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Pre-Adolescent Alcohol Expectancies: Critical Shifts and Associated Maturational Processes

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Abstract

Children's alcohol expectancies shift in late childhood/early adolescence in ways thought to lead to increased risk for adolescent alcohol use. The precise nature of this shift and the maturational processes that may influence it remain to be clarified. To these ends, we compared expectancy endorsement by grade across four expectancy domains: positive, negative, arousal and sedation, in a cross-sectional sample of 3rd-6th grade children attending afterschool programs (n = 299). Structural equation modeling (SEM) then was used to describe the relationships between expectancies and differences in: (a) cognitive ability and concept formation, (b) risk-taking personality traits, and (c) social exposure or values regarding alcohol-related information. Results showed those children in higher grades endorsed significantly more positive, negative and sedating expectancies for alcohol than their younger peers. Concept formation partially and fully mediated the relationships between grade and both positive and sedating expectancies, respectively, but not the relationship between grade and negative expectancies. Sensation seeking did not increase across grades in this sample, and the relationship between sensation seeking and positive expectancies was fully mediated by reported alcohol exposure and values. This study provides a basis for future exploration of developmental influences on alcohol expectancies, an understanding of which may be helpful in the design of prevention efforts targeting high risk youth prior to adolescence.

Keywords

children; adolescent; sensation seeking; neurocognitive development; alcohol risk factors

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In a special issue of the journal *Pediatrics*, Masten, Faden, Zucker, and Spear (2008) documented the population-wide increase in alcohol consumption known to occur from late childhood to emerging adulthood in the United States. In the same issue, this rise in alcohol consumption was linked to complex and multifaceted social/developmental processes occurring across this age range (Brown et al., 2008; Windle et al., 2008; Zucker, Donovan, Masten, Mattson, & Moss, 2008). Although thorough review is beyond the scope of this paper, these mechanisms included genetic/biological, environmental/cultural, within-family, and personality/psychosocial developmental processes; all were characterized as interdependent and understood to evolve in a complex manner. Because researchers cannot capture the entirety of these multifaceted processes in a single study, one strategy to obtain traction in this domain has been to measure variables that may reflect a downstream product of these unfolding processes.

Anticipatory/expectancy mechanisms have been theorized, in both the human and animal literatures (Buckner, 2010; Goldman, Darkes, Reich, & Brandon, 2006; Holland & Gallagher, 2004; Redish, Jensen, & Johnson, 2008), to serve this transdisciplinary function by connecting biological and experiential/environmental inputs with subsequent decisions/actions. Matsomoto and Tanaka (2004, p. 178) indicated that the prefrontal cortex links biologically important signals with actions "based on goal expectation and memory of action-outcome contingency." Using primarily language-based probes, human alcohol expectancies have been shown to predict concurrent and future drinking, to reciprocally increase with drinking experience, and to mediate the influence of other risk factors on alcohol use (Goldman, 1989, 1999; Goldman, Reich, & Darkes, 2006). Most importantly with respect to the current study, alcohol expectancies have been found in children well before they have had personal experience with drinking, suggesting that a key source of alcohol expectancy information is observational (vicarious) and culturally transmitted (Donovan, Molina, & Kelly, 2009; Miller, Smith, & Goldman, 1990; Noll, Zucker, & Greenberg, 1990; Zucker, Kincaid, Fitzgerald, & Bingham, 1995).

Although expectancies and pre-expectancy cognitive schema have been found in very young children (even 3 to 5 years of age; Zucker et al., 2008), studies of late childhood have suggested important changes in expectancies that precede the upsurge in drinking that occurs during adolescence. Miller, Smith and Goldman (1990) observed an escalation in children's positive expectancies around 3rd to 4th grade, suggesting a developmentally important transition occurring at this time. Other studies of this phenomenon have shown that, even in the context of increasing positive expectancies, younger children primarily reported negative expectancies of alcohol. In contrast, older children and adolescents reported more of both positive and negative alcohol expectancies, but emphasized the positive expectancies as their dominant characterization of alcohol effects (Cameron, Stritzke, & Durkin, 2003; Johnson & Johnson, 1995; Query, Rosenberg, & Tisak, 1998; Schell, Martino, Ellickson, Collins, & McCaffrey, 2005; Wiers, Gunning, & Sergeant, 1998).

Cognitive neuroscience approaches (noted earlier) suggested that viewing expectancies from the perspective of memory structure, rather than as a simple list of verbal descriptors or beliefs, might offer advantages. To this end, Rather, Goldman, Roehrich, and Brannick (1992) examined expectancies in late adolescence using empirical techniques (multidimensional scaling; MDS) to generate a model of an associational network of expectancies. This technique placed expectancies in a multidimensional space described by two primary axes representing positive-negative, and arousal-sedation expectancies. When repeated in a younger sample (Dunn & Goldman, 1996, 1998), the resulting modeling revealed a steady transition during the late elementary school years from an emphasis on the positive-negative dimension (primarily stressing the negatives), to a stronger focus on more

positive and arousing expectancies. The differences seen in these MDS models between younger and older children could arise from a cognitive network that gains one set of associates and extinguishes another (i.e., gains and losses model) or, alternatively, that incorporates new associations of all types, with one set increasing at a greater rate than another (i.e. differential gains model). More specifically, the shift towards positive and arousing expectancies would be consistent with a gains and losses model if children assimilated more positive and arousing expectancies while reducing, or rendering more remote, associations to negative and/or sedating expectancies linked within the network. Alternatively, a differential gains model would best characterize the changes if children's expectancy networks became more elaborate across all dimensions throughout development, but with a greater rate of acquisition of positive/arousing entries (resulting in a competitive advantage in the activation/accessibility of these associates).

Most studies to date have supported a differential gains perspective, even after controlling for measurement invariance across age groups (McCarthy, Pedersen, & D'Amico, 2009; Schell et al., 2005). These studies primarily examined differential gains associated with positive and negative expectancies, however, and not arousal and sedation expectancies identified in the associational network approach. These latter expectancies are significant because they map onto theories of risk for problematic alcohol use (see Newlin & Renton, 2010; Newlin & Strubler, 2007; Schuckit et al., 2005).

In the present study, relative differences in children's expectancy endorsement across successive grade levels in a cross-sectional sample of youth were examined for their consistency with either a gains and losses model or differential gains model of expectancy development. While it is understood that cross-sectional sampling of children in different elementary school grades serves only as a proxy for a within-participants longitudinal investigation, this strategy can suggest relevant developmental processes before a more costly longitudinal study is pursued. In this context, we hypothesized that differences in expectancies across development would occur in a pattern consistent with a differential gains model of expectancy development, such that (a) more expectancies would be endorsed by youth in more advanced grades relative to younger children across all four axes of the multidimensional solution described by Dunn and Goldman (1996): positive, negative, arousal, and sedation, and (b) that the shift upward in positive and arousing expectancies endorsed by children in higher grades relative to children in lower grades would exceed the corresponding shift upward in endorsement of negative and sedating expectancies. The prediction that older children would endorse more expectancies of all types was inconsistent with a gains and losses model (i.e., that youth in advanced grades would endorse fewer negative and/or sedation expectancies than their younger peers). We cast these predictions in terms of shifts (directional differences across grades) because the three grades primarily sampled for this study; 3, 4, and 5; constitute only a portion of the developmental range in which changes might be seen. That is, while we conducted critical tests of differences from the youngest to the oldest in *this* sample; the total range of absolute changes would necessitate sampling further into adolescence. Measures appropriate and factorially invariant across this extended age range are not currently available for all of the constructs examined.

Because, as noted above, changes in expectancy organization and emphasis may be construed as a downstream product of multifaceted developmental processes (i.e., changes in physical, psychological, and social status presumably lead to a changing matrix of sought-after [rewarding] outcomes), we also began the examination of upstream influences that might lead to differential expectancies as children develop. To this end, we conducted a preliminary exploration of some individual characteristics that might change as children develop, and in turn, may influence the acquisition of expectancies: cognitive ability and concept formation, risk-taking personality traits, and social exposure or values regarding

alcohol-related information. We hypothesized that differences in each of these characteristics across grades would partially mediate the relationships between grade and expectancy endorsement, particularly for positive and arousing expectancies (see Figure 1).

We chose to examine cognitive processes because extensive neurocognitive development documented during late childhood and early adolescence (Demetriou et al., 2002; Keating, 2004; Steinberg, 2005) might provide a substrate for changes in how children encode and interpret information about alcohol. Researchers have speculated that these developmental changes in cognition form a possible pathway for more diverse types of alcohol expectancies in older children and adolescents (Cameron et al., 2003; Dunn & Goldman, 2000; Schell et al., 2005). Improvements in abstract and multidimensional thinking during adolescence may lead to increased comprehension of more nuanced or potentially inconsistent effects of alcohol, or assist with incorporating information about how alcohol affects others outside of the youth's personal experience (i.e., peers, family members or media figures). Positive expectancies have been associated with verbal skills, spatial working memory, attention and other executive functions (Tapert, McCarthy, Aarons, Schweinsburg, & Brown, 2003; Deckel, Hesselbrock, & Bauer, 1995; Pulido, Anderson, Armstead, Brown, & Tapert, 2009; Thush et al., 2008). In the current sample, we utilized a measure of concept formation and articulation to represent a skill set we anticipated might be uniquely suited to understanding alcohol expectancy development.

Risk taking personality characteristics were examined because they also have been shown to increase from childhood to adolescence and then to decrease again in adulthood (Martin et al., 2002; Spear, 2000; Zuckerman & Neeb, 1980). This pattern may be evolutionarily advantageous; enhanced risk taking may allow adolescents to meet critical social milestones (Masten et al., 2008; Spear, 2000), such as distancing themselves from their caregivers, becoming closer to their peer group, and mating successfully. Sensation seeking/risk-taking may impact how children encode information about alcohol by enhancing responses to fun or novel features while diminishing the salience of negative aspects (consistent with the acquired preparedness model of risk for alcohol use; Smith & Anderson, 2001).

For similar reasons, we included measures of social exposure and values related to alcohol. Because expectancies (as noted above) have been shown to appear before drinking occurs, children must acquire them vicariously. Suggested influences on such vicarious acquisition are societal norms (Donovan et al., 2009), parental and peer behaviors (Cumsille, Sayer, & Graham, 2000; Ellis, Zucker, & Fitzgerald, 1997), and media exposures (Austin & Meili, 1994; Dal Cin, Worth, Dalton, & Sargent, 2008; Dunn & Yniguez, 1999).

Method

Participants

To avoid interrupting the children's education during normal school hours, a sample was drawn from 3rd to 6th grade children enrolled in after-school programs offered either by YMCA Latchkey or School Age Child Care (SACC, run by the local public school district). These were the two largest after-school care programs in the Tampa Bay area and were available at elementary schools in representative urban, suburban and rural neighborhoods. Both programs were similar in terms of setting (typically held in the school cafeteria), structure and staff, and no program differences were found on any of the variables of interest. These after-school programs provided a comfortable environment for the research staff to complete a comprehensive assessment battery. Parents were asked for active consent via take-home forms, and children provided their assent verbally. Only students who returned the parental consent forms were allowed to participate. Thirty-two percent of the

children approached returned their parental permission slips; of these individuals, 75% agreed to participate.

The resulting sample included 299 3rd to 6th grade students between 7 and 12 years old (m = 9.36 years, SD = 1.01; 60% female). Although the rate of participation might have presented issues associated with self-selection, the sample was diverse and matched the demographic makeup of the Tampa Bay area; 54% of participants were white, non-Hispanic, 21% Hispanic/Latino(a), 9% black, non-Hispanic, 3% Asian, and 14% multiracial, other or unknown.

Because of the participant's age, actual drinking was expected to be quite low in this sample. Out of 299 participants, only 10% indicated that they had at least a few sips of a drink of alcohol in their lifetime and less than 2% had ever drunk more than a few sips. These low rates of consumption suggested that any differences we might see in the expectancies of younger and older children would be unlikely to arise from the pharmacological effects of alcohol.

Measures

Slosson's Oral Reading Test - Revised (SORT-R)—This well-normed measure, with internal consistency and test retest reliability coefficients above .95 (Slosson, 1990), was administered to ensure that participants met the minimum reading level required to complete the assessments. Participants who experienced difficulties reading test materials (n = 7) were administered one or more of the self-report measures verbally and recorded their responses confidentially after each item was read aloud. Three of these participants did not complete the DKEFS-Sorting task. Despite these protocol modifications, no significant differences were noted in self-report subscales for participants who had difficulty reading. Although these students performed more poorly on the sort recognition subscale of the DKEFS-Sorting task (t = 2.41, p < .05), their inclusion did not impact relationships observed between measures of interest.

Delis-Kaplan Executive Functioning System Sorting Task (DKEFS-Sorting)—This task, modeled after the California Card Sorting Task (Greve, Farrell, Besson, & Crouch, 1995), was designed to measure development of aspects of concept formation and categorization (Greve, Love, Dickens, & Williams, 2000). In the free sort condition, each child was asked to sort six cards into two groups, with three cards per group, as many times as possible based on similar visual-spatial (5) or verbal-semantic (3) features, and to describe how they sorted the cards. In the recognition condition, the administrator sorted the cards based on the same features and the participant was asked to describe how the cards in the two groups were similar to one another. The following scaled scores were used in subsequent analyses: Free Sorting Confirmed Correct Sorts, Free Sort Description Score, and Sort Recognition Description Score (Delis, Kramer, Kaplan, & Holdnack, 2004).

Memory Model-Based Expectancy Questionnaire (MMBEQ)—The MMBEQ was an explicit alcohol expectancy measure based upon the MDS modeling described in the introduction. Additional psychometric development allowed for factor score computation to examine mean differences in expectancies across age groups (Dunn & Goldman, 1996; Dunn, 1999). It consisted of 41 items derived from individual interviews and focus groups with 2nd to 5th grade children that were scored into 4 factors: positive-social (e.g. funny, cool), negative-arousal (e.g. dangerous, mad), sedated-impaired (e.g. dizzy, sleepy), and wild & crazy (e.g. loud, wild). To ensure readability and comprehension, children were asked to read the expectancy terms aloud to the administrator prior to completing the assessment and were provided with definitions for terms with which they were not familiar.

A graphic was used to display the meaning of scale anchors: “never” was represented by an empty rectangular box, “sometimes” by a partially filled box, “usually” by a mostly filled box, and “always” by a completely filled box. Coefficients alpha for the four scales ranged from .82 - .92, and their correlations with drinking ranged from -.14 (sedated-impaired) to . 38 (positive-social; Dunn, 1999). Although participants responded to this survey on a Likert scale: “never”, “sometimes”, “usually” or “always,” items were re-coded as either endorsed (1) or not endorsed (0) because we were interested in whether children held these expectancies *at all* at different ages (i.e., whether these expectancies appeared within their associational network of expectancies). Then, to allow for comparison of the shifts across the three grades sampled in subscales with different numbers of items, z-scores were calculated for each subscale across the full sample. The resulting scales were examined to ensure factorial invariance across 3rd -5th grades.

Sensation Seeking Scale for Children (SSSC)—Developed through modification of the Sensation Seeking Scale (SSS; Zuckerman, Kolin, Price, & Zoob, 1964), authors of the SSSC selected and refined items from the SSS that were relevant to children between the ages of 7 and 12 years old (Russo et al., 1991, 1993). The scale consisted of 26 forced-choice items that formed three factors: Thrill and Adventure Seeking (TAS), Drug and Alcohol Attitudes (DAA) and Social Disinhibition (SD). The corrected split-half reliability estimate for the SSSC was r (828) = .85 and the coefficient alpha was .83. Due to overlap in content between the DAA scale and other variables of interest (e.g., alcohol expectancies, alcohol exposure and values), this scale was excluded from analyses. The TAS scale was transformed to improve the normality of the distribution (Osborne, 2002).

Demographic and Drinking Questionnaire (DDQ)—This instrument was compiled for the current study and contained items from state and national youth surveys and other studies of children's drinking, including grade, sex and race (i.e., Dunn & Goldman, 1996; Johnston, Bachman, & O'Malley, 2003). Percentage of the academic year completed was calculated and added to the child's grade in order to provide more fine-tuned gradation of development occurring across the school year. As children's self-reported race and ethnicity was only moderately reliable when compared to the records provided by the school district (based on parent/guardian report; kappa = .59), we utilized race and ethnicity data provided from the school district with parental consent, when available (n=264), and children's self-report when it was not.

Perceived peer (i.e. “How often do you think your close friends have had a drink of alcohol in the past year?”) and parental norms (e.g. “How often do you think your parents have had a drink of alcohol in the past year?”) and attitudes (e.g. “How do you think your close friends would feel about you having one or two drinks of an alcoholic beverage?”) towards pre-adolescent alcohol use, and participants' evaluations of drinking by individuals of different ages (e.g., same-grade peers, friends, parents; “How many of the students in your grade at school would you say have tried to drink alcoholic beverages?”), were used as indicators of the latent variable *alcohol exposure and values* in later structural modeling. Scores representing perceived peer norms, friend's drinking, parent's drinking, and attitudes towards alcohol use, were transformed to improve the normality of their distributions (Osborne, 2002).

Procedure

Students were given written information and informed consent forms to bring home for their parents to sign and students whose parents completed the consent forms were tested individually. At the beginning of the session, the administrator explained the research study to the participant. After obtaining the child's assent, the administrator began the assessment

battery, and completed all cognitive measures prior to alcohol relevant measures. The total assessment took an average of 80 minutes (Range: 35-150 minutes). Each participant was thanked for their participation and compensated for their time with a small toy.

Analysis Strategy

Zero order correlations assessed the relationships between grade and each category of alcohol expectancy (represented by z-scores), and differences in expectancies between grades were assessed via t-tests and one way analysis of variance (ANOVA). To examine possible influences on expectancies, structural equation models (SEM) were tested that incorporated developmentally-relevant factors as exogenous variables and the three expectancy domains shown above to be significantly correlated with grade as endogenous (dependent) variables. Testing was accomplished using MPlus Version 5.21 (Muthén & Muthén, 1998) and maximum likelihood estimation. As several of the included factors (e.g., sensation seeking, alcohol exposure and values) often have been associated with demographic characteristics (Nolen-Hoeksema & Hilt, 2006; Zuckerman, 1994), manifest variables for sex and race also were included in the SEM.

Measurement model—A confirmatory factor analysis (CFA) that allowed for correlations among the latent variables was used first to determine if subscales of standardized measures could reliably indicate the aforementioned expectancy constructs along with the latent constructs of concept formation and articulation, sensation seeking, and alcohol exposure and values. Three indicators for each expectancy construct were formed by randomly grouping the items from each scale into three separate parcels (Little, Cunningham, Shahar, & Widaman, 2002), and computing the mean of all items in each parcel to arrive at the indicator score. Before proceeding with the SEM, we implemented a multiple indicator multiple cause (MIMIC) model for each latent variable with sex and ethnicity as covariates (Bollen, 1989). In SEM analyses, race was characterized as either white or non-white as sub-sample sizes did not allow for more fine-tuned examination of racial and cultural differences (independent testing of the structural models showed that the only race category significantly related to the variables of interest was “white;” therefore, to maintain power across all components of the model, the racial predictor was dichotomized into white and non-white.). Grade level was included in MIMIC models of expectancies to determine whether expectancy scales were developmentally invariant (Chung, Hipwell, Loeber, White, & Stouthamer-Loeber, 2008; McCarthy et al., 2009; Schell et al., 2005). By testing for group differences in factor means and indicator intercepts, these MIMIC models evaluated measurement invariance for latent variables across these covariates. Due to small within-group sample sizes (i.e., 17 6^{th} graders), and several groups occurring within each grade, MIMIC models were preferred over multiple group analyses (Muthén, 1989).

Structural model—The resulting measurement model was incorporated into SEM to determine if the relationships between grade and the expectancy domains were mediated by concept formation and articulation, sensation seeking, and alcohol exposure/values (see Figure 1). The influence of sex on positive and negative alcohol expectancies was estimated both directly and indirectly through concept formation and articulation, sensation seeking, and alcohol exposure/values. Indirect paths from race to both expectancies through sensation seeking and alcohol exposure and values (but not concept formation and articulation) were also estimated. After fitting the originally hypothesized model, all non-significant paths were removed to arrive at a final trimmed model. Goodness of fit of the overall model was evaluated through multiple approaches (Hu & Bentler, 1999; McDonald & Ho, 2002) including: the ratio of χ^2 to the degrees of freedom (good fit indicated by a ratio smaller than 3 to 1), the Comparative Fit Index (CFI; good fit indicated by scores greater than 0.95), the Root Mean Square Error of Approximation (RMSEA; values less than 0.05 indicated good

model fit) and the Standardized Root Mean Squared Residual (SRMR; values less than 0.08 indicated good model fit). All path coefficients were standardized to ease interpretation. Within the final SEM, indirect effects for mediation were estimated, with associated significance tests and 95% confidence intervals computed via Sobel's method (1982).

Results

Findings are presented in two parts. In the first part, we review the shifts (differences) observed among children across elementary school grade levels in the four expectancy domains identified via MDS modeling in previous studies as measured by the MMBEQ; positive-social, negative-arousal, wild & crazy, and sedated-impaired. In the second part, we report on the structural equation models that provided preliminary tests of possible mediators of these differences in the expectancy domains.

Associations between Expectancies and Grade

Of the four expectancies domains, three were correlated with grade, indicating increases in endorsement across development (positive-social, $r = .25$, $p < .01$; negative-arousal, $r = .19$, $p < .05$; sedating-impaired, $r = .12$, $p < .01$). Figure 2 shows the relative shift in all four expectancy domains across children in the 3rd, 4th, and 5th grades. As can be seen in this figure, expectancies in three of the four domains were lowest for 3rd grade children relative to the overall sample and increased across grades. As reported in previous research, positive-social and negative-arousal expectancies shifted most from their third grade relative lows to their fifth grade highs. Sedating-impaired expectancies changed less dramatically, but also were relatively higher for 5th grade children. Post-hoc analyses (see Figure 2) for a one way ANOVA revealed that positive expectancies differed significantly between 4th and 5th graders, while negative expectancies differed between 3rd and 4th graders. Although sedated-impaired expectancies were significantly correlated with grade, the ANOVA for group differences was not significant. This is likely due to the reduction in sample size after excluding 6th graders. While 5th grade arousal was elevated relative to younger grades, the contrast between them was less pronounced because most of these expectancies were endorsed in lower grades as well, thus truncating the range of values. That is, all grades included in this study endorsed wild & crazy expectancies, and it was only the 5th graders that began to show relative elevations. The pattern of observed shifts was clearly inconsistent with a gains and losses model.

Although the relationship between positive-social expectancy endorsement and grade as compared to negative-arousal expectancy endorsement was both visually more apparent (see Figure 2), and was characterized by a larger correlation $r = .25$ vs. .19), t-tests comparing the difference between two dependent correlations from the same sample ($t = .76$, $p = .45$; Chen & Popovich, 2002), and between the difference in z-score ranges from 3rd to 5th grade (positive-social difference: $m = -.62$, $SE = .14$, negative-arousal difference, $m = -.49$, $SE = .15$; $t = .61$, $p = .54$), were not significant. Hence, the second part of the prediction relating to the differential gains model was not supported in this sample; our data did not show a greater shift for positive-social expectancies as compared to negative-arousal expectancies.

Statistical Modeling

Measurement Model—Tests of the measurement model supported the underlying factor structure of our model (see Figure 3), with one exception: perceived parent use was a poor indicator of alcohol exposure/values ($\beta = .17$), and was removed as a factor indicator. Because perceived parent use seemed theoretically important despite the absence of a relationship with the other indicators of alcohol exposure and values, it was included as an independent manifest variable in the subsequent SEM. Nonsignificant correlations between

latent variables were removed from the initial measurement model (see Figure 3). The resulting final measurement model offered a good fit to the observed data (χ^2 = 102.75, *df* = 67, p = .003), with χ^2/df ratio = 1.53, CFI = .98, RMSEA = .04 (90% CI: 0.03 - 0.06), and *SRMR* = .05. MIMIC models confirmed the absence of significant direct relationships between demographic covariates and factor indicators while controlling for factor means. These results also confirmed measurement invariance for all latent factors across sex and ethnicity, and across grade for expectancies. Significant paths from covariates to factor means were retained for the subsequent SEM's.

Structural Model—Figure 4 displays the trimmed final model. The final SEM offered good overall fit to the data (χ^2 = 268.57, *df* = 178, p < .001), with CFI = .96, RMSEA = .04 (90% CI: 0.03 - 0.05), SRMR = 0.06 and χ^2/df =1.51. As can be seen in Figure 4, grade level (as a proxy for developmental advancement) significantly and directly predicted positive-social and negative-arousal, but not sedated-impaired expectancies. Positive-social expectancies were also influenced indirectly, through a path that included concept formation (β = .08, 95% CI [0.05, 0.11], z = 2.65, p < .01). In contrast, grade level only predicted sedated-impaired expectancies via a path that included concept formation (β = .06, 95% CI [0.04, 0.09], z = 2.34, p < .05). These results partially supported the original hypothesis that the differences in expectancies as children aged might be mediated by heightened concept formation abilities; mediation was partial for the positive-social expectancies, total for sedated-impaired expectancies, and not present for negative-arousal expectancies.

Contrary to hypotheses, grade level was not significantly related to sensation seeking or alcohol exposure and values; that is, the model did not support the idea that sensation seeking and alcohol exposure and values systematically elevated within this age range (this finding does not rule out that these variables might increase as children move further into adolescence). As a result, any influence of these two variables on expectancies was present independent of hypothesized developmental processes. In fact, a pathway (influenced by sex and race; males had generally higher levels of sensation-seeking [t = 5.59, p < .001], as did white participants [t = 3.08, p < .01]) was present that ran from sensation-seeking through alcohol exposure to positive-social expectancies (β = .05, 95% CI [0.02, 0.07], z = 2.01, p < .05), but not to negative-arousal or sedated-impaired expectancies. This pathway represented full mediation of the relationship between sensation-seeking and positive-social expectancies through alcohol exposure/values. Improved concept formation and articulation did not relate to greater alcohol exposure/values, indicating that enhanced sophistication in concept formation did not impact how children saw other's use.

Children's perception of their parents' drinking was entered into the model as a measured, rather than a latent variable. In this form, the influence of being white on positive-social alcohol expectancies was fully mediated by greater perceived parental drinking (the indirect effect differed significantly from zero [β = .04, 95% CI [0.02, 0.06], z = 2.14, p < .05], but the direct effect did not). Although the pathway between perceived parent drinking and negative-arousal expectancies was not significant in the model, these perceptions were correlated with both positive-social (r = .22, p < .01) and negative-arousal (r = .13, p < .05) alcohol expectancies, whereas perceived friend's and peer's drinking was only significantly related to positive-social expectancies (r = .12, p < .05 and r = .18, p < .01, respectively).

Discussion

Alcohol Expectancies across Grades

In different approaches to studying the developmental progression of alcohol expectancies as children move through late childhood and early adolescence, alcohol expectancies have been characterized both as an information (semantic) network and as a set of discrete factors

(Goldman & Rather, 1993). The present study utilized a cross-sectional sample to investigate developmental differences across grades for four discrete domains derived from earlier semantic network models (Dunn & Goldman, 1996, 1998, 2000). The four domains examined (positive-social, negative-arousal, wild & crazy, and sedated-impaired) had been shown in the previous research on expectancy networks to reasonably represent the full expectancy semantic network, and to be in play during this developmental period.

Using z-scores to adjust for each child's expectancy endorsement relative to the other children across all three grades, endorsement of three of the four alcohol expectancy domains were found to significantly increase with grade. Although visual inspection suggested that these within-domain shifts across grades were larger for positive-social than negative-arousal expectancies, these differences were not statistically significant. Perhaps more substantial (significant) differences might be observed if young people were sampled into higher grades. Wild & crazy expectancies were already widely endorsed by third graders and did not show significant differences across grades. These results were consistent with previous literature that had shown late childhood to be a key developmental time for shifts in children's understanding of alcohol effects (Cameron et al., 2003; Dunn & Goldman, 1996, 1998, 2000; Schell et al., 2005). New to the literature, however, was that significant differences were observed not just in positive and negative content but also in expectations of sedation.

While the cross-sectional nature of this data limit the interpretation of these findings, the direction of the differences described fit more closely with a differential gains rather than a gains and losses model, and underscored that children gained knowledge of alcohol effects across multiple domains. Our prediction that gains in positive-social expectancies would exceed those for negative-arousal expectancies was not supported, however, over this range of school grades. There is reason to believe from previous work (Dunn & Goldman, 1998) that this difference would be more substantial if viewed across a longer developmental course (i.e., further into adolescence). An unequal increase in positive expectancies could help explain how changes in young people's cognitive schemas prepare them for alcohol initiation that typically occurs a few years after the developmental period studied in this investigation. Longitudinal studies over a lengthier developmental period clearly are warranted. Ultimately, knowledge of alcohol expectancy development in childhood, and how intake of alcohol information is impacted by preexisting internal characteristics and environmental cues, may provide professionals with additional tools to intervene prior to the development of problematic drinking problems associated with high positive alcohol expectancies later in life.

Of note, expectations of arousal (i.e. wild & crazy) from alcohol use were already relatively high in third and fourth graders as compared to fifth graders. Dunn and Goldman (1996) had previously observed using MDS modeling that as children aged, their expectancy networks revealed a greater emphasis on arousing and positive expectancies. The factorial approach used in this study further revealed that this shift in emphasis might be primarily due to increases in positive expectancies that may reconfigure the expectancy network when merged with already-present arousal expectancies. That is, as positive expectancies increased across grades, the mutual influence of positive and already-present arousing expectancies may have presented as a heightened emphasis on positive/arousing expectancies in network modeling.

Underlying Developmental Processes

In addition, the present study also began to assess the influence of developmental processes, known from previous research to influence risk for later drinking, on expectancies. To this end, we investigated the power of developmentally-related differences in cognitive

processing (i.e., concept formation), personality (sensation-seeking), and children's familiarity and comfort with drinking among their extended peer group, to predict expectancy endorsement.

Of the three latent variables chosen to represent putative developmental processes that might contribute to expectancy change, only concept formation increased across the three grades assessed in this study. Concept formation, therefore, was the only possible mediator of the relationship between grade level and higher rates of expectancy endorsement. Our hypothesis regarding this potential substrate of developmentally-associated changes in expectancies observed in prior research was supported. Differences in concept formation partially and fully mediated the relationships between grade and both positive-social and sedated-impaired expectancies, respectively, but not the relationship between grade and negative-arousal expectancies. The more sophisticated the children's ability to parse concepts, the more elevated these expectancies were. Although increasing risk with cognitive sophistication might appear counterintuitive, this relationship might represent increases in risk as a function of maturation into adolescence as children's ability to incorporate and describe new information improves. Enhanced concept formation skills may allow youth to integrate a broader range of potentially inconsistent information (i.e. newer positive with existing negative information), as well as information from more distal sources (i.e. media or peers rather than personal experience).

In this vein, a recent study examining the differential item functioning of positive and negative expectancy items might be instructive (McCarthy et al., 2009). These researchers reported that items representing positive alcohol expectancies were more “difficult” for youth (6^{th} through 8^{th} grade) during early adolescence than negative expectancy items. “Difficulty” in this study referred to the need for higher levels of the latent trait to be present for youths to endorse a positive expectancy item relative to a negative expectancy item. In accord with our proposed model of expectancy development, advances in cognitive sophistication might reduce the difference in item difficulty between positive and negative expectancies as youth approach adolescence. Parallel investigations of item difficulty between 3^{rd} and 6^{th} grade would be useful.

Variation in sensation-seeking and in alcohol exposure/values was related to differences in positive-social alcohol expectancies but not to grade level. Additionally, the influence of sensation seeking on positive-social expectancies was fully mediated by alcohol exposure. This finding suggests that children with higher sensation seeking saw drinking in their environment as more normative and endorsed greater approval for it. This general level of approval then was manifested as higher levels of positive expectancies. Not surprisingly, sensation-seeking levels were related to race and sex such that white and male participants reported higher sensation seeking. Why sensation-seeking did not differ across the grades assessed in this study could not be determined. While it was possible that some differences were too small to detect using the current measures, the absence of a relationship was likely due to the young age of the participants. Developmental changes in sensation seeking are most associated with pubertal development, which typically occurs just after the age range targeted in this sample (ages 11 to 13), as do substantial changes in children's social environment, such as increases in peer affiliation (Larson & Richards, 1991; Mathur & Berndt, 2006; Steinberg & Silverberg, 1986).

Because the evaluation of the measurement model revealed that children's perception of their parents' alcohol use could not be used as an indicator of alcohol exposure, it became possible to evaluate the influence of this variable on its own (as a manifest, rather than latent, variable). Children who believed that their parents drank more frequently (shown to be correlated to parent's report in this age range; Smith, Miller, Kroll, Simmons, & Gallen,

1999) had both more positive-social *and* more negative-arousing alcohol expectancies than children who thought their parent's drank less frequently. In contrast, children's perceptions of peer alcohol use were associated with positive-social but *not* negative-arousal alcohol expectancies. These relationships may be due to children observing drinking in different contexts, based on age. Although we do not have specific data in this domain, it is possible that youth who perceive that their friends and same-aged peers are drinking may be placing this use in a more positive social context, while children might observe parent's alcohol use across multiple contexts and, as a result, may have a broader understanding of both positive and negative effects of alcohol. Perceptions of parent alcohol use fully mediated the positive relationship between being white and having more positive-social alcohol expectancies, potentially indicating a stronger transmission of positive expectancies from parents to children within white families (Chartier, Hesselbrock, & Hesselbrock, 2009; Shen, Locke-Wellman, & Hill, 2001).

Limitations

The most important limitation of this study was the use of a cross-sectional design to explore a developmental phenomenon, which only allowed for examination of correlational, rather than true longitudinal relationships as they unfold over time. Furthermore, data were gathered from children approaching adolescence but who mostly had not undergone the pubertal or environmental shifts (i.e., to middle school) that might dramatically affect the developmental processes examined. Application of the current methods to a middle school population is warranted.

The use of after-school programs for sampling might have affected representativeness, as might have the rate at which parent's gave consent for their children to participate using an active consent procedure (32% of the children contacted returned their parental permission slips; of these individuals, 75% agreed to participate). It is estimated that only 15% of grade school children are enrolled in after-school programs and these children are more likely to come from non-white, low income, working, single-parent families (Afterschool Alliance, 2009). Children whose parents provide active consent (Dent et al., 1993), and children who participate in after-school care (Miller, 2003), however, may also be at lower risk for substance use, depression, poor academic performance and risky sexual behavior, in part as a result of being in an after-school program. As many of these variables are protective of alcohol exposure (non-white families, supervised peer environments, conscientious parenting), the relationships found here may be stronger in traditional school-aged sample. In support for the use of this sample, public schools and the YMCA are the top two providers of after-school care in the nation (Afterschool Alliance, 2009), and the school district from which the current sample was selected spanned urban, suburban and rural regions of the county, thereby increasing representativeness.

Conclusion

The current findings describe increases in several types of alcohol expectancies across late childhood. Cognitive development, specifically improvements in concept formation, is highlighted as one pathway by which expectancy networks may be both consolidating and broadening to incorporate information in children's environment. Additionally, relationships were observed that indicate a complex chain of influence of demographic characteristics, personality, early processing of alcohol cues and environmental exposure on alcohol expectancies. While some of these results elaborated on processes well underway at this age (i.e. cognitive development), many other influences had only just begun or not yet started to play a role in the development of cognitions about alcohol, including pubertal development and changes in social environment as children transition into middle and high school. These processes continue through high school and young adulthood, also interplaying with context

and an accumulation of personal drinking experiences that both confirm and disprove expectations. Longitudinal exploration of these interactive events can begin to tease apart causal relationships. Ultimately, knowledge of alcohol expectancy development in childhood, and how intake of alcohol information is impacted by preexisting internal characteristics and environmental cues, may provide professionals with tools to intervene prior to the development of problematic drinking problems associated with high positive alcohol expectancies later in life.

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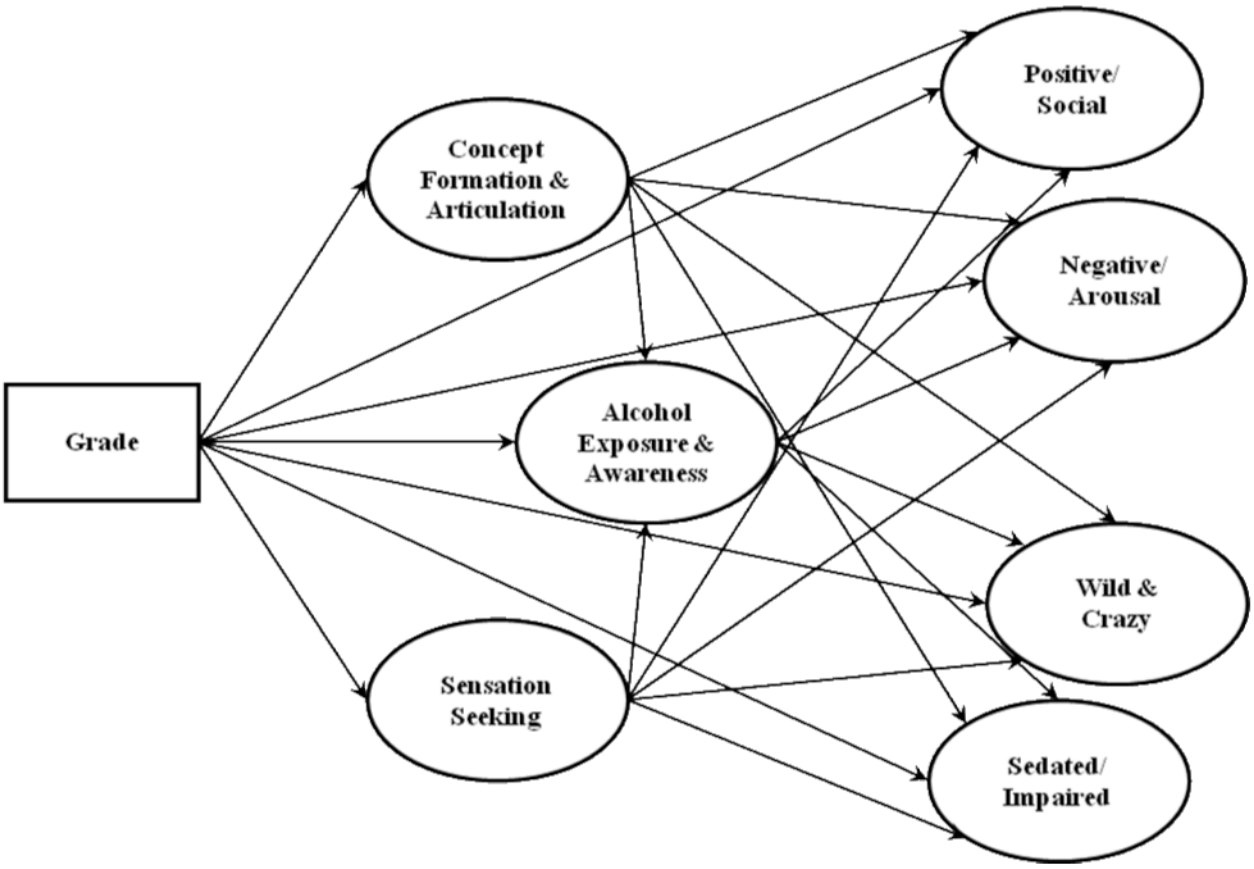

Figure 1.
Hypothesized model of relationships among variables associated with developmental changes in alcohol expectancies.

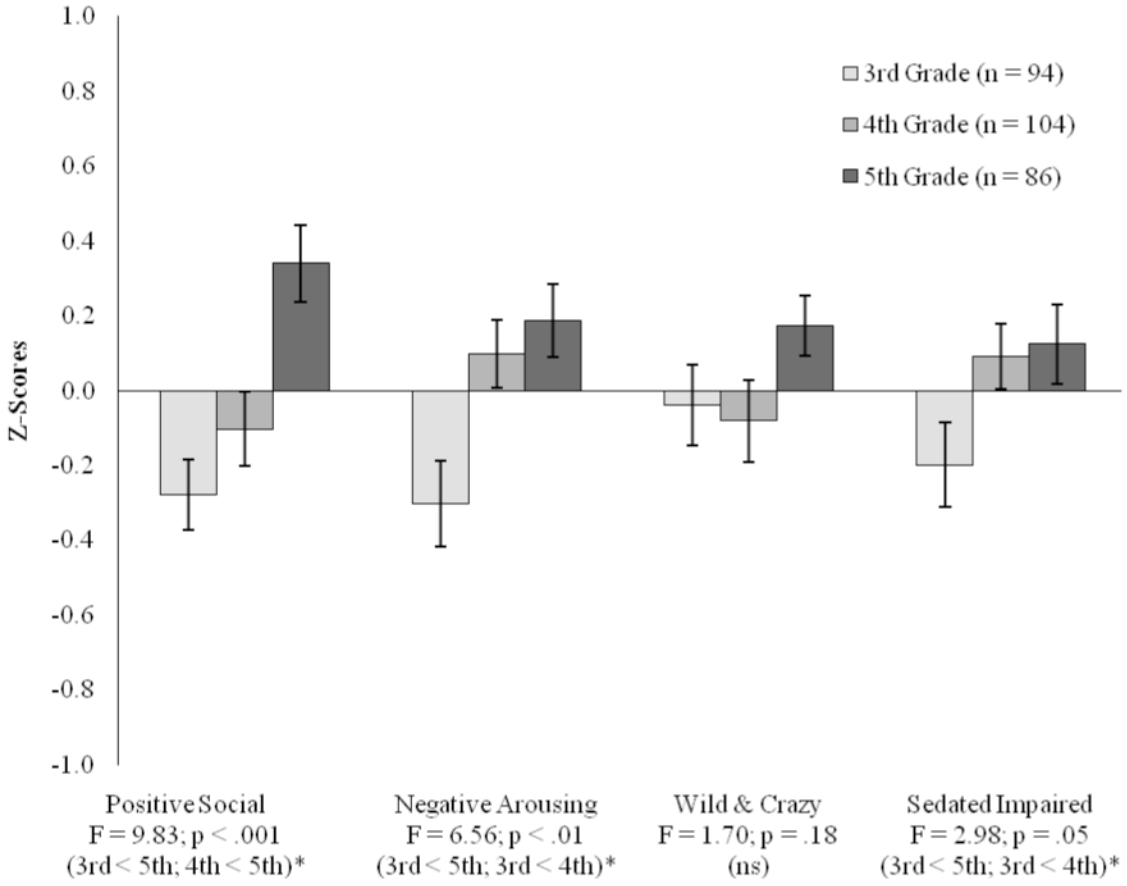

Figure 2.

Differences in alcohol expectancy z-scores between 3rd-5th grade students (n = 284) *Notes*: Z-scores were calculated using the full sample of participants (*n* = 299); error bars represent the standard error. Sixth graders were excluded from this graph due to the small sample size (*n* = 16). * Significant post-hoc comparisons (p < .05)

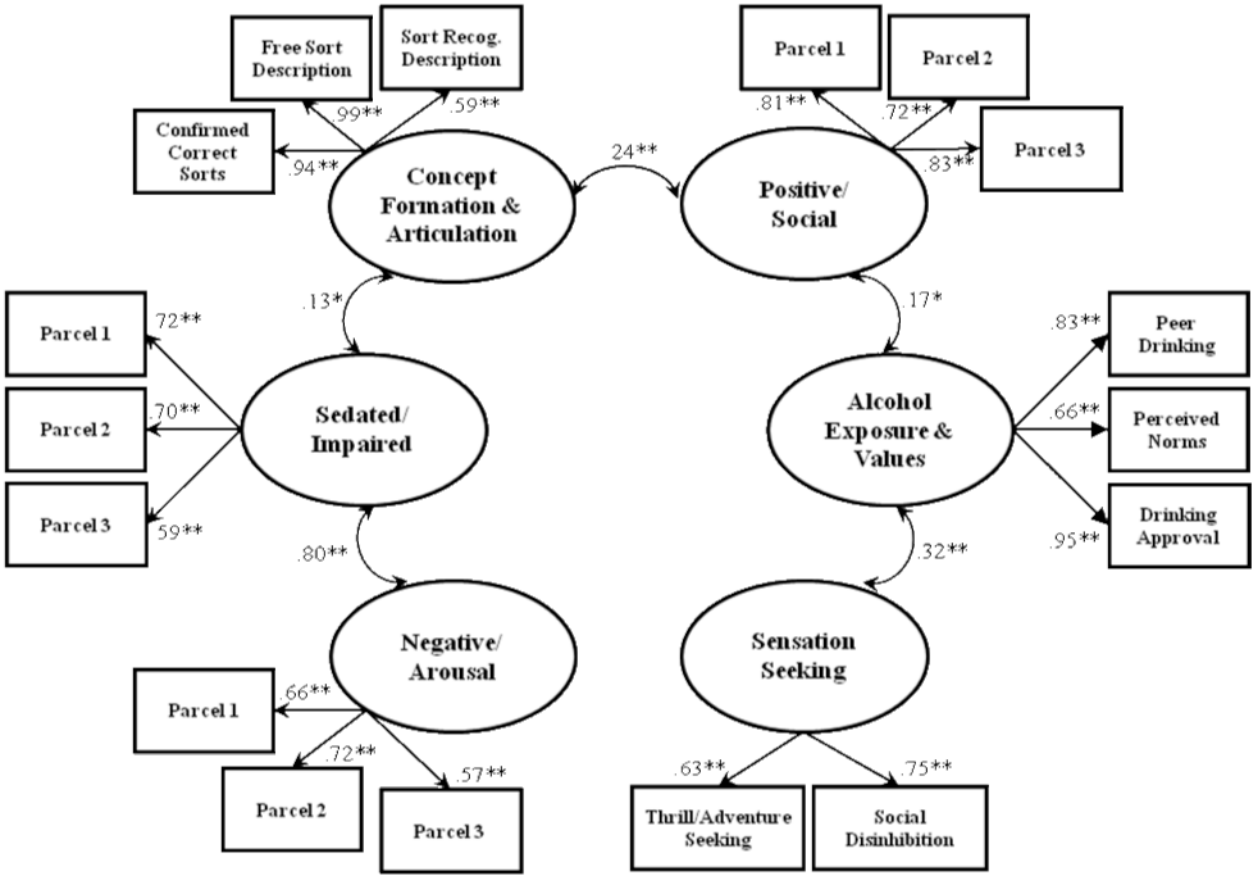

Figure 3.

Measurement model of the relationships between observed variables and the latent variables they were hypothesized to represent (n = 299).

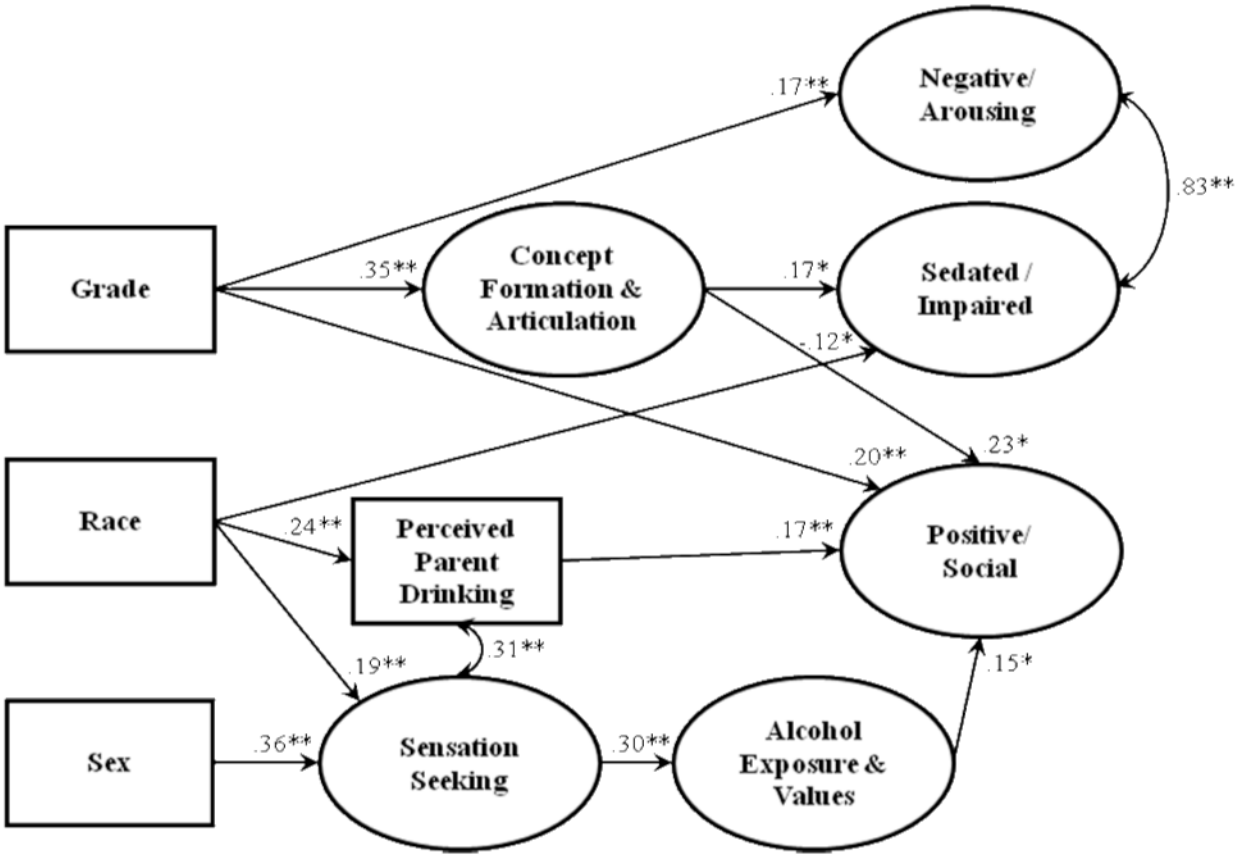

Figure 4.
Structural Equation Model of demographic, cognitive, social and personality variables associated with differences in alcohol expectancies (n = 299).