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Keywords:

Adolescence, ATI-TA, Demographic Differences, Model-based Clustering, Time Attitude Profile, Time Perspective

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Demographic Differences in Adolescent Time Attitude Profiles in an Urban High School: A Person-Oriented Analysis Using Model-Based Clustering

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Abstract

The purpose of the study was to use model-based clustering to identify adolescent time attitude profiles in a sample of students from an urban high school using Adolescent Time Inventory-Time Attitude (ATI-TA) scores and to examine the association of ATI-TA profiles with demographic variables and grade point average (GPA). Three ATI-TA profiles were identified—Positives, Ambivalent, and Conflicted—two of which were similar to clusters identified in previous studies. Results indicated that gender and grade were not associated with cluster membership. However, socioeconomic status, ethnicity, and GPA were related to cluster membership. Although overall effect sizes for socioeconomic status and ethnicity were small, post-hoc analyses suggested that differences among ethnic groups should be investigated further. There were substantial GPA differences between some clusters (Cohen's d = .36 – 1.27). Future directions for research on adolescent time attitude profiles should include in-depth studies examining the relationship between profile membership and achievement and longitudinal studies to observe whether time attitude profile membership changes over time.

Keywords: adolescence, ATI-TA, demographic differences, model-based clustering, time attitude profile, time perspective

According to Piaget (1975), adolescence is a critical time in development during which higher-level reasoning develops, including the ability to think abstractly and utilize mental representations of time. Piaget's work suggests that adolescence is one of the earliest times appropriate for the study of time attitudes. Constructs related to time have been associated with educational outcomes for adolescents in several studies (e.g., Bowles, 2008; Worrell & Hale, 2001; Worrell, Latto, & Perlinski, 1999). Time attitudes constitute one dimension of time perspective and assess an individual's emotional and evaluative attitudes or feelings towards their past, present, and future (Mello & Worrell, 2015; Worrell, Mello, & Buhl, 2013). Researchers have found that adolescents' time

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attitudes have meaningful relationships with academic achievement and school outcomes (Adelabu, 2007; Bowles, 2008), risk factors (Somers & Gizzi, 2001), demographic variables (Andretta, Worrell, Mello, Dixson, & Baik, 2013), and well-being (Boniwell, Osin, Linley, & Ivanchenko, 2010).

Much extant research conducted on time attitudes in adolescents is limited to attitudes towards the future. However, individuals' time perspectives encompass their past, present, and future (e.g., Frank, 1939; Lewin, 1942; Zimbardo & Boyd, 1999, 2008), and a singular focus on attitudes toward the future can result in an incomplete view of the relationship between time perspective and other constructs. Thus, researchers have begun to examine attitudes towards multiple time periods. Moreover, instead of using attitudes towards the past, present, or future *separately* to predict outcomes, some researchers now study attitudes towards the past, present, and future simultaneously using profiles that encompass participants' attitudes towards the three time periods. *Time attitude profiles* are individuals' patterns of attitudes across the three dimensions of time.

Findings from studies using time attitude profiles have yielded more robust relationships between time attitudes and adolescent outcomes, suggesting that time perspective plays a more important role in adolescent functioning than previously realized. For example, whereas the correlation between time attitude scores and academic achievement is modest, differences across profiles yield medium effect sizes (e.g., Alansari, Worrell, Rubie-Davies, & Webber, 2013). Similar findings have been reported for time attitude scores and adolescent alcohol use, with correlations yielding modest to moderate relationships (e.g., Keough, Zimbardo, & Boyd, 1999), and profiles predicting substantial differences in risky drinking (McKay, Andretta, Magee, & Worrell, 2014).

There have been two previous studies of time attitude profiles in the U.S. (Andretta, Worrell, & Mello, 2014; Andretta et al., 2013), both using a recently developed scale, the Adolescent Time Inventory-Time Attitudes (ATI-TA; Mello & Worrell, 2007), and the same sample of 300 adolescents. In this study, we examined time attitude profiles in a substantially larger sample of adolescents attending an urban high school in a western state. Our goals were to see if the ATI-TA scores were psychometrically sound and if time attitude profiles would emerge in a larger group. We begin with a review of the small but growing literature on time attitude profiles of adolescents. We then discuss how time attitudes are measured and summarize the previous studies that have identified time attitude profiles in adolescents to provide a basis for the hypotheses proposed.

Literature Review

Previous Research on Time Attitudes

Adolescent Time Inventory-Time Attitudes. There are several measures that assess attitudes towards time. In reviewing this literature, we focus primarily on research done using the ATI-TA (Mello & Worrell, 2007), as this measure is used in the current study. The ATI-TA is a 30-item measure that has six 5-item subscales: (a) Past Positive, (b) Past Negative, (c) Present Positive, (d) Present Negative, (e) Future Positive, and (f) Future Negative. Scores on the ATI-TA have yielded evidence of internal consistency, structural validity, and convergent and discriminant validity in adolescent samples in the United States (Worrell & Mello, 2009; Worrell et al., 2013) in addition to other countries

(Alansari et al., 2013; Buhl & Lindner, 2009; McKay, Cole, Percy, Worrell, & Mello, 2015; Worrell et al., 2013). Importantly, on the basis of cluster analysis, which groups participants with similar patterns or profiles of responses, ATI-TA scores have been used to develop time attitude profiles, allowing researchers to simultaneously account for attitudes towards the past, present, and future.

The use of profiles is a recent addition to adolescent time attitude research, and only four studies in three different national contexts have reported on ATI-TA profiles of adolescents: Germany (Buhl & Lindner, 2009), New Zealand (Alansari et al., 2013), and the United States (Andretta et al., 2014; Andretta et al., 2013). Researchers have examined differences in academic variables (Alansari et al., 2013; Buhl & Lindner, 2009), psychological variables (Andretta et al., 2014; Buhl & Lindner, 2009), and demographic variables (Andretta et al., 2014) based on time attitude profiles.

Germany. Buhl and Lindner (2009) administered a preliminary version of the ATI-TA to approximately 1,700 adolescents (M_{age} = 14 years, 51% female) in the eighth and ninth grades. They also assessed life satisfaction, self-efficacy, teacher/student relationships, perspective-taking, trust in school, perceived support in school, and college aspirations. Buhl and Lindner found six profiles within their sample, which they labeled based on how far below or above the sample mean those profile scores fell. The profile characterized by very high means on the three positive subscales and very low means on the three negative subscales was labeled *Optimistic*, whereas a profile characterized by very high means on the three negative subscales and very high means on the three negative subscales was labeled *Pessimistic*. A profile labeled *Balanced* was characterized by moderately high means on the three positive subscales and moderately low means on the three negative subscales. The *Tangentially Pessimistic* profile was characterized by low mean scores on both positive and negative subscales, the *Ambivalent* profile was characterized by average mean scores on all six subscales, and the *Past Pessimistic/Future Optimistic* profile had high scores on future positive and low to average scores on all other subscales. These profiles were then used as independent variables for comparing the outcome variables.

Buhl and Lindner (2009) found that students with the more positive profiles—Optimistic, Past Pessimistic/Future Optimistic, and Balanced—had higher scores on self-efficacy, trust in school, perspective taking, and life-satisfaction than students with the more negative profiles—Tangentially Pessimistic and Pessimistic; the Ambivalent group's scores fell in the middle. These findings indicated that ATI-TA profiles can predict meaningful differences among adolescents on both academic and psychological variables and served as a catalyst for continued exploration of time attitude profiles.

United States. In two studies using American adolescents, Andretta, Worrell, Mello, Dixson, and Baik (2013) and Andretta, Worrell, and Mello (2014) reported on ATI-TA scores in a diverse sample of 300 American adolescents (M_{age} = 16) attending several schools in western states. This sample was 60% male, 41% European American, 25.3% Asian American, 11% African American, and 10.3% Latino. Andretta et al. (2013, 2014) identified five profiles, similar to the profiles reported by Buhl and Lindner (2009). However, Andretta and colleagues renamed the profiles to better match their outcomes: Balanced, Pessimists (previously *Tendency to Pessimism*), Positives (previously

Optimistic), Negatives (previously *Pessimistic*), and Optimists (previously *Past Pessimistic/Future Optimistic*).

Andretta et al. (2013) found that there were no statistically significant relationships between adolescent time attitude profiles and gender, grade, or socioeconomic status (SES) subgroups, suggesting that these demographic variables are not related to time attitude profile membership. In a later study, Andretta et al. (2014) examined the relationship between time attitude profile membership and educational and psychological variables in the same sample. They found statistically significant but small differences in grade point averages (GPA, $p < .01$) and educational expectations (e.g., what kind of college do you plan on attending; $p < .03$) among profiles, but the differences were not practically significant. The relationship between educational attainment (i.e., how much school will you have completed by 30 years old) and time attitude profile membership was not statistically significant ($p = .12$). However, more students with positive profiles (Positives [82%] and Optimists [81%]) expected to earn a four-year degree than their peers with other profiles (Balanced [72%], Negatives [73%], and Pessimists [64%]). The relationships between time attitude profile membership and psychological well-being (i.e., perceived stress and self-esteem) were both statistically and practically significant. Adolescents with more positive profiles reported lower perceived stress and higher self-esteem than those with negative profiles. Thus, time attitude profile membership could be a useful tool to help to identify adolescents in need of interventions to build self-esteem or those at risk for high stress.

New Zealand. In a fourth study, Alansari et al. (2013) examined adolescent time attitude profiles using the ATI-TA. They used a sample of 579 female high school students in New Zealand between the ages of 13 and 15 years (51.5% European, 32.3% Asian, 5.5% Maori, 4.1% Pacific Islander, 8% Other). Alansari et al. measured five academic variables: (a) achievement within the last 12 months, (b) perceived academic self-ranking, (c) "wagging" (i.e., cutting class), (d) attitude towards school, and (e) attitude towards teachers. They found four time attitude profiles similar to those found in Andretta et al. (2013) and Andretta et al. (2014): Negatives, Pessimists, Optimists, and Positives. Alansari et al. (2013) reported that the more positive profiles (i.e., Positives and Optimists) were associated with more positive academic outcomes; the largest differences were found when participants with Positive profiles were compared to participants with Negative profiles. There was also a strong relationship between time attitude profiles and attitudinal variables, such as attitude towards school and attitude towards teachers.

The Current Study

As noted in the review of literature, research on adolescent time attitude profiles is nascent. ATI-TA profiles have only been identified in three samples, one of which consisted of a fairly small sample of American adolescents. Although profile membership has been found to predict differences in academic variables, psychological variables, and demographic variables to a lesser extent, there is clearly a need for more studies to see if the findings are replicated in other samples. Moreover, the ATI is also a relatively new instrument, and all of the psychometric studies on ATI-TA scores are based on single

samples. Thus, there is no information on the replicability of ATI-TA scores or time attitude clusters based on the ATI in a national context.

In this study, we asked three interrelated research questions. First, are ATI-TA scores internally consistent and is the six-factor ATI-TA model supported in this sample of urban high school students? We hypothesized that the scores would reflect the same psychometric rigor as found in the previous studies (Alansari et al., 2013; Buhl & Lindner, 2009; McKay, Cole et al., 2015; Worrell et al., 2013). The second question was whether the ATI-TA scores in this study would yield interpretable time attitude profiles similar to those found in previous studies (i.e., Alansari et al., 2013; Andretta et al., 2014; Andretta et al., 2013; Buhl & Lindner, 2009). As clusters can differ by sample, replication in independent samples is an important way to assess their generalizability and to discover potential new clusters. Based on previous studies, we expected to find clusters similar to those found in previous studies. Finally, the third question, which could only be asked if Questions 1 and 2 yielded positive results, was whether there would be statistically and practically significant differences in demographic variables and GPA among adolescent time attitude profiles. Again, based on prior studies, we expected to find meaningful differences in achievement favoring positive clusters but no meaningful differences in demographic variables.

Method

Participants

Participants consisted of 1,491 adolescents (54% female, n = 801) between the ages of 14 and 19 years. Ten participants did not report their age, and six did not report their grade. Participants were enrolled in an urban high school in a western state in grades 9-12: (a) 9th grade (n = 396, 27%), (b) 10th grade (n = 372, 25%), (c) 11th grade (n = 338, 23%), and (d) 12th grade (n = 379, 26%). Participants self-reported their ethnicity as (a) African American (n = 310, 21%), (b) Asian American (n = 137, 9%), (c) European American (n = 561, 38%), (d) Latino (n = 287, 20%), (e) Native American (n = 9, 0.61%), and (f) Multi-Ethnic (n = 160, 11%). Twenty-seven participants did not report their ethnicity.

Measures

Demographic measures included SES as measured by parental education level, ethnicity, gender, grade, and GPA. All measures except GPA were self-reported. Parental education level was used as a proxy for SES. Parental education level is frequently used to assess SES, along with family income and parental occupation or employment (Marks, 2011). Parental education was reported as follows: *Less than high school* (n = 96, 7%), *High School Diploma* (n = 152, 11%), *Some College* (n = 246, 18%), *Undergraduate Degree* (n = 351, 26%), *Graduate Degree* (n = 505, 37%). Nine percent of the participants (n = 141) did not report their parents' education level. GPA was taken from the previous semester records provided by the school. Mean GPA for the sample was 3.01 (SD = 0.83). Six participants did not have a reported GPA.

Time attitudes were measured using the ATI-TA. As noted previously, the ATI-TA consists of six 5-item subscales. Subscale scores consist of the mean score for the five

items making up that subscale. ATI-TA scores have been found to be reliable ($.68 \leq \alpha \leq .92$) and structurally valid in the U.S. (Worrell et al., 2013), Germany (Buhl & Lindner, 2009; Worrell et al., 2013), New Zealand (Alansari et al., 2013), and the United Kingdom (McKay, Cole et al., 2015). Convergent and discriminant validity evidence has also been reported for ATI-TA scores (Alansari et al., 2013; Andretta et al., 2014; Worrell & Mello, 2009).

Procedure

A survey administered by the teachers at the participants' school included the ATI-TA in addition to other variables. The school used the survey data to assess variables, such as school climate, used in decision-making by the school administration. The researchers were granted permission to use the aggregated data for research, a decision that was supported by the Institutional Review Board at the lead researcher's institution.

After ascertaining that ATI-TA scores were reliable and structurally valid, model-based clustering was applied to these scores as suggested by Oh and Raftery (2007). Model-based clustering is "based on probability models in which objects are assumed to follow a finite mixture of probability distributions such that each component distribution represents a cluster" (Oh & Raftery, 2007, p. 560). There are several benefits to using model-based clustering instead of distance clustering (i.e., Wards or K-means). First, model-based clustering uses simultaneous estimation, which minimizes research bias because the researcher's assumptions about the composition of or amount of clusters do not influence the cluster outcomes. Second, model-based clustering relies on statistical inference. Third, this technique addresses "(a) measurement errors in the dissimilarities; (b) errors in estimating the object configuration; and (c) clustering uncertainty" (Oh & Raftery, 2007, p. 561). In sum, model-based clustering is a robust procedure that is likely to replicate.

Results

Preliminary Analyses

Intercorrelations, means, and standard deviations for GPA and the six ATI-TA subscales are presented in Table 1. The ATI-TA subscale scores were neither substantially skewed nor kurtotic. Means for positive subscales were higher than means for negative subscales, and intercorrelations among the subscales were as expected given the theoretical framework. GPA was not significantly or meaningfully (i.e., $r > .30$) associated with ATI-TA scores. Scores on the six subscales of the ATI-TA had strong reliability estimates ($\alpha > .85$), and confirmatory factor analyses indicated that the 6-factor model fit the data best, with all fit coefficients in the close range: Satorra-Bentler χ^2 (390, N = 1,491) = 1336.48, $p > .001$, nonnormed fit index = .953, comparative fit index = .958, standardized root mean square residual = .035, and root mean square error of approximation (RMSEA) = .040, with the RMSEA 90% confidence interval ranging from .038 to .043.

Table 1
Descriptive Statistics for ATI-TA Subscales and GPA

	1.	2.	3.	4.	5.	6.	GPA	*M*	*SD*	α
1. PSP	1.00	—	—	—	—	—	—	3.71	.84	.88
2. PSN	-.58	1.00	—	—	—	—	—	2.39	.96	.90
3. PRP	.56	-.34	1.00	—	—	—	—	3.61	.84	.91
4. PRN	-.36	.62	-.64	1.00	—	—	—	2.57	.89	.87
5. FTP	.50	-.25	.59	-.35	1.00	—	—	4.00	.81	.92
6. FTN	-.27	.58	-.35	.64	-.59	1.00	—	2.11	.84	.86
7. GPA	.20	-.29	.24	-.25	.17	-.29	1.00	3.01	.83	—

Note. *N* = 1,491. ATI-TA = Adolescent Time Inventory–Time Attitude; PSP = Past Positive; PSN = Past Negative; PRP = Present Positive; PRN = Present Negative; FTP = Future Positive; FTN = Future Negative.

Table 2
Gaussian Finite Mixture Models Fitted by Expectation-Maximization Using ATI-TA Scores

Number of Components	*df*	Parameterization	BIC	ICL	*l*
3	*73*	*VEV*	*-16251.27*	*-16568.45*	*-7858.922*
4	93	EEV	-16618.04	-17314.18	-7969.235
5	115	EEV	-16354.17	-17213.44	-7756.92
6	137	EEV	-16352.97	-17386.81	-7675.942
7	159	EEV	-16413.69	-17336.12	-7625.922
8	181	EEV	-16442.97	-17452.27	-7560.184
9	203	EEV	-16493.92	-17630.81	-7505.278

Note. N = 1,491. The mclust package for *R* statistics returns the three optimal models for the data, which include the least and most amount of components. VEV = ellipsoidal, equal shape; EEV = ellipsoidal, equal volume, and equal shape; BIC = Bayesian Information Criterion; ICL = Integrated Completed Likelihood; *l* = Log-Likelihood. The optimal solution is italicized.

Cluster Analyses

Clusters were formed with Bayesian model-based clustering and Gaussian Finite Mixture Models in R using *mclust* (Fraley & Raferty, 2002; Fraley, Raftery, Murphy, & Scrucca, 2012) and *mclust* software (Fritsch, 2012). There are three criteria considered when using Gaussian Finite Mixture Models: (a) Bayesian Information Criterion (BIC), (b) Integrated Completed Likelihood (ICL), and (c) Log-Likelihood (*l*). The software can produce solutions ranging from two to nine clusters. All possible cluster solutions are presented in Table 2.

Using the Gaussian Finite Mixture Models criteria and raw scores for each of the six subscales, we identified three possible cluster solutions that best fit the data: (a) a three-cluster, (b) a five-cluster, or (c) a six-cluster solution. For each of these solutions, we calculated the average posterior probabilities (APP). APP indicates "the limit of the relative frequency with which the hypothesis is correct" (Kolaczkowski & Thornton, 2007, p. 2). To determine the best cluster solution, we looked for high APP values for all clusters; high APP values indicate the probability that the participants would be reassigned to that same cluster in subsequent analyses. Based on APP scores for each cluster, the three-cluster solution best fit the data. The APP for each of the three clusters was greater than .84, which indicates that the participants would be reassigned to that cluster in 84% of trials: (a) Cluster 1 APP = .91, (b) Cluster 2 APP = .92, and (c) Cluster 3 APP = .85.

To facilitate comparisons among the clusters, raw ATI-TA subscale scores were converted into *T*-scores ($M = 50$, $SD = 10$). This conversion yields comparable scores that are easily interpretable. For example, if members of Cluster X have a mean score of 55 on the past-positive subscale, those members have a higher score than the sample mean by half of a standard deviation. Similarly, if members of Cluster X have a mean score of 45 on the past-positive subscale, those members have a lower score than the mean by half of a standard deviation. Both valence of the subscale (i.e., positive and negative) and the relationship of the score to the mean (i.e., above or below) were taken into account when interpreting the meaning of the subscale scores. For example, a future negative score of 60 is higher than the sample mean by one standard deviation.

Two visual representations of the three clusters are presented in Figure 1. Members of Cluster 1 ($n = 119$) had above average negative subscale scores with scores more than one standard deviation greater than the mean on both the past-negative and future-negative subscale. This group's positive subscale scores were positive but average (i.e., within .3 SDs of the mean). Cluster 1 resembled the Negative profile identified in previous studies, but did not have positive subscales substantially below the mean as in previous studies, so it differed from the previously identified Negative profile. Consequently, Cluster 1 was labeled *Conflicted*.

All six subscales in Cluster 2 ($n = 1{,}120$) differed by less than half of a standard deviation from the mean, with the negative scores above the sample mean and the positive scores below the sample mean. This profile matched a profile found by Buhl and Lindner (2009), in which all subscales were at the sample mean. Thus, this cluster was given the label, *Ambivalent*, as named by Buhl and Lindner (2009).

Members of Cluster 3 ($n = 252$) had above average positive subscale scores, ranging

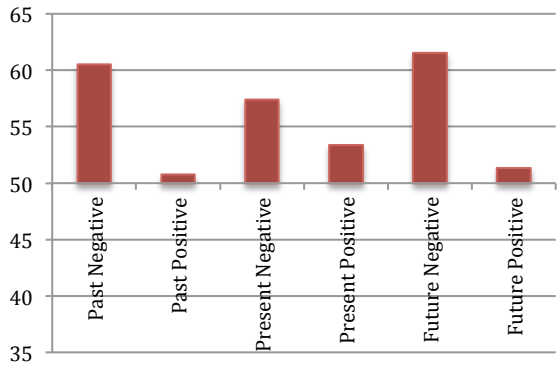
from 0.7 *SD*s to 1.1 *SD*s above the mean and below average negative subscale means, ranging from 0.9 *SD*s to 1.2 *SD*s below the sample mean. This cluster was labeled *Positives*, in keeping with the name given in previous studies (Alansari et al., 2013; Andretta et al., 2014; Andretta et al., 2013).

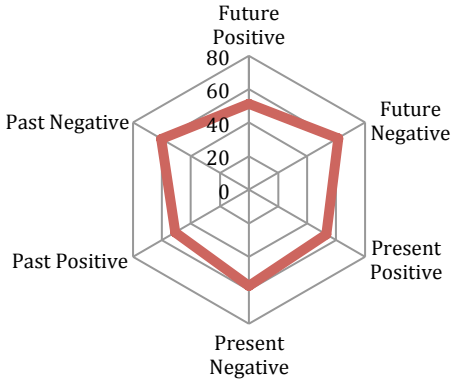
Primary Analyses

Demographic variables. Cross-tabulations were used to examine differences in gender, SES, and ethnicity across the time attitude profiles (see Table 3). There were slightly more males than females in the *Conflicted* profile and slightly more females than males in the *Ambivalent* profile. Males and females were evenly distributed in the *Positive* profile. The relationship between gender and profile membership was statistically significant, but the effect size was small, χ^2 (2, N = 1,491) = 9.31, $p < .01$, Cramer's $V = 0.08$. There was an approximately equal distribution by grade level across the profiles: no one grade was overrepresented or underrepresented. The analysis indicated that grade was not significantly related to profile membership, χ^2 (6, N = 1,485) = 8.0, $p > .01$, Cramer's $V = 0.05$. Sample sizes vary for these results, based upon accommodations for missing data.

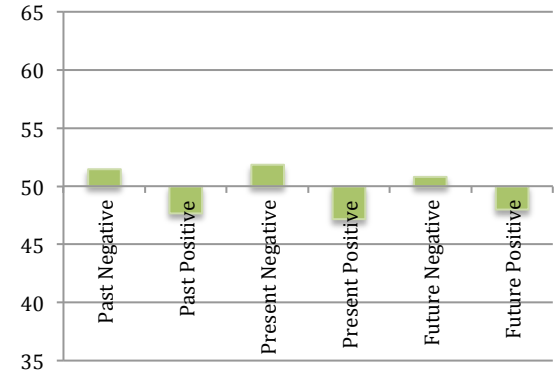
Considering the relationship among SES and time attitude profile membership, there were nearly twice as many participants with parents who had an undergraduate degree or higher in the Positives profile as compared to participants in the Conflicted profile. Additionally, there were twice as many participants whose parents' highest level of education was a high school diploma in the Conflicted profile compared to participants in the Positives profile. SES was significantly related to profile membership, χ^2 (8, N = 1,350) = 37.8, $p < .01$, but the overall effect size was modest, Cramer's $V = 0.11$. An analysis of cell percentages indicated that students who reported having parents with graduate degrees had an observed frequency 65% greater than expected in the Positives group, whereas students with parents with some college or less had observed frequencies 36% to 45% lower than expected in the Positives. Individuals reporting having parents who had only a high school diploma were 71% above their expected frequency in the Conflicted cell.

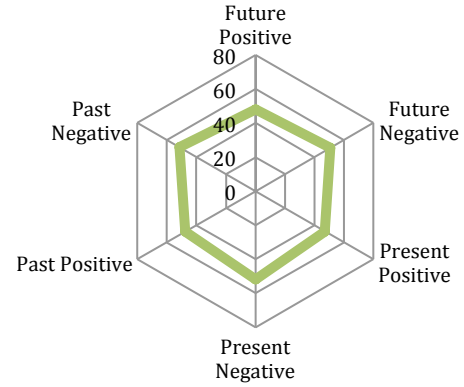
There were interesting patterns of profile membership within ethnicity (see Table 3). For example, in the Positives group, there were 1.4 to 2.3 times more European Americans than any other racial/ethnic group. Additionally, African Americans were 2 to 3 times more likely to be in the Conflicted group as compared to the other groups. However, even though ethnicity was significantly associated with profile membership, χ^2 (10, N = 1,464) = 62.4, $p < .01$, the overall effect was small, Cramer's $V = 0.15$. An analysis of cell percentages indicated that the observed frequency for African Americans in the Conflicted cell was 102% greater than expected and in the Positives cell was 31% lower than expected. Asian Americans were 36% below the expected frequency in the Conflicted cell and 40% below in the Positives cell, whereas European Americans were 40% below the expected frequency in the Conflicted cell and 37% above the expected frequency in the Positives cell. Latinos did not differ by more than 15% in any cell.



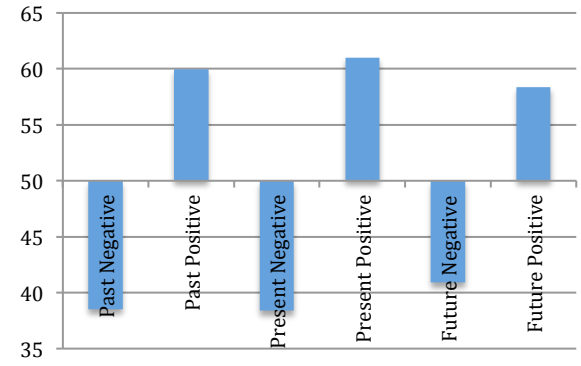


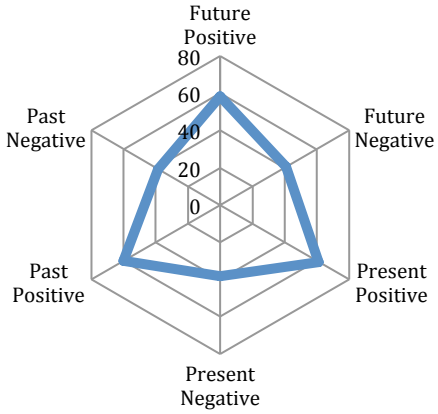
Cluster 1: Conflicted (*n* = 119, 8%)





Cluster 2: Ambivalent (*n* = 1,120, 75%)





Cluster 3: Positives (*n* = 252, 17%)

Figure 1. Three-cluster solution profiles are shown using *T*-scores so that means between clusters can be directly compared. The bar charts present mean scores per profile. The web charts provide another visual representation of profiles to facilitate comparison between papers that have also used the ATI-TA to create profiles.

GPA. Analysis of variance (ANOVA) was used to examine the relationship between GPA and cluster membership. The means and standard deviations of GPA for each cluster were as follows: (a) Conflicted (M = 2.50, SD = 0.82), (b) Ambivalent (M = 2.80, SD = 0.83), and (c) Positive (M = 3.40, SD = 0.65). The ANOVA indicated a significant difference of GPA across clusters $F(2, 1482) = 54.03$, $p < .001$, although the effect size was small ($\eta^2 = .07$). However, post-hoc analyses indicated that students with Positive profiles had meaningfully higher GPAs than those with both Ambivalent profiles (Cohen's d = 0.75) and Conflicted profiles (Cohen's d = 1.27). The differences between the Ambivalent and the Conflicted profiles were smaller (Cohen's d = 0.36), favoring the Ambivalent group.

Table 3
Demographic Variables by Time Attitude Profile

Variable	Conflicted *n* = 119, 8%	Ambivalent *n* = 1,120, 75%	Positive *n* = 252, 17%
Gender			
Female	51 (43/6)	627 (56/78)	126 (50/16)
Male	68 (57/10)	493 (44/72)	126 (50/18)
Grade			
9	28 (24/7)	301 (27/76)	67 (27/17)
10	25 (21/7)	292 (26/78)	55 (22/15)
11	36 (30/11)	237 (21/70)	65 (26/19)
12	30 (25/7)	286 (26/75)	63 (25/17
SES			
Less than HS	8 (7/8)	79 (8/83)	9 (4/9)
HS Diploma	21 (19/14)	115 (11/76)	16 (7/5)
Some College	26 (24/11)	193 (19/78)	27 (12/11)
Undergrad Degree	26 (24/7)	262 (26/75)	63 (27/18)
Graduate Degree	28 (26/6)	360 (36/71)	117 (50/23)
Ethnicity			
African American	50 (43/16)	224 (20/72)	36 (15/12)
Asian American	7 (6/5)	116 (11/85)	14 (6/10)
European American	27 (23/5)	405 (37/72)	129 (52/23)
Latin@	22 (9/8)	224 (20/78)	41 (16/14)
Multi-Ethnic	10 (9/6)	125 (11/78)	25 (10/16)

Note. Both column percentages (left) and row percentages (right) are reported. Percentages may not add to 100% exactly due to the fact that the participants who responded Native American (n = 9) were not included in the table.

Discussion

In the present study, model-based clustering was used to create adolescent time attitude profiles from ATI-TA scores. Differences among profiles were examined with

regard to demographic variables and academic achievement. In keeping with previous research, ATI-TA scores were found to be reliable and structurally valid and interpretable profiles were identified. Two profiles found in previous studies were found in this study, the *Positives* profile (Alansari et al., 2013; Andretta et al., 2014; Buhl & Lindner, 2009) and the *Ambivalent* profile (Buhl & Lindner, 2009). We also found a *Conflicted* profile, which has not been observed in any prior studies. Finally, as found in the previous sample from the United States, gender and grade were not strongly related to time attitude profile membership; however, stronger relationships were found for SES, ethnicity, and GPA.

Psychometric Results

The psychometric findings in this study support the use of ATI-TA scores as a measure of time attitudes in American adolescents. This finding is an important one for several reasons. First, the only previous study of ATI-TA scores in the United States had a much smaller sample, so the results of this study represent a generalization of the scores within this national context. Second, ATI-TA scores have been found to be reliable in samples in New Zealand (Alansari et al., 2013), Germany (Buhl & Lindner, 2009), the United Kingdom (McKay, Cole et al., 2015), and the United States (Worrell et al., 2013). However, this study is the first to replicate these findings in an independent sample in any country. Third, although Zimbardo and Boyd (1999) have a time measure that assesses attitudes across the three time periods—the Zimbardo Time Perspective Inventory (ZTPI)—ZTPI scores are not psychometrically sound in adolescent samples (McKay, Worrell, Temple, Perry, & Cole, 2014; McKay, Worrell et al., 2015; Worrell & Mello, 2007).

Time Attitude Clusters

Three interpretable clusters were found in the current study, which differs from previous studies. Buhl and Lindner (2009) found a 6-cluster solution, Andretta et al. (2013) and Andretta et al. (2014) found a 5-cluster solution, and Alansari et al. (2013) found a 4-cluster solution. However, although no study has yielded the same number of clusters, many of the clusters that have been found are similar. One of the three time-attitude profiles (Positives) in our dataset resembled those found in previous North American studies. Interestingly, the Positive profile is the only profile that has been found in *all* samples that have used the ATI-TA. In the current study, 17% of the overall sample was Positives, in contrast to 4% (Buhl & Lindner, 2009), 28% (Andretta et al., 2014; Andretta et al., 2013), and 39% (Alansari et al., 2013) in the other studies.

Buhl and Lindner (2009) reported an Ambivalent profile similar to the one in this study. However, whereas 75% of the participants in this study were in the Ambivalent profile, only 5.7% of the Buhl and Lindner study were in this profile. The substantial proportion of the sample and the fact that profile differences placed this group between the Positives and the more negative Conflicted profile suggest that this profile may be a transitional one. Finally, the Conflicted profile, which consisted of 8% of the sample, is unique to this study. This profile is characterized by very high negative attitudes and average positive attitudes. Like the Ambivalent and Pessimistic profiles found by Buhl and Lindner, the Conflicted profile had low membership relative to the total sample.

Differences Among Clusters

In keeping with the third hypothesis, we found that gender and school grade level representation were not meaningfully related to time attitude profile membership. This finding replicates the finding of Andretta et al. (2013) and suggests that time attitude profiles do not change as adolescents age. The relationships with SES and ethnicity are a bit more complex. Like Andretta et al. (2013), time attitude profile membership was not meaningfully related to either ethnicity or SES in this study. However, in the current study, this finding may be related to the fact that 75% of the adolescents were classified as Ambivalents. As the Ambivalent profile is neither strongly positive nor negative and may be transitional, relationships between profile membership and demographic variables that are present in other profiles may not be evident in this sample.

Moreover, in using expected frequencies within cells as an alternative method to examine effect size, we found the deviation of expected frequencies in the Positives profile favored students whose parents had graduate degrees, whereas students whose parents had only a high school diploma were overrepresented in the Conflicted group and that the lower SES groups were generally underrepresented in the Positives. This finding mirrors the pattern found in the secondary analysis of SES conducted by Andretta et al. (2013) and suggests that higher SES levels may be associated with more positive time attitude profiles.

The findings for ethnicity were similar. European Americans were overrepresented in the Positives profile and underrepresented in the Conflicted profile, whereas African Americans were overrepresented in the Conflicted profile and underrepresented in the Positives profile. These findings complement those of Andretta et al. (2013). Although those researchers did not examine expected frequencies, they did look at post-hoc differences on time attitude scores and found that African Americans had lower Present Positive scores and higher Future Negative scores than Asian Americans, European Americans, or Latinos, a finding attributed to the sociopolitical context of the United States.

Asian Americans, on the other hand, were underrepresented in both the Positives and Conflicted profiles. The findings for Asian Americans are consistent with previous research on this group. The lower than expected proportion in the Conflicted group may be related to their above-average performance in school contexts (Erwin & Worrell, 2012), whereas the underrepresentation in the Positives group may be related to the higher levels of pessimism that this group reports (Chang, 1996). These findings suggest the need for more detailed studies on the relationship between time attitudes and time attitude profiles, in addition to SES and ethnicity, to examine if time attitudes are affected by these variables in the same manner as academic achievement.

Finally, with regard to GPA, we replicated the findings of Alansari et al. (2013) and Andretta et al. (2014). Time attitude scores were not meaningfully related to academic achievement, but there were meaningful differences in academic achievement among time attitude profiles. Andretta and colleagues (2014) found a meaningful difference between Positives and Pessimists, and Alansari and colleagues found meaningful differences between Positives and Pessimists and between Positives and Negatives, all favoring the positives. Unlike previous studies, GPA in this study was from school records rather than self-report. Yet this study still replicated the finding that Positives had

meaningfully higher GPAs than Negatives, suggesting a real difference. Future research will need to examine if the relationship between GPA and time attitude profiles is consistently predictive and independent of the relationship between the profiles and SES, which is also often related to academic performance.

Limitations and Future Directions

This study had several limitations. First, the sample was from one high school and may not be generalizable to other schools. Second, cluster analyses were conducted with the whole sample. This raises the question of whether the same clusters would emerge if examined by demographic subgroup such as African Americans or low-SES students. Third, there continues to be an active discussion about which clustering method will yield the most accurate results for adolescent time attitude profiles. Three different clustering methods—latent profile analysis (Buhl & Lindner, 2009), hierarchical clustering (Alansari et al., 2013; Andretta et al., 2013, 2014), and model-based clustering (the current study)—have been used in this growing literature, and different numbers of clusters have been found across the different methods. One can argue that this is a limitation, or one can argue that the fact that some clusters were similar across methods is a strength. Nonetheless, it will be important to compare cluster methods in future studies to see if the method affects the number of clusters that emerge. Finally, the study is cross-sectional. Thus, longitudinal studies are needed to better understand the stability of profile membership over time and to see if evidence continues to support the hypothesis that the Ambivalent cluster is transitional.

In conclusion, there is still a considerable amount of research to be done on adolescent time attitude profiles. Replication is needed to be able to identify which profiles are more likely to generalize across adolescent samples. The current findings replicated two existing profiles, but also identified a new profile. Additionally, more research is needed to better understand the implications of profile membership. What does it mean for students academically and socially to have a Conflicted or Ambivalent time attitude profile? Finally, could time attitude profiles be a new opportunity to identify high school students who may benefit from interventions (i.e., Oyserman, Terry, & Bybee, 2002)?

Author Biographies

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Zena R. Mello*, PhD, is an Assistant Professor of Psychology at San Francisco State University. Dr. Mello's research focuses on the theory and measurement of time perspective and perceptions of demographic group membership in adolescents. Her work has been supported by the National Science Foundation and the Institute for Education Sciences. She was the recipient of the Outstanding Dissertation Award from the Human Development Division of the American Educational Research Association, and she has served on the Executive Council of the Society for Research on Adolescence and the Editorial Board of the* International Journal of Behavioral Development*.*

References

Adelabu, D. H. (2007). Time perspective and school membership as correlates to academic achievement among African American adolescents. *Adolescence*, *42*, 525–538.

Alansari, M., Worrell, F. C., Rubie-Davies, C., & Webber, M. (2013). Adolescent Time Attitude Scale (ATAS) scores and academic outcomes in secondary school females in New Zealand. *International Journal of Quantitative Research in Education*, *1,* 251–274. doi:10.1504/IJQRE.2013.057687

Andretta, J. R., Worrell, F. C., & Mello, Z. R. (2014). Predicting educational outcomes and psychological well-being in adolescents using time attitude profiles. *Psychology in the Schools*, *51*, 434–445. doi:10.1002/pits.21762

Andretta, J. R., Worrell, F. C., Mello, Z. R., Dixson, D. D., & Baik, S. H. (2013). Demographic group differences in adolescents' time attitudes. *Journal of Adolescence*, *36*, 289–301. doi:10.1016/j.adolescence.2012.11.005

Boniwell, I., Osin, E., Linley, P. A., & Ivanchenko, G. V. (2010). A question of balance: Time perspective and well-being in British and Russian samples. *The Journal of Positive Psychology*, *5*, 24–40. doi:10.1080/17439760903271181

Bowles, T. (2008). The relationship of time orientation with perceived academic performance and preparation for assessment in adolescents. *Educational Psychology*, *28*, 551–565. doi:10.1080/01443410701880134

Buhl, M., & Lindner, D. (2009). Time perspectives in adolescence: Measurement, profiles, and links with personality characteristics and scholastic experience. *Diskurs Kindheits- und Jungendforschung*, *2*, 197–216.

Chang, E. C. (1996). Evidence for the cultural specificity of pessimism in Asians vs Caucasians: A test of a general negativity hypothesis. *Personality and Individual Differences, 21,* 819–822. doi:10.1016/0191-8869(96)00110-9.

Erwin, J. O., & Worrell, F. C. (2012). Assessment practices and the underrepresentation of minority students in gifted and talented education. *Journal of Psychoeducational Assessment, 30,* 74–87. doi:10.1177/0734282911428197

Fraley, C., & Raftery, A. E. (2002). Model-based clustering, discriminant analysis, and density estimation. *Journal of the American Statistical Association*, *97*, 611–631. doi:10.1198/016214502760047131

Fraley, C., Raftery, A. E., Murphy, T. B., & Scrucca, L. (2012). *mclust Version 4 for R: Normal mixture modeling for model-based clustering, classification, and density estimation* (Technical Report No. 597). Seattle: Department of Statistics, University of Washington.

Frank, L. K. (1939). Time perspectives. *Journal of Social Philosophy*, *4*, 293–312.

Fritsch, A. (2012). mclust Version 1 for R: Process an MCMC sample of clustering. Retrieved from http://CRAN.R-project.org/package=mclust

Keough, K. A., Zimbardo, P. G., & Boyd, J. N. (1999). Who's smoking, drinking, and using drugs? Time perspective as a predictor of substance use. *Basic and Applied Social Psychology, 21,* 149–164. doi:10.1207/S15324834BA210207

Kolaczkowski, B., & Thornton, J. W. (2007). Supplementary appendix: Average posterior probability equals pro-portion correct under special conditions; "Effects of branch length uncertainty on Bayesian posterior probabilities for phylogenetic hypotheses." *Molecular Biology and Evolution*, *24*, 2108–2118. doi:10.1093/molbev/msm141

Lewin, K. (1942). Time perspective and morale. In G. Watson (Ed.), *Civilian morale* (pp. 48–70). Oxford, England: Houghton Mifflin.

Marks, G. N. (2011). Issues in the conceptualization and measurement of socioeconomic background: Do different measures generate different conclusions? *Social Indicators Research*, *104*, 225–251. doi:10.1007/s11205-010-9741-1

McKay, M. T., Andretta, J. R., Magee, J., & Worrell, F. C. (2014). What do temporal profiles tell us about adolescent alcohol use? Results from a large sample in the United Kingdom. *Journal of Adolescence, 37,* 1319–1328. doi:10.1016/j.adolescence.2014.09.008

McKay, M. T., Cole, J. C., Percy, A., Worrell, F. C., & Mello, Z. R. (2015). Reliability and factorial validity of Adolescent Time Inventory-Time Attitude (ATI-TA) scores in Scottish and Northern Irish adolescents. *Personality and Individual Differences, 86,* 412–416. doi:10.1016/j.paid.2015.06.040

McKay, M. T., Worrell, F. C., Temple, E., Perry, J. L., & Cole, J. C. (2014). A critical examination of the reliability and validity of the SZTPI-15 in British, American, and Australian samples. *Personality and Individual Differences, 69,* 168–172. doi:10.1016/j.paid.2014.05.030

McKay, M. T., Worrell, F. C., Temple, E., Perry, J. L., Cole, J. C., & Mello, Z. R. (2015). Less is not always more: The case of the 36-item short form of the Zimbardo Time Perspective Inventory. *Personality and Individual Differences, 72,* 68–71. doi:10.1016/j.paid.2014.08.018

Mello, Z. R., & Worrell, F. C. (2007). *The Adolescent Time Inventory–English.* Berkeley, CA: The University of California, Berkeley. Retrieved from http://www.uccs.edu/zmello/ati.html

Mello, Z. R., & Worrell, F. C. (2015). The past, the present, and the future: A conceptual model of time perspective in adolescence. In M. Stolarski, N. Fieulaine, & W. van Beek (Eds.), *Time perspective theory: Review, research, and application. Essays in honor of Phillip G. Zimbardo* (pp. 115–129). Zug, Switzerland: Springer.

Oh, M. -S., & Raftery, A. E. (2007). Model-based clustering with dissimilarities: A Bayesian approach. *Journal of Computational and Graphical Statistics*, *16*, 559–585. doi:10.1198/106186007X236127

Oyserman, D., Terry, K., & Bybee, D. (2002). A possible selves intervention to enhance school involvement. *Journal of Adolescence, 25,* 313–326. doi:10.1006/jado.2002.0474

Piaget, J. (1975). The intellectual development of the adolescent. In A. H. Esman (Ed.), *The psychology of adolescence: Essential readings* (pp. 104–108). New York, NY: International Universities Press.

Somers, C. L., & Gizzi, T. J. (2001). Predicting adolescents' risky behaviours: The influence of future orientation, school involvement, and school attachment. *Adolescent & Family Health*, *2*(1), 3–11.

Worrell, F. C., & Hale, R. L. (2001). The relationship of hope in the future and perceived school climate to school completion. *School Psychology Quarterly, 16,* 370–388. doi:10.1521/scpq.16.4.370.19896

Worrell, F. C., Latto, I. K., & Perlinski, M. A. (1999). The relationship of risk status to self-esteem and perceived life chances. *The Journal of At-Risk Issues, 5*(2), 33–38.

Worrell, F. C., & Mello, Z. R. (2007). The reliability and validity of Zimbardo Time Perspective Inventory scores in academically talented adolescents. *Educational and Psychological Measurement*, *67,* 487–504. doi:10.1177/0013164406296985

Worrell, F. C., & Mello, Z. R. (2009). Convergent and discriminant validity of time attitude scores on the Adolescent Time Perspective Inventory. *Diskurs Kindheits- und Jugendforschung, 2,* 185–196.

Worrell, F. C., Mello, Z. R., & Buhl, M. (2013). Introducing English and German versions of the Adolescent Time Attitude Scale. *Assessment*, *20,* 496–510. doi:10.1177/1073191110396202

Zimbardo, P. G., & Boyd, J. N. (1999). Putting time in perspective: A valid, reliable individual-differences metric. *Journal of Personality and Social Psychology*, *77,* 1271–1288. doi:10.1037/0022-3514.77.6.1271

Zimbardo, P. G., & Boyd, J. N. (2008). *The time paradox: The new psychology of time that will change your life.* New York, NY: Free Press.