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Positive and negative time attitudes, intrinsic motivation, behavioral engagement and substance use among urban adolescents

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ABSTRACT

Introduction: Behavioral engagement in schools is an important contributor to academic outcomes for adolescents, but may also protect them from substance abuse. Positive and negative attitudes to the past, present, and future have been linked to adaptive and maladaptive behaviors in adolescence, respectively, but there is a need for research that examines whether time attitudes promote behavioral engagement and lower risk for substance use.

Methods: Structural equation models involving 1961 diverse high school students were utilized, which controlled for sex, GPA, and alcohol use.

Results: Positive time attitudes were positively associated with behavioral engagement and students' GPA. Girls had stronger levels of behavioral engagement. Positive time attitudes were indirectly associated with less marijuana use via intrinsic motivation, engagement, and less alcohol use. The indirect effect of positive time attitudes on engagement via intrinsic motivation was significant and substantial. In a second structural model, we examined the effects of negative time attitudes, intrinsic motivation, and behavioral engagement on marijuana use. Negative time attitudes and intrinsic motivation were indirectly associated with less marijuana use via behavioral engagement. Both models explained 41% of the variance in engagement and 36% of the variance in marijuana use, suggesting that positive and negative time attitudes are equally valuable in understanding academic engagement and marijuana use among adolescents. A third model indicated that behavioral engagement was negatively related to a latent variable composed of binge drinking and alcohol use.

Conclusions: Implications for practice and future research are discussed, as the current findings suggest the importance of positive time attitudes as promotive of behavioral engagement and protective against substance use.

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Engagement; drug use; happiness; adolescence; intrinsic motivation; time attitudes

Introduction

Time attitudes refer to positive and negative attitudes to the past, present, and future. For instance, one may have happy memories, feel happy in the present, and hold positive expectations for future happiness. Past positive attitudes may be seen as a sign of nostalgia, present positive attitudes as happiness, and future positive attitudes as hope or positive expectations, each of which promotes engagement in schools and are important aspects of psychological wellbeing (Seligman 2004; Froiland 2018). Similarly, negative attitudes toward the past can signal resentment, negative attitudes to the present can be interpreted as discontent, and negative attitudes toward the future may indicate pessimism or fatalism. Measuring attitudes to all three time periods at once can help predict a variety of academic and psychological outcomes (McKay et al. 2016; Wells, McKay, et al., 2018).

Although time attitudes are likely to be related to students' behaviors in schools, as time attitudes are affective variables, it is likely that their impact on student behaviors is indirect. Intrinsic motivation is a good candidate as a

mediator between positive affect and behavior, as intrinsic motivation has been shown to have positive associations with both behavioral engagement (Froiland and Worrell 2016) and positive emotions (Froiland 2011). In this study, we examined the association of time attitudes to behavioral engagement (defined as active participation in school and classroom contexts; see Appleton et al. 2006) and substance use in a sample of high school students. We included time attitudes' associations with both positive (behavioral engagement) and negative (substance use) behaviors to ascertain if positive time attitudes functioned as a promotive factor for engagement and a protective factor, mitigating substance abuse risk.

Time attitudes and psychological outcomes

The importance of time perspective in psychological functioning has been heralded by several influential theorists (Lewin 1935; Frank 1939; Erikson 1968), and there is substantial literature on the adaptive correlates of a variety of

time constructs focused on the future (e.g. future orientation, hope, optimism, perceived life chances, possible selves). Beginning in the 1980s, several researchers argued for the importance of studying the past and present in addition to the future, resulting in several time perspective models that incorporate all three time periods (e.g. Zimbardo and Boyd 1999; Mello and Worrell 2015). Time attitudes, the construct used in this study, is one component of time perspective as theorized by Mello and Worrell (2015), and are defined as ‘positive and negative feelings toward the past, the present, and the future’ (p. 117).

Although individual time attitudes have shown modest to moderate associations with psychological and behavioral outcomes (Alansari et al. 2013; Andretta et al. 2014; Worrell and Andretta 2019), time attitude *profiles*, which are based on *multiple* time attitudes, have shown substantial associations with educational outcomes. For example, a positive time attitude profile – defined by high positive and low negative attitudes to the past, present, and future – is associated with the most adaptive educational and psychological outcomes relative to negative, pessimistic, ambivalent, or optimistic time attitude profiles (e.g. Worrell and Andretta 2019). On the other hand, negative profiles are associated with less adaptive outcomes, such as symptoms of anxiety and depression (McKay, Perry, et al. 2018). In this study, we combined the positive time attitudes and negative time attitudes into latent constructs so that we could investigate the association of composite time constructs that were not based on clustering or latent profile analysis. This approach allowed us to examine time attitude composites based on multiple time attitudes in variable-centered analyses.

Engagement and academic outcomes

Engagement in school is well established as a factor that predicts academic achievement and school success (Appleton et al. 2006; Chase et al. 2014; Froiland and Worrell 2016). In a longitudinal study with high school students in Grades 10–12, Chase et al. found that behavioral engagement in Grade 10 – operationalized with attendance, preparing for class, completing homework on time, and participating in classroom discussions – was the strongest predictor of achievement in Grade 12; they also found that achievement in Grade 10 predicted behavioral, cognitive, and emotional engagement in Grade 12, suggesting a reciprocal relationship between achievement and engagement.

Although no researchers have investigated the associations among time attitudes, intrinsic motivation, and behavioral engagement, the research on time attitudes suggests that positive time attitudes will predict both behavioral engagement and intrinsic motivation. For example, Alansari et al. (2013) found that positive time attitudes were positively associated with attitudes toward school and teachers whereas negative time attitudes had inverse associations with these variables. Worrell and Andretta (2019) reported that positive and negative time attitudes were associated with school belonging in theoretically congruent directions and Froiland et al. (2019) found that psychological need

satisfaction, operationalized with measures of autonomy, competence, and relatedness was associated with happiness, as measured by positive attitudes to the present. Thus, we hypothesized that intrinsic motivation would mediate the relationship between positive time attitudes and behavioral engagement.

Time attitudes and substance use

Research has also indicated that, at least in the United Kingdom, temporal constructs are associated with alcohol use in adolescence. Loose et al. (2018) found that the deviation from a balanced time perspective score was positively associated with higher scores on the Adolescent Alcohol Involvement Scale in a sample of 12 to 16-year-old British adolescents. In a study of British university students, McKay, Perry, et al. (2018) reported that present hedonism scores predicted scores on the Alcohol Use Disorders Identification Test. The association between temporal profiles and alcohol use has also been examined in the United Kingdom. McKay et al. (2014) identified four profiles on the basis of Zimbardo Time Perspective Inventory scores: Balanced, Past Negative, Present Hedonistic, and Future. They found that adolescents in the Balanced and Future groups were more like to be abstainers whereas those in the Present Hedonistic group were more likely to be problem drinkers.

In the first study to examine the relationship between time attitudes and alcohol use among adolescents, McKay et al. (2016) found that 12 to 13-year-old, British adolescents with positive time attitude profiles reported using alcohol less within the last month and a lower likelihood of using alcohol within their lifetime. In a subsequent longitudinal study, adolescents with positive time profiles at Time 1 were less likely to drink alcohol a year later than those with other profiles (Wells, Morgan, et al. 2018). The association between time attitudes and alcohol use has not been examined in the US. Finally, in a longitudinal study of time attitude profiles, McKay et al. (2020) looked at the association of four-time attitude profiles (Ambivalents, Negatives, Negative-Futures, and Negatives) in relation to alcohol use in a sample aged 12–13 years in the first data collection period. These authors reported that Positives were (a) more likely to be abstainers, (b) less likely to exceed the gender-specified threshold for drinking if they did drink, and (c) less likely to report alcohol-related harms at Wave 4 three years later.

There is a need for studies to examine the relationship between time attitudes and alcohol or marijuana use in the US, especially because adolescents are more likely to use alcohol and marijuana than any other mind-altering substance (Whitney and Froiland 2015). For adolescents and young adults, alcohol use is the largest risk factor for death and severe injury (Griswold et al. 2018). Drinking in high school puts youth at risk for forming bad habits with alcohol (e.g. not monitoring one’s own drinking) during young adulthood (Jensen et al. 2019). Under-age alcohol use also puts students at risk for developing later psychological

problems (Substance Abuse and Mental Health Services Administration 2013), although it is important to note that youth are drinking less alcohol in recent years (Vashishtha et al. 2020).

With marijuana recently becoming legal for adults in many states, it is important to consider its effect on adolescents. Marijuana use in high school puts youth at risk for subsequent cannabis abuse, alcohol abuse, juvenile delinquency, dropping out of high school, and depression (D'Amico et al. 2017). Indeed, marijuana is considered a gateway drug to more dangerous substances (Hall and Lynskey 2005), and marijuana use predicts worse mental health and academic outcomes for students than alcohol use. These statistics suggest that marijuana use may lead to even more negative outcomes for students than alcohol use (D'Amico et al. 2017). Moreover, there is a relationship between alcohol and marijuana use in adolescence, with alcohol use being most common and dual-use more common than marijuana use alone (Jackson et al. 2008; Pape et al. 2009). In the United States, it is extremely rare for marijuana use to precede alcohol use, according to an analysis of data from the World Health Organization World Mental Health Surveys (Degenhardt et al. 2010). Instead, several decades of research show a 'gateway pattern' of adolescents progressing from alcohol use to marijuana to more illicit substances, often due to issues of availability, price, and legality (Pacula 1998; Kandel 2002; Flory et al. 2004; Crost and Guerrero 2012).

Students who use marijuana are more likely than others to be depressed, bored, or anxious (Phillips et al. 2017), suggesting that marijuana use will be negatively related with positive time attitudes. McKay, Andretta, et al. (2018) compared adolescents with different time attitude profiles on cannabis use in a 2-year longitudinal study and reported several differences with substantial effect sizes. Individuals who had a positive time attitude profile at Time 1 and Time 2 reported substantially less cannabis use than individuals in other profiles (Negatives, Moderately Negatives, and Ambivalents; $d_s > 3.00$). On the other hand, individuals who remained in the Negative Profile reported increased use relative to the Moderately Negative profile, and individuals who moved into the Negative profile also reported increased marijuana use relative to moving into the Moderately Negative or Ambivalent profiles, albeit with smaller effect sizes (d_s in the 0.22 range). These results indicate that both positive and negative time attitude composites are associated with cannabis use.

Substance use and engagement

Although there is substantial literature linking substance use to academic achievement among adolescents (Huỳnh et al. 2019), the literature on substance abuse and academic engagement is nascent. In a study of 10th-graders in Norway, Diseth and Samdal (2015) determined that alcohol use was negatively related to academic engagement; however, the engagement measure included both cognitive and behavioral indicators of engagement (e.g. paying attention in class

and taking school seriously). Li and Lerner (2011) found a negative relationship between behavioral engagement (e.g. attending school) and substance use in 8th grade. They also found that decreasing engagement predicted more substance abuse, but they did not isolate effects for specific substances. Binge drinking makes alcohol use even more dangerous for adolescents and predicts lower attendance among high school students (Patte et al. 2017a).

Patte et al. (2017b) found that increases in both alcohol and marijuana use were related to lower behavioral engagement (e.g. skipping classes, failing to complete homework), with marijuana use having a slightly more adverse impact than alcohol. Marijuana use in adolescence has also been associated with lower expectations of educational attainment and higher dropout rates (Lynskey et al. 2003; Patte et al. 2017b), although there is a dearth of studies specifically addressing classroom behavioral engagement in relation to marijuana use.

The present study

We used structural equation modeling to assess the associations among time attitudes, intrinsic motivation, marijuana and alcohol use, and behavioral engagement. Given the evidence in the literature that girls usually have a small but statistically significant advantage over boys on both achievement and engagement (Froiland and Oros 2014; Froiland and Davison 2016b, 2020; Froiland and Worrell 2016), we controlled for both of these relationships in the models. Likewise, low grades predict more marijuana use (King et al. 2019), so we controlled for GPA in the current study.

We examined two primary models in this study. The first structural equation model included positive time attitudes, sex, GPA, intrinsic motivation, behavioral engagement, alcohol use, and marijuana use. We hypothesized that while controlling for GPA and sex, (a) positive time attitudes would be positively associated with intrinsic motivation and behavioral engagement, (b) the positive indirect effect of positive time attitudes on engagement via intrinsic motivation would be larger than the direct effect of positive time attitudes on engagement, (c) behavioral engagement would be negatively associated with alcohol use and marijuana use, and (d) positive time attitudes would be indirectly and negatively related to alcohol and marijuana use via intrinsic motivation and engagement. In the second structural equation model, we replaced positive time attitudes with negative time attitudes and examined the same hypotheses as in the first model. A third model focused exclusively on drinking and included the effects of positive time attitudes, intrinsic motivation, and behavioral engagement on a latent variable for drinking (a combination of any alcohol use and binge drinking).

Method

Participants

This study involved 1961 participants (52.8% female) from an urban high school in the San Francisco Bay Area. The sample had the following distribution by race/ethnicity:

21.9% African American, 39.4% European American, 12.3% Latinx, 9.3% Asian American, 0.5% American Indian or Alaskan Natives, and 10.1% mixed race/ethnicity (10.1%). Asian Americans included several subgroups: Asian Indian (1.2%), Cambodian (0.3%), Chinese (3.2%), Filipino (0.7%), Japanese (0.6%), Korean (0.4%), Laotian (0.1%), Other Asian (2.1%), Vietnamese (0.6%), Native Hawaiians (0.1%), Samoans (0.1%), and Pacific Islanders (0.1%). 29% of students were in ninth grade, 26% were in tenth grade, 26% were in eleventh grade, and 20% were in twelfth grade.

Parent education was obtained from district records. A third of the parents (32.2%) had graduate degrees, 22.6% had undergraduate degrees, 16.6% had some college classes, 10.2% had a high school diploma, and 4.5% did not complete high school. The parent education level (54.6% with a bachelor's degree or higher) was higher than the national average for parents with children in the home, which is 43.4%, (Froiland and Davison 2016a), but the Bay Area is known for adult education levels that are well above the national average. For instance, 55% of adults in San Francisco County have a bachelor's degree or higher (U.S. Census Bureau 2017); thus, the parents of the students in this diverse sample had levels of education that are representative of the area. The sample included approximately 60% of the students attending the school.

Measures

Positive and negative time attitudes

The Adolescent and Adult Time Inventory Time Attitude Scale (AATI-TA, Mello and Worrell 2007) consists of six 5-item subscales that assess positive and negative attitudes toward the past, the present, and the future (Worrell et al. 2013). Sample items for the positive subscales include the following: 'I have very happy memories of my childhood' (past positive), 'I am happy with my current life' (present positive), and 'I look forward to my future' (future positive). Sample items for the negative subscales include the following: 'My past is a time in my life I would like to forget' (past negative), 'I am not satisfied with my present' (present negative), and 'Thinking about my future makes me sad' (future negative). Response options range from 1 (*totally disagree*) to 5 (*totally agree*). As demonstrated in a recent meta-analysis by McKay et al. (2020), AATI-TA scores have strong internal consistency estimates (mean α s ≥ 0.75) and structural validity evidence (Worrell et al. 2018; Worrell et al. 2020). There is also evidence of convergent validity with hope, optimism, self-esteem, anxiety, positivity, psychological need satisfaction, well-being, and depression scores (Worrell and Mello 2009; Cole et al. 2017; Froiland et al. 2019), and time attitude scores from the Japanese version (Shirai 1997) of Nuttin's (1985) Time Attitude Scale (Chishima et al. 2019). To use time attitude composites, two latent variables – positive time attitudes and negative time attitudes – were created using confirmatory factor analyses. Omega internal consistency estimates for the positive and negative composites were 0.72 and 0.79, respectively.

Intrinsic motivation

Intrinsic motivation was an average of students' ratings on five items that were taken from a five-item scale of emotional engagement developed by Skinner et al. (2009): (a) 'When I'm in class, I feel good;' (b) 'When we work on something in class, I feel interested;' (c) 'Class is fun;' (d) 'When we work on something in class, I get involved;' and (e) 'I enjoy learning new things in class.' Responses to all items were on a 1 to 7 Likert-type scale (1 = *not at all true*; 4 = *somewhat true*; 7 = *very true*). Scores on this scale have demonstrated stability over the course of the school year (fall to spring $r = 0.63$, $p < 0.001$; Skinner et al. 2009), have exhibited moderate concurrent validity ($r = 0.57$, $p < 0.001$) with behavioral engagement, and have predicted the development of behavioral engagement over the course of a school year (Skinner et al. 2009). Froiland and Worrell (2016) found strong internal consistency estimates ($\alpha \geq 0.90$) for these scores.

Behavioral engagement

The engagement was an average of students' ratings on the five items assessing students' reports of behavioral engagement in the classroom. The items include (a) 'I try hard to do well in school,' (b) 'In class, I work as hard as I can,' (c) 'When I'm in class, I participate in class discussions,' (d) 'I pay attention in class,' and (e) 'When I'm in class, I listen very carefully.' These items were rated on the same 1 to 7 Likert-type scale as the intrinsic motivation items. This scale's scores have demonstrated stability over the course of the school year (fall to spring behavioral engagement $r = 0.57$, $p < 0.001$; Skinner et al. 2009). As evidence of convergent validity, scores on this measure of behavioral engagement were negatively related to boredom, frustration, and anxiety (Skinner et al. 2009). These scores also showed evidence of strong internal consistency for diverse sub-samples ($\alpha \geq 0.90$; Froiland and Worrell 2016).

Alcohol and marijuana use

Alcohol use, binge drinking, and marijuana use were each assessed with a single item. Students were asked, 'During the past 30 days, on how many days did you use ... at least one drink of alcohol, five or more drinks of alcohol within a couple of hours, marijuana.' Students had the following response options: 1 = 0 days; 2 = 1 day; 3 = 2 days; 4 = 3–9 days; 5 = 10–19 days; 6 = 20–30 days. 35% of the students reported using marijuana within the past 30 days, 41.3% reported using alcohol within the past 30 days, and 24% reported binge drinking. Spearman's rho was used to examine the associations between alcohol use and marijuana use and the other variables in the study. Because the majority of the participants answered 0-days for all three questions, the variables were treated as dichotomous in the structural equation models (i.e. 0 = 0 days; 1 = 1–30 days).

Sex and GPA

Gender was self-reported, and students' academic achievement was based on their cumulative GPA in the spring of

Table 1. Descriptive statistics for variables in study ($n = 1961$).

Variable	Range	<i>M</i>	<i>SD</i>
Past positive attitudes	1.00–5.00	3.60	0.83
Present positive attitudes	1.00–5.00	3.56	0.83
Future positive attitudes	1.00–5.00	4.00	0.79
Past negative attitudes	1.00–5.00	2.43	0.90
Present negative attitudes	1.00–5.00	2.48	0.87
Future negative attitudes	1.00–5.00	1.96	0.77
Intrinsic motivation	1.00–7.00	4.49	1.22
Behavioral engagement	1.00–7.00	5.20	1.11
GPA	0.00–4.00	2.95	0.90
Alcohol use	0.00–1.00	0.41	0.49
Marijuana use	0.00–1.00	0.35	0.48
Binge drinking	0.00–1.00	0.24	0.43

2011. GPA data for students in the study were obtained from administrative records at the district's research office. GPA in high school has a strong predictive relationship with the first-year GPA in college (Sawyer 2013). Means, standard deviations, and ranges for GPA and the other variables are included in Table 1.

Procedure

The data collection is approved by the district's research office and used by the school and district administration to inform educational decision making at the school site, the district uses student assent for participation. The survey is administered to all students, but students do not have to participate if they choose not to. The school administers the surveys, and when the survey data are entered, these data are merged with demographic data from the district using student identification numbers as the linking variable. De-identified data files were made available for this research, which has been approved by the institutional review board of the researcher's institution.

Data analysis plan

Structural equation modeling in AMOS 26 was implemented to test the models, affording a simultaneous examination of the multivariate relations among time attitudes, marijuana use, alcohol use, intrinsic motivation, and engagement, while controlling for GPA and sex. Strong model fit was determined by a comparative fit index (CFI), an incremental fit index (IFI), and a Tucker–Lewis Index (TLI) of 0.95 or higher, as well as a root mean square error of approximation (RMSEA) less than 0.06 (Hu and Bentler 1999). Because a large n makes the model very unlikely to have a nonsignificant χ^2 (Kenny 2018), the Hoelter Index was used, which indicates how small the sample size would need to be for the χ^2 to become nonsignificant (Kenny 2018). Due to the large sample size in the current study, the CFI, IFI, TLI, and RMSEA were given more weight (Froiland and Davison 2014; Froiland et al. 2019).

Structural equation modeling analyses were conducted with 1961 cases, including some missing data, which was handled through full information maximum likelihood (FIML) estimation. The amount of missing data ranged from 2.9% (i.e. behavioral engagement) to 13.9% (present positive). FIML is one of the most effective ways of handling

missing data (Baraldi and Enders 2010). To test the indirect relations between time perspective and engagement via intrinsic motivation and to test the indirect relations between psychosocial variables and marijuana use, the bootstrapping test was used to examine the significance of the indirect effect (Shrout and Bolger 2002).

Results

Preliminary analyses

Table 2 shows bivariate correlations among each of the non-categorical variables used in the study. All correlations involving marijuana use and alcohol use were based on Spearman's rho, rather than Pearson's r . Marijuana use and alcohol use were moderately and positively correlated with each other. The median and mode were both 1 for the rank-ordered (1–6) marijuana and alcohol use variables, which contributed to the decision to treat these as dichotomous variables in the structural models.

Structural equation models

The first model, which included positive time attitudes, had a good fit: CFI = 0.98, TLI = 0.95, IFI = 0.98, RMSEA = 0.04, 90% CI [0.034–0.051]. The χ^2 was significant, $\chi^2(20) = 89.96$, $p < 0.01$, suggesting that the data differed significantly from the model. However, the Hoelter Index indicated that 685 cases or fewer would lead to a nonsignificant χ^2 , indicating that significance was due to the size of the sample and not model fit. Overall, then, the model fit to the data was good. Interpretation of coefficients are based on Ferguson's (2009) suggestions for β with regard to the minimum effect for interpreting practical significance: 0.2 (minimum level for practical significance, labeled modest in this study), 0.5 (medium), and 0.8 (large). Based on these criteria, many of the statistically significant coefficients in the two figures were not practically significant. The variance accounted for in engagement ($R^2 = 0.41$) and marijuana use ($R^2 = 0.36$) were moderate in effect size, whereas the R^2 for alcohol use was 0.02.

In keeping with the first hypothesis, positive time perspective was positively associated with intrinsic motivation and behavioral engagement, but only the association with intrinsic motivation was moderate in size (see Figure 1 for the standardized coefficients). Also as predicted, the standardized indirect effect of positive time perspective on behavioral engagement (0.27, $p < 0.01$) was modest and almost three times the direct effect of positive time perspective on behavioral engagement; the standardized total effect of positive time perspective on behavioral engagement was 0.38, $p < 0.01$ and modest. As predicted in the third hypothesis, behavioral engagement was significantly and negatively associated with alcohol use and marijuana use, but the coefficients were not practically significant. However, the direct standardized negative effect of engagement on alcohol use was more than twice that of engagement on marijuana use.

In keeping with the fourth hypothesis, positive time perspective (-0.08), intrinsic motivation (-0.10) and behavioral

Table 2. Correlations among variables in study ($n = 1961$).

Variable	1	2	3	4	5	6	7	8	9	10
1. Past positive										
2. Present positive	0.50*									
3. Future positive	0.34*	0.50*								
4. Past negative	-0.56*	-0.34*	-0.17*							
5. Present negative	-0.33*	-0.69*	-0.31*	0.59*						
6. Future negative	-0.18*	-0.33*	-0.58*	0.49*	0.57*					
7. Intrinsic motivation	0.26*	0.40*	0.32*	-0.16*	-0.31*	-0.22*				
8. Behavioral engagement	0.21*	0.31*	0.27*	-0.18*	-0.27*	-0.24*	0.62*			
9. GPA	0.16*	0.15*	0.10*	-0.21*	-0.15*	-0.16*	0.08*	0.22*		
10. Alcohol use ^a	0.03	0.02	0.03	-0.02	0.00	-0.01	-0.10*	-0.17*	0.02	
11. Marijuana use ^a	-0.04	-0.05	0.01	0.05	0.04	0.00	-0.10*	-0.19*	-0.11*	0.62*

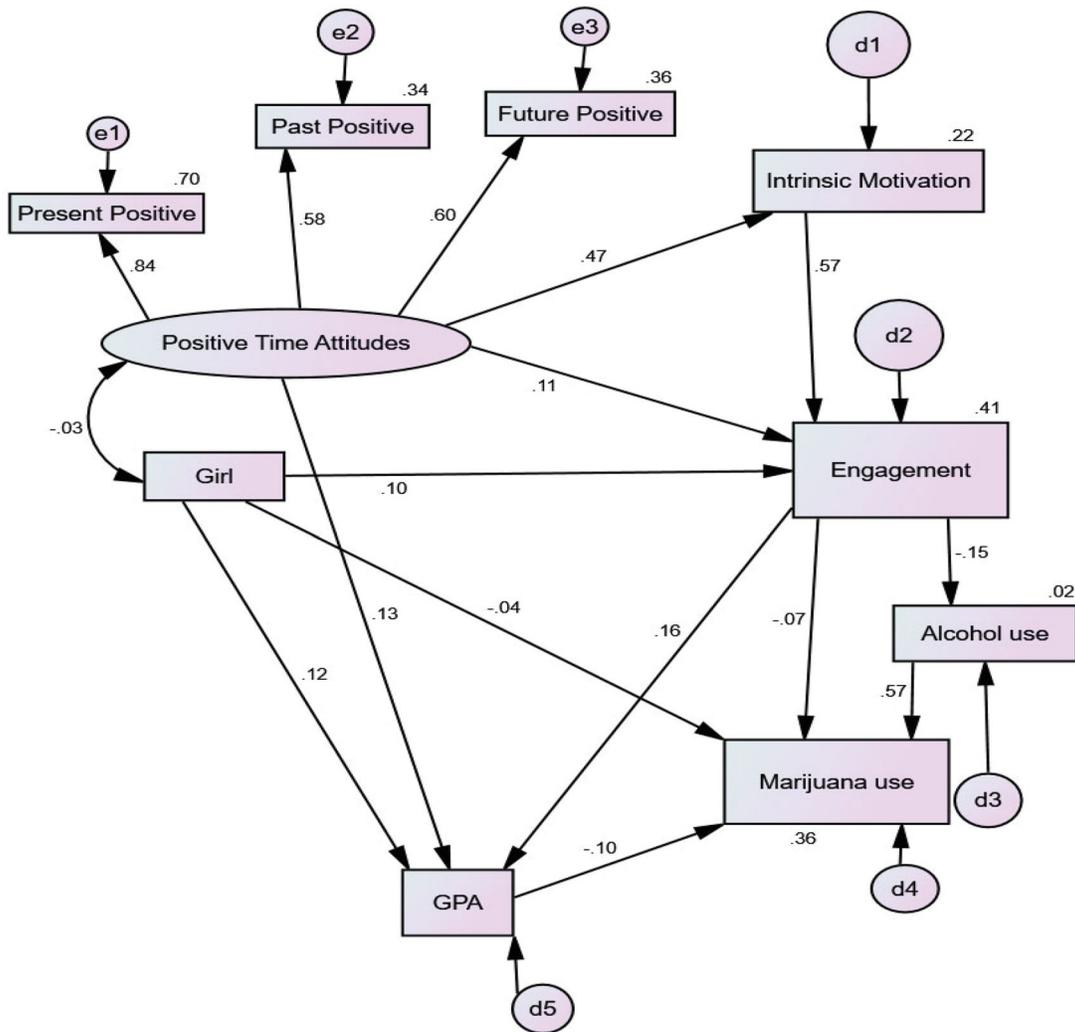
* $p < 0.001$.^aThese correlations are based on Spearman's rho.

Figure 1. Positive time attitudes and academic predictors of marijuana use. Note. All path coefficients shown are standardized and significant at $p < 0.01$, except for Girl to Marijuana Use ($p < 0.05$). R^2 for Engagement = 0.41 and 0.36 for Marijuana use. The standardized indirect effect of Positive Time Attitudes on Behavioral Engagement is 0.27, $p < 0.01$. The standardized total effect of Behavioral Engagement on Marijuana use is -0.17 , $p < 0.01$.

engagement (-0.10) each had statistically significant ($p < 0.01$) but non-interpretable negative standardized indirect effects on marijuana use. The standardized indirect effect of positive time attitudes and intrinsic motivation on alcohol use were -0.06 and -0.09 ($p < 0.01$), respectively. The standardized total effect of behavioral engagement on alcohol use was -0.15 and on marijuana use was -0.17 . Taken together, these findings indicate that intrinsic motivation

partially mediates the effect of positive time perspective on engagement.

The second model, which included the effects of negative time attitudes on marijuana use, also had a good fit: CFI = 0.98, TLI = 0.96, IFI = 0.98, RMSEA = 0.04, 90% CI [0.032–0.050]. The χ^2 was significant, $\chi^2(20) = 85.39$, $p < 0.01$. The general pattern of results was similar to the results reported for positive time attitudes, although the

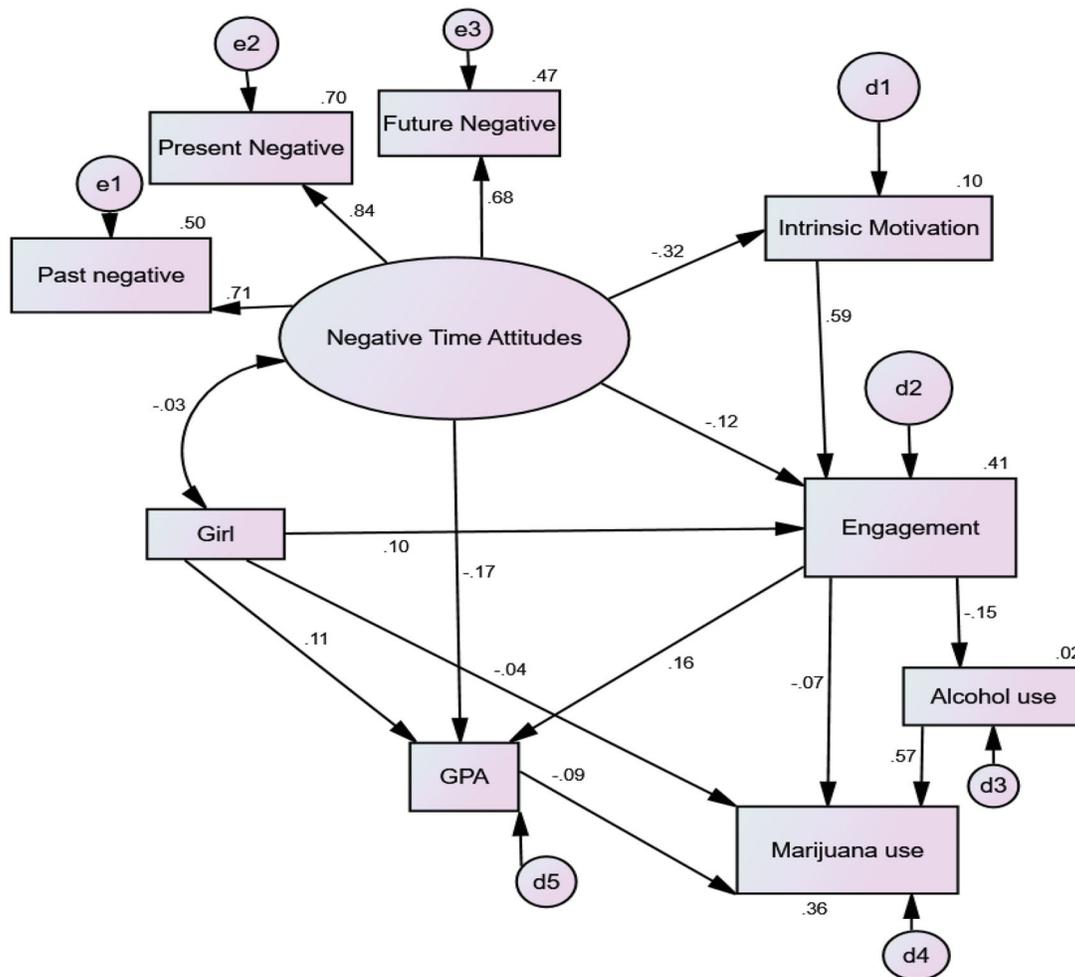


Figure 2. Negative time attitudes and academic predictors of marijuana use. *Note.* All path coefficients shown are standardized and significant at $p < 0.01$, except Girl to Marijuana Use. R^2 for Engagement = 0.41 and 0.36 for Marijuana use. The standardized indirect effect of Negative Time Attitudes on Behavioral Engagement is -0.19 , $p < 0.01$. The standardized total effect of Negative Time Attitudes on Behavioral Engagement is -0.30 , $p < 0.01$. The standardized total effect of Behavioral Engagement on Marijuana use is -0.17 , $p < 0.01$.

coefficients from the time attitude composite were negative. Negative time attitudes (Figure 2) were not as strongly related to intrinsic motivation as positive time attitudes (standardized coefficient = 0.32 vs. 0.47, respectively), but the effect was practically significant. The standardized total effect of negative time attitudes on behavioral engagement was -0.30 , $p < 0.01$. The standardized total effect of behavioral engagement on alcohol use (-0.15) and marijuana use (-0.17) was similar to the first model, and the standardized indirect effect of negative time attitudes on marijuana use (0.07 , $p < 0.01$) was comparable to the indirect effect of positive time attitudes on marijuana use (0.08). Like the first model, this model explained behavioral engagement ($R^2 = 0.41$) and marijuana use ($R^2 = 0.36$) equally well with moderate effect sizes. The R^2 for alcohol was again very small (0.02).

Because both models explained so little variance in alcohol, a third model was analyzed in which a latent variable for drinking was the outcome. The indicator variables were binge drinking within the past 30 days and drinking at all within the past 30 days (see Figure 3). This model, which included the effects of positive time attitudes on alcohol use and binge drinking had a good fit: CFI = 0.98, TLI = 0.97,

IFI = 0.98, RMSEA = 0.04, 90% CI [0.028–0.046]. The χ^2 was significant, $\chi^2(21) = 76.72$, $p < 0.01$. This model explained 5% of the variance in drinking. The direct effect of behavioral engagement on drinking alcohol (-0.22) was stronger than the first model, and the standardized indirect effect of positive time attitudes on drinking (-0.06 , $p < 0.01$) was comparable to the indirect effect of positive time attitudes on alcohol use in the first model.

Discussion

In this study, we examined the direct and indirect contributions of positive and negative time attitudes to behavioral engagement and marijuana use in a sample of students attending an urban high school. The key and novel findings of this study are that positive time attitudes put adolescents at a somewhat lower risk for alcohol use, binge drinking, and marijuana use, via increasing the likelihood that they will be intrinsically motivated and behaviorally engaged with learning opportunities. Likewise, negative time attitudes put students at greater risk for lower behavioral engagement and more marijuana use, in part via lower intrinsic motivation to learn.

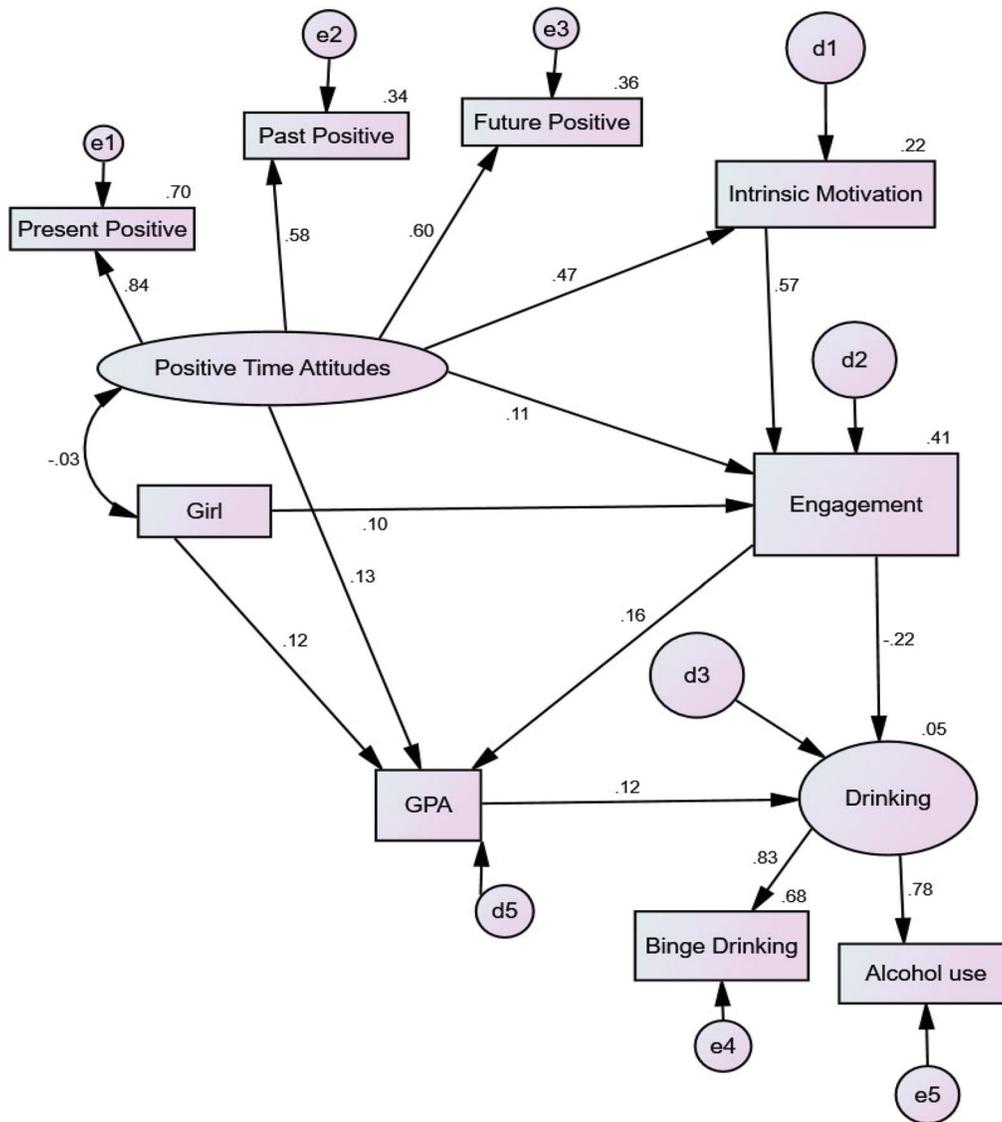


Figure 3. Positive time attitudes and academic predictors of alcohol use and binge drinking. *Note.* All path coefficients shown are standardized and significant at $p < 0.01$.

Positive time attitudes were indirectly and negatively related to alcohol use via intrinsic motivation and behavioral engagement, which complements the findings of a direct relationship between positive time attitudes and alcohol use in the UK (McKay et al. 2016). Positive time attitudes were positively associated with engagement and negatively associated with marijuana use. Importantly, the indirect effects of positive time attitudes and intrinsic motivation on marijuana use are above and beyond the strong effect of alcohol use on marijuana use. Both alcohol use and marijuana use were negatively associated with behavioral engagement, and intrinsic motivation partially mediated the relationship between positive time attitudes and engagement, with the indirect relationship being stronger than the direct relationship. Both the model with positive time attitudes and the model with negative time attitudes treated behavioral engagement and alcohol use as predictors of marijuana use. These models explained 41% of the variance in behavioral

engagement and 36% of the variance in marijuana use suggesting that positive time attitudes, negative time attitudes, and intrinsic motivation to learn are important variables for understanding both behavioral engagement (Froiland and Worrell 2016; Ryan and Deci 2017) and substance abuse.

Importantly, alcohol use was the strongest predictor of marijuana use, which is in accordance with prior research (e.g. Degenhardt et al. 2010), and part of the indirect effect of social-psychological variables on marijuana use was via less alcohol use. The relationship between the social-psychological variables – that is, positive time attitudes, negative time attitudes, intrinsic motivation – and marijuana use is largely indirect via behavioral engagement. Taken together, the findings from our study indicate that behavioral engagement is an important target for protecting adolescents from alcohol and marijuana use, while low levels of substance use may also promote engagement.

Limitations and directions for future research

There are several limitations to the current study. The study relied on one wave of data, which precludes examining relationships across time. Future longitudinal studies should examine the extent to which positive time perspective and intrinsic motivation to learn contribute in concert to long-term behavioral engagement and substance use. Behavioral engagement could be assessed via teacher report in future studies because educators are generally good at observing and estimating students' engagement, whereas students are more skilled at reporting on their own intrinsic motivation (Lee and Reeve 2012; Froiland and Oros 2014). Furthermore, intervention studies may benefit from identifying students' time attitude profiles, as research suggests profiles are differentially related to adaptive and maladaptive outcomes (Worrell and Andretta 2019). Overall, this study suggests that positive time attitudes are an important construct for high school students because they are associated with intrinsic motivation, GPA, substance use, and behavioral engagement, which are all important for wellbeing and success in school and in broader life.

Implications

Often, adults that want to increase behavioral engagement among youth adopt behavioral management systems (e.g. providing detentions for bad behavior and awarding points for participation), which focus youth on extrinsic regulation (Ryan and Deci 2017; Froiland 2020; Kowalski and Froiland 2020). However, numerous studies indicate that intrinsic motivation leads to a plethora of better outcomes than extrinsic regulation, including more optimal neural activation, psychological wellbeing, and higher achievement, while also being a strong predictor of behavioral engagement (Froiland and Worrell 2016; Di Domenico and Ryan 2017). The current study suggests that positive attitudes toward time are a pathway to intrinsic motivation, lower risk of substance use, and greater behavioral engagement.

Leaders interested in promoting behavioral engagement and less substance use during adolescence would be wise to provide interventions that support the development of positive attitudes to the past, present, and future and intrinsic motivation, as these positive psychology constructs play a role in supporting student behavioral engagement. Some ways of supporting intrinsic motivation and happiness include positive psychology and social psychological interventions, such as the following: gratitude journals (Emmons et al. 2019), focusing on the novelty in every situation via mindfulness theory (Ngnoumen and Langer 2016), setting intrinsic life goals for learning (Froiland 2018; Froiland and Worrell 2017), and developing positive teacher–student relationships in high school (Froiland et al. 2016, 2019). Such positive psychological interventions can be combined with parenting techniques that promote reduced substance use, such as making less alcohol available, open communication, monitoring, and autonomy-supportive communication (Froiland Forthcoming; Whitney and Froiland 2015; Vashishtha et al. 2020). However, the present results suggest

that decreasing negative time attitudes may work equally well in terms of promoting academic engagement and reducing the risk of substance use. This suggests that Rational Emotive Therapy (RET) based preventive interventions that teach students to overcome negative thinking about the past, present, and future (David et al. 2019) could promote behavioral engagement and reduce the risk of adolescent substance abuse.

Disclosure statement

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