). All students completed one-month follow-up measures (demographic measure,

Timeline Follow-Back measure). Following completion of these measures, those students assigned to the treatment condition received the body image presentation, while those assigned to the attention-matched control condition received the ECALC. This method was used to ensure that all students received the same information and educational benefits as part of the Health Education course regardless of assignment to condition. Students were also debriefed at this time (Appendix G) and the qualifying class within each school received a pizza party. This visit used approximately fifty-minutes of class time.

Analysis Plan

Alcohol consumption.

Information collected within the measures (gender, weight, TLFB) will allow for the calculation of participants' estimated blood alcohol concentration (eBAC) values for each drinking day. This information is valuable because intoxication is a strong indicator of risky drinking, and is influenced by a number of factors in addition to standard measures of risk such as drinking quantity. These factors include weight, the duration of the drinking event, and gender differences in alcohol metabolism. It follows that if a male and female consumed the same number of drinks (quantity), the female would likely exhibit a greater degree of intoxication (blood alcohol concentration) due to metabolism and typical weight differences. Most studies currently utilize drinking quantity measures which may provide misleading indicators of risk when failing to account for length of the drinking occasion and gender influence. Indeed, research is increasingly demonstrating that females are experiencing negative consequences that parallel or surpass their male peers despite males reporting higher drinking quantities relative to females (LaBrie & Pederson, 2008; Pederson & LaBrie, 2006; Presley & Pimental, 2006). These findings may reflect the impact of intoxication on risk status.

The following equation will be employed to calculate mean and peak eBAC values for the past 30 days: eBAC = [(number of drinks / 2) x (GC / weight)] - (.017 x hours of drinking) where GC is a gender constant: 9.0 for females and 7.5 for males (Matthews & Miller, 1979). The Matthews and Miller (1979) formula has been widely used in retrospective estimations of blood alcohol concentration (Baer et al., 1992; Barnett, Wei, & Czachowski, 2009; Borsari, Neal, Collins, & Carey, 2001; Carey, Henson, Carey, & Maisto, 2009; Kahler, Hustad, Barnett, Strong, & Borsari, 2008; Rutledge, Park, & Sher, 2008) and was identified as yielding the most accurate eBAC calculation among five prominent formulas when compared to actual blood alcohol concentration obtained by a breath test (Hustad & Carey, 2005). This formula has also been demonstrated to yield eBAC calculations that possess a significant linear trend relationship with negative consequences such as experiencing trouble with the police, having unprotected sex, incurring injuries and increased ER visits (Tuner, Bauerle, & Shu, 2004).

Alcohol expectancies.

Two distinct statistical techniques will be used to assess changes in alcohol expectancies: a factor analytic method, and a method based on multidimensional scaling (MDS). These techniques were selected in response to ongoing debate among expectancy theorists regarding appropriate strategies to delineate “true” dimensions of expectancy within a memory framework.

Factor analytic approaches have been the primary basis for the development of many widely used alcohol expectancy measures to date. The CEOA questionnaire is one of the more prominently used measures with adolescents, and is itself a factor analytically derived measure which groups alcohol expectancies into four positive and three negative factors. These factors are believed to accurately reflect the conceptualization and perception of alcohol among adolescents using a minimal number of items. The use of a Likert response scale within the CEOA also

allows for the measurement of expectancy strength (Collins, Lapp, Emmons, & Isaac, 1990) and renders this measure amenable for use in both research and applied settings. In the present study, univariate analyses of co-variance (ANCOVA) will be applied to assess the effect of each of the study conditions on responses to the CEOA.

Although factor analytic models are useful in that they may be used to predict behavior, an inherent weakness exists in that solutions are typically interpreted by forcibly collapsing factor elements into simple composite factor scores (Rather et al., 1992). These mathematically derived composites are unlikely to adequately describe the breadth of expectancy nodes believed to exist at the heart of the memory network (Aarons, Goldman, Greenbaum, & Coovert, 2003; Davison, 1983) and may therefore be insufficient in capturing changes in expectancy activation over time. Alternatively, multidimensional scaling (MDS; Kruskal & Wish, 1978) has been used among cognitive scientists to model concept organization in psychological space (Lee, 2001; Nosofsky, 1984, 1992; Shepard, 1957). In contrast to factor analytic methods, MDS solutions are interpreted as graphic representations of stimulus items which are "mapped" relative to one another in multidimensional space (Goldman & Rather, 1993). The dimensional map places these items in proximity to one another based on naturally occurring similarities or differences among them, with items closer to each other in the stimulus configuration more likely to activate together. Individual differences scaling (INDSCAL) is a variant of MDS which analyzes dimensional structure as a function of individual differences such as gender or drinker level (Rather & Goldman, 1994). This method's most prominent features include a group stimulus configuration and associated subjects' dimensional weights matrix, both well known and highly useful in applied contexts. Previous studies using MDS and INDSCAL techniques (Cruz, 2007; Cruz & Dunn, 2003; Dunn & Goldman, 1996, 1998; Rather et al., 1992) have demonstrated the

utility of this method in mapping alcohol expectancy information networks among adults, adolescents and children, with resulting maps directly corresponding to behavioral processes (Goldman & Darkes, 2004). These procedures have also been applied to Likert scale-based surveys in the past (Dunn & Goldman, 1996; 1998). In the present study, INDSCAL will be applied to responses on the CEOA to assess whether participants who received the ECALC show decreased emphasis on positive and arousing expectancies compared to participants in the attention-matched control condition.

RESULTS

Of the 384 students invited to participate in the study, 383 (99.7%) obtained parental consent and provided assent to do so. The student who did not return a parental consent form was given alternate assignments that were completed in the school library during all research sessions. Of the 383 participants, 368 (96.1%) completed all follow-up measures. Among the non-completers, 5 (1.3%) were absent during post-test and follow-up sessions. Analyses were conducted to ensure completers and those who completed only baseline measures were not significantly different. Chi-square analyses revealed no significant differences between the two groups across conditions, schools, genders, class standings, ethnicities or races. A univariate analysis of variance (ANOVA) revealed no significant difference between groups on age. Results are summarized in Table 1. The remaining 10 (2.6%) non-completers provided invalid data (8 surveys contained blank CEOA and TLFB measures, and 2 surveys contained inappropriate comments throughout which made it apparent the responses were not valid). Analyses were conducted to ensure that completers and invalid responders were not significantly different. Chi-square analyses revealed no significant differences between the two groups across conditions, schools, genders, class standings, ethnicities or races. A univariate ANOVA revealed no significant difference between groups on age. Results are summarized in Table 2.

The main purpose of this study was to evaluate the effectiveness of the ECALC among students at both ends of the high school spectrum: 9^{th} and 12^{th} grades. It is likely that the presence of students in 10^{th} and 11^{th} grades is due to the mixed nature of Health Education classes in each of the schools involved. These courses combine students from different grade levels, and thus one class section may include students from two or more grades. In recognition

of developmental differences in perception and use of alcohol among adolescents, 9th and 10th grade participants will be analyzed separately from those in the 11th and 12th grades.

Furthermore, this study seeks to demonstrate that changes in alcohol use correspond to changes in key alcohol expectancies facilitated by the ECALC. In order to link expectancy changes to changes in drinking behavior, it is necessary to evaluate alcohol expectancies among drinkers (N=149, 40.5%) separately from participants who abstained from alcohol use during the months surveyed at baseline and follow-up (N=219, 59.5%). Results are presented for both groups in the following sections.

Participants in 11th and 12th grades

Drinkers.

Baseline participant characteristics.

Chi-square analyses were conducted to assess baseline differences between conditions on demographic factors of school, gender, ethnicity, and race. Comparisons revealed significant differences between conditions across schools [X^2 (2, N=104) = 20.02, $p < .001$, partial eta^2 = .439] and genders [X^2 (1, N=104) = 4.54, p = .033, partial eta^2 = .209]. Results indicated that the ECALC condition included a greater number of Crooms Academy students and a greater number of males relative to the control condition. A univariate ANOVA confirmed that groups were similar in age and both typical and peak alcohol consumption. In addition, a multivariate analysis of variance (MANOVA) was conducted to examine baseline differences between the conditions on CEOA subscale scores. No significant differences in expectancy endorsement were found between conditions. A comparison of the groups is provided in Table 3.

Changes in alcohol consumption.

A series of 2 (ECALC, attention-matched control) x 2 (male, female) analyses of covariance (ANCOVA) were conducted with baseline drinking as a covariate to assess drinking changes from baseline to one-month following the intervention. Results revealed a significant main effect of condition on mean eBAC [$F(1, 99) = 5.19$, $p = .025$, partial $eta^2 = .050$], mean number of alcohol drinks consumed per sitting [$F(1, 99) = 18.27$, $p < .001$, partial $eta^2 = .156$], peak number of drinks consumed in one sitting [$F(1, 99) = 7.17$, $p = .009$, partial $eta^2 = .068$], and mean number of drinking days per week [$F(1, 99) = 6.90$, $p = .010$, partial $eta^2 = .065$]. Findings indicated a significant reduction in mean drinking and intoxication as well as peak drinking from baseline to one-month follow-up in the ECALC condition relative to attention-matched controls. No gender effects were found, indicating that changes in alcohol use did not differ between males and females. Results are summarized in Table 4.

Changes in alcohol expectancies.

Expectancy changes were assessed first with a series of 2 (ECALC, attention-matched control) x 2 (male, female) ANCOVA analyses with baseline expectancies as covariates to assess changes in expectancy endorsement from baseline to posttest. Analyses were conducted on each of the seven CEOA subscales (Sociability, Tension Reduction, Liquid Courage, Sexuality, Cognitive/Behavioral Impairment, Risk and Aggression, and Self-Perception). Results revealed a significant main effect of condition on the Cognitive Behavioral Impairment subscale [$F(1, 81) = 4.28$, $p = .042$, partial $eta^2 = .050$] indicating that participants reported greater agreement with expected effects of feeling dizzy, having slowed responses and having dulled senses from baseline to posttest relative to those in the control condition. No gender effects were found, indicating that changes were similar between males and females. No significant effect of

condition or gender was found on the remaining six CEOA subscales. Results are summarized in Table 5.

An INDSCAL procedure was used to map alcohol expectancies into a memory network format, with expectancies represented by nodes that are closely or more distantly linked in multidimensional space. One of the benefits of applying INDSCAL is its ability to simultaneously analyze proximity matrices for multiple participant groups and provide a graphic stimulus configuration that best represents all groups. Eight proximity matrices based on participant responses to the CEOA measure were used as input for the INDSCAL analysis (i.e., one proximity matrix for each gender within each condition from baseline to posttest). A two-dimensional solution (see Figure 1), accounting for 61.9% of the variance (stress = .22) was considered optimal on the basis of Davison's (1992) technique of dimension selection. Stress and R^2 are used to evaluate the fit of the configurations; low stress and high R^2 values are indicative of good fit. A three-dimensional solution offered a minimal increase in the variance accounted for (2.1%), and therefore a two-dimensional solution was used for interpretability. Consistent with previous work on alcohol expectancies, the two dimensions of the INDSCAL stimulus configuration can most accurately be described as representations of the positive-negative and arousal-sedation effects of alcohol.

INDSCAL also provided a measure of dimension emphasis for each of the eight participant groups in the analysis (group weights). Higher group weights for a particular dimension reflect greater emphasis placed on that dimension for each experimental condition at each measurement time. The plot of each pair of group weights (see Figure 2) indicated an increased emphasis on the positive-negative dimension among ECALC males and females, as well as decreased emphasis on the arousal-sedation dimension among ECALC females relative

to control groups. Individual expectancy item means were examined to assess the direction of changes in dimensional emphasis. Means for negative expectancies (e.g., impaired writing, difficulty thinking, slow) were higher and means for positive expectancies (e.g., courageous, creative, enjoy sex more) were lower following exposure to the ECALC. Further, means for sedating expectancy effects (e.g., moody, tough, self-critical) were higher while means for arousing expectancy effects (e.g., sociable, talkative, humorous) were lower following exposure to the ECALC. These findings are consistent with a reduced likelihood of drinking in the future (Dunn & Goldman, 1998; Dunn et al., 2000) and mirror changes in alcohol use found in this study.

Table 1. Group comparisons for ECALC (N=72) and control (N=32) conditions among 11th and 12th grade drinkers

	ECALC	Control		
	N (%)	*N (%)*	χ^2 *(df)*	*p*
School				
Crooms Academy	24 (33.3)	1 (3.1)	20.02 (2)	<.001
Lake Mary	34 (47.2)	12 (37.5)		
Winter Springs	14 (19.4)	19 (59.4)		
Gender				
Male	34 (47.2)	8 (25.0)	4.54 (1)	.033
Female	38 (52.8)	24 (75.0)		
Ethnicity				
Caucasian	48 (66.7)	21 (65.6)	3.30 (4)	.509
African American	14 (19.4)	4 (12.5)		
Asian	1 (1.4)	1 (3.1)		
Native Hawaiian / Pacific Islander	0 (0.0)	0 (0.0)		
American Indian / Alaska Native	2 (2.8)	0 (0.0)		
Other	7 (9.7)	6 (18.8)		
Race				
Hispanic	22 (30.6)	10 (31.3)	0.01 (1)	.944
Non-Hispanic	50 (69.4)	22 (68.8)		
	M (SD)	*M* (SD)	*F (df)*	*p*
Age	16.89 (0.82)	16.63 (0.71)	2.513 (1, 102)	.116
Alcohol Use				
Mean eBAC	.079 (.097)	.063 (.079)	0.48 (1, 97)	.491
Peak eBAC	.117 (.154)	.091 (.106)	0.50 (1, 97)	.480
Mean # Drinks/Sitting	4.09 (3.38)	3.24 (3.29)	0.39 (1, 97)	.535
Peak # Drinks	5.58 (5.06)	4.53 (4.59)	0.24 (1, 97)	.626
Mean # Drinking Days/Wk	0.57 (0.53)	0.62 (0.56)	<0.01 (1, 97)	.997
Alcohol Expectancies				
Sociability	27.07 (3.62)	27.38 (4.39)	0.30 (7, 94)	.950
Tension Reduction	9.00 (2.33)	8.34 (2.09)		
Liquid Courage	14.79 (3.48)	14.72 (3.65)		
Sexuality	10.67 (3.09)	10.94 (3.72)		
CBI	25.92 (5.21)	27.31 (5.22)		
Risk & Aggression	13.06 (3.41)	13.59 (3.40)		
Self-Perception	8.22 (2.63)	8.31 (2.13)		

Note: CBI = Cognitive Behavioral Impairment

*$p < .05$ **$p < .01$ ***$p < .001$

Table 2. Changes in alcohol consumption from baseline to one-month follow-up among 11th and 12th grade drinkers

	Baseline	Follow-Up		*F*	*F*	*F*
	M (SD)	*M* (SD)	*df*	(Group)	(Gender)	(Group x Gender)
Mean eBAC						
ECALC	.079 (.097)	.018 (.048)	1, 99	5.19*	0.68	0.02
Control	.063 (.079)	.042 (.066)				
Peak eBAC						
ECALC	.117 (.154)	.052 (.096)	1, 99	2.54	0.52	0.03
Control	.091 (.106)	.082 (.106)				
Mean # Drinks/Sitting						
ECALC	4.09 (3.38)	0.92 (1.90)	1, 99	18.27***	0.38	2.93
Control	3.24 (3.29)	2.69 (3.29)				
Peak # Drinks						
ECALC	5.58 (5.06)	2.76 (3.97)	1, 99	7.17**	<0.01	1.78
Control	4.53 (4.59)	4.56 (4.71)				
Mean # Drink Days/Wk						
ECALC	0.57 (0.53)	0.33 (0.46)	1, 99	6.90*	0.55	1.54
Control	0.62 (0.56)	0.62 (0.66)				

Note: Mean eBAC = Mean estimated blood alcohol concentration, Peak eBAC = Peak estimated blood alcohol concentration, Mean # Drinks/Sitting = Mean number of alcoholic drinks consumed per sitting, Peak # Drinks = Peak number of alcoholic drinks consumed in one sitting, Mean # Drink Days/Wk = Mean number of drinking days per week.

*$p < .05$ **$p < .01$ ***$p < .001$