



Reliability and factorial validity of Adolescent Time Inventory–Time Attitude (ATI-TA) Scores in Scottish and Northern Irish adolescents



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ABSTRACT

The contemporary literature investigating the construct broadly known as time perspective is replete with methodological and conceptual concerns. These concerns focus on the reliability and factorial validity of measurement tools, and the sample-specific modification of scales. These issues continue to hamper the development of this potentially useful psychological construct. An emerging body of evidence has supported the six-factor structure of scores on the Adolescent Time Inventory–Time Attitudes Scale, as well as their reliability. The present study utilized data from the first wave of a longitudinal study in the United Kingdom to examine the reliability, validity, and cross-cultural invariance of the scale. Results showed that the hypothesized six-factor model provided the best fit for the data; all alpha and omega estimates were $>.70$; scores on ATI-TA factors related meaningfully to self-efficacy scores; and the factor structure was invariant across both research sites. Results are discussed in the context of the extant temporal literature.

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1. Introduction

Time perspective is an individual difference variable which describes the extent to which people focus on the past, the present, and the future, and the extent to which that focus is associated with a range of human behaviors (e.g., Beenstock, Adams, & White, 2011; McKay, Andretta, Magee, & Worrell, 2014a; Zimbardo & Boyd, 1999). Time perspective is essentially an umbrella term for a construct which is multi-faceted (Shipp, Edwards, & Schurer-Lambert, 2009) and which more specifically assesses the influence of time with respect to valence, attitude, orientation, extension, affect, focus and speed, among others (Lasane & O'Donnell, 2005; Mello & Worrell, 2015).

In fact, a growing interest in the construct has been accompanied by the development of a number of instruments designed to assess its various dimensions. These include but are not limited to the Zimbardo Time Perspective Inventory (ZTPI; Zimbardo & Boyd, 1999), the Consideration of Future Consequences Scale (CFCs; Strathman, Gleicher, Boninger, & Edwards, 1994), and the Temporal Focus Scale (TFS; Shipp et al., 2009). However, in all cases, researchers have reported some

conceptual or measurement difficulties with these measures (see for example McKay, Worrell, Temple, Perry, & Cole, 2014b; Worrell & Mello, 2007). It has been suggested that the difficulties operationalizing time perspective have limited its utility in psychological research, and to a large extent these difficulties remain (Adams, 2009; Shipp et al., 2009).

The ZTPI (Zimbardo & Boyd, 1999) is one of the most ambitious instruments, in that it attempts to measure affective, behavioral, and cognitive aspects of time perspective across the past, the present, and the future (Zimbardo & Boyd, 1999, 2008). There are several versions of the scale in the literature, ranging in length from 15 items to 56 items, and the scale has been translated into several languages and used in 24 countries (Sircova et al., 2014). Nonetheless, scores on most of the ZTPI versions have not held up to rigorous psychometric scrutiny (McKay, Morgan, van Exel, & Worrell, 2015a; McKay et al., 2014b; Sircova et al., 2014; Worrell & Mello, 2007), and factor structures with strong fit indices are typically sample specific (McKay et al., 2014a). Upon examining the ZTPI, several researchers have argued that the psychometric concerns are due, at least in part, to the inclusion of items on the ZTPI measuring constructs other than time perspective (e.g., Crockett, Weinman, Hankins, & Marteau, 2009; Shipp et al., 2009; Worrell & Mello, 2007; Worrell, Mello, & Buhl, 2013).

Psychometric inconsistencies have also been reported in studies using the CFCs. These studies have yielded one-factor (Hevey et al.,

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2010; Strathman et al., 1994), two-factor (Adams, 2012; Arnocky, Milfont, & Nicol, 2014; Joireman, Balliet, Spratt, Spangenberg, & Schultz, 2008; Rappange, Brouwer, & Van Exel, 2009) and bifactor (McKay et al., 2015a) solutions. Some researchers have attempted to address problems with the CFCS by creating a revised version of the scale. For example, in their development of the CFCS-14, a modified version of the CFCS, Joireman et al. (2012) allowed seven correlated error terms between items in order to achieve a good-fitting model for a hypothesized two-factor structure. However a subsequent study failed to support the two-factor structure and had to permit an additional correlated error term in order to achieve a good fit (Khachatryan, Joireman, & Casavant, 2013). Similarly, although reported much less frequently in the literature than the other two scales, issues have been reported with the factorial validity of TFS scores (McKay, Percy, Goudie, Sumnall, & Cole, 2012).

1.1. The present study

One of the more promising temporal measures in terms of its factorial validity and reliability is the Adolescent Time Inventory–Time Attitudes scale (ATI-TA; Mello & Worrell, 2007). This 30-item scale assesses both negative and positive attitudes towards the past, present and future. Whereas the ZTPI was developed to simultaneously assess the cognitive, affective and behavioral dimensions of a broad construct, time perspective, the ATI-TA focuses on affect. To date, ATI-TA scores have been examined in samples in Germany (Buhl & Linder, 2009; Worrell et al., 2013), the United States (Worrell et al., 2013) and New Zealand (Alansari, Worrell, Rubie-Davies, & Webber, 2013). Internal consistency estimates for the subscale scores have ranged from .77 to .90 in whole samples (with some minor variability in ethnic subsamples), with confidence intervals from .72 to .91. Moreover, structural validity analyses have supported the six-factor structure in all three national contexts with fit indices all in the good to close ranges (e.g., $.944 \leq CFI \leq .965$; $.033 \leq RMSEA \leq .041$). Moreover, Worrell and Mello (2009) reported strong criterion-related validity evidence for the six subscale scores.

The present study sought to examine the structural validity, internal consistency, concurrent validity and cross-cultural invariance of the ATI-TA in two samples of adolescents in the United Kingdom (UK), one from Northern Ireland and one from Scotland. It was hypothesized that internal consistency estimates would be .70 or higher for subscale scores, that the six-factor structure would achieve an acceptable fit in both samples, and that ATI-TA scores would be meaningfully related (i.e., $r > .30$) to scores on self-concept and sensation seeking measures. Sensation seeking has elsewhere been found to be meaningfully and negatively ($-.24 \leq r \leq -.31$) related to future time perspective, and meaningfully and positively ($.45 \leq r \leq .57$) related to present time perspective (Zimbardo & Boyd, 1999; Zimbardo, Keough, & Boyd, 1997; Keough, Zimbardo, & Boyd, 1999). Moreover, in the development of the ZTPI, Zimbardo and Boyd (1999) reported statistically significant relationships between self-esteem and their past negative ($r = -.48$), past positive ($r = .28$) and present fatalistic ($r = -.28$) factors.

2. Method

2.1. Participants

Data were drawn from two independent samples in the UK. At the time of data collection participants were in school Grade 8 (aged 12–13 years old). Sample 1 consisted of 1580 adolescents (40% females, 1.7% unreported) attending secondary schools in Northern Ireland. Sample 2 consisted of 813 adolescents (46.7% female, 1.4% unreported) attending secondary schools in Scotland. Both groups of adolescents completed the ATI-TA alongside several other questionnaires as part of a large scale representative longitudinal study.

2.2. Measures

The ATI-TA is a 30-item instrument with six 5-item subscales assessing past negative, past positive, present negative, present positive, future negative, and future positive attitudes. ATI-TA scores are scores on a 5-point Likert scale with verbal and numerical anchors (1 = *totally disagree*, 5 = *totally agree*). Scores on items within each factor are summed and divided by five to yield a mean score. As previously noted, ATI-TA scores have been shown to be internally consistent and structurally valid in New Zealand (Alansari et al., 2013), Germany, and the US (Worrell et al., 2013), and there has also been evidence of convergent and discriminant validity (Worrell & Mello, 2009).

The Self-efficacy Questionnaire for Children (SEQ-C; Muris, 2001) contains 21 items assessing three domains of self-efficacy: (a) academic self-efficacy (α current study = .84), (b) emotional self-efficacy (α current study = .78), and (c) social self-efficacy (α current study = .68). Each subscale consists of seven items, and respondents rate their competence in each self-efficacy domain on a 5-point Likert scale (1 = *not at all*; 5 = *very well*). Scores on items within factors were totaled and divided by seven to give a mean score. SEQ-C subscale scores have been found to be structurally valid and internally consistent ($\alpha > .80$; Muris, 2001).

Sensation seeking was measured using the four-item Brief Sensation Seeking Scale (BSSS-4; Stephenson, Hoyle, Palmgreen, & Slater, 2003). Responses to the four items were given on a 5-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (5) and totaled to give a sensation seeking score. Scores in the present study were found to be internally consistent (α current study = .79).

3. Results

3.1. Descriptive statistics

Table 1 contains means and standard deviations, as well as subscale intercorrelations by sample. As can be seen, means for positive subscales are generally higher than means for negative subscales, in keeping with the extant literature (Worrell et al., 2013), and the distributions of the scores are neither skewed nor kurtotic. Subscale intercorrelations also were in keeping with theory and the previous literature: Intercorrelations were higher for more proximal subscales (e.g., past and present) than less proximal ones (e.g., past and future), and internal consistency estimates as well as a 95% confidence interval for alpha are also reported for sample scores. Nine of the 12 estimates are .78 or higher with one estimate falling below .70 (i.e., Future Negative scores in the Northern Ireland sample), and two estimates falling in the low .7 range (Past Positive and Future Negative scores in the Scottish sample).

3.2. Factor analyses

Confirmatory factor analyses were conducted using MPlus (version 7; Muthén & Muthén, 1998–2012) and, because the data were ordinal and the sample size was large, robust weighted least squares estimation (Byrne, 2012). In keeping with best practice (Byrne, 2012; Thompson, 2004), several indicators of fit were used to evaluate the models. These included the Tucker–Lewis Index (TLI), which takes model complexity into account; the Comparative Fit Index (CFI), which takes sample size into account; and the root mean square error of approximation (RMSEA) and its 90% confidence interval. TLI and CFI values greater than .90 are indicative of acceptable fit, and values of these indices greater than .95 are indicative of close fit. As the RMSEA is an index of misfit, values less than .08 are indicative of acceptable fit and values below .05 are indicative of close fit (Marsh, Hau, & Wen, 2004).

As can be seen in Table 2, the pattern of findings was similar for both samples. None of the fit indices was in the acceptable range for the two-factor models, with similar results for the three-factor model in the Scottish sample; the indices were just in the acceptable range for the

Table 1
Descriptive statistics for Adolescent Time Inventory–Time Attitude scores.

	<i>M</i>	<i>SD</i>	α	95% CI	ω	1	2	3	4	5	6
<i>Northern Ireland (n = 1580)</i>											
1. Past positive	4.03	0.79	.81	.79, .82	.87	–	–.83	.70	–.63	.57	–.54
2. Past negative	2.10	0.91	.83	.81, .84	.88	–.66	–	–.63	.80	–.40	.69
3. Present positive	3.93	0.77	.82	.80, .83	.87	.53	–.45	–	–.88	.67	–.66
4. Present negative	2.11	0.81	.79	.78, .81	.85	–.46	.61	–.68	–	–.54	.79
5. Future positive	4.12	0.71	.81	.80, .83	.88	.40	–.25	.51	–.38	–	–.80
6. Future negative	2.04	0.71	.68	.66, .71	.78	–.35	.47	–.46	.56	–.56	–
<i>Scotland (n = 813)</i>											
1. Past positive	4.00	0.82	.72	.69, .75	.83	–	–.77	.75	–.60	.58	–.45
2. Past negative	2.30	0.98	.80	.78, .82	.86	–.57	–	–.58	.80	–.40	.70
3. Present positive	4.02	0.81	.80	.78, .82	.87	.55	–.41	–	–.81	.69	–.56
4. Present negative	2.05	0.85	.79	.76, .81	.86	–.42	.61	–.60	–	–.60	.82
5. Future positive	4.21	0.71	.78	.75, .80	.86	.38	–.26	.48	–.42	–	–.76
6. Future negative	2.02	0.80	.70	.67, .73	.80	–.27	.51	–.36	.59	–.51	–

Note. Skew and kurtosis values were small, ranging from $-.94$ to $.82$ and $-.26$ to $.99$, respectively. Correlations below the diagonal are for observed scores and correlations above the diagonal are for the latent constructs from the six-factor measurement model (see Table 2). Omega estimates are based on the coefficients from the six-factor model, which are reported in Table 3.

three-factor model in the Northern Ireland sample. However, the hypothesized six-factor model was supported by every index, with TLI and CFI values in the close or acceptable range, and RMSEA values in the acceptable range. Factor coefficients and effect sizes for the six-factor model are presented in Table 3 for both samples. In the Northern Ireland sample, no coefficient was below $.50$, and in the sample from Scotland, one Past Positive coefficient was in the $.40$ range.

Configural invariance (similar pattern of factors), metric or measurement invariance (similar pattern of factors and factor loadings constrained to be equal), and scalar invariance (constraining intercepts to be equal) were all examined in a multi-group CFA using the six-factor model. These findings are also presented in Table 2. Cheung and Rensvold's (2002) recommendation—that is, a change in CFI of $.01$ or less is indicative of invariance—was used to assess invariance. As can be seen in Table 2, the samples demonstrated configural, metric, and scalar, also known as strong, invariances.

3.3. Concurrent validity

Results of Pearson correlations (two-tailed) between scores on ATI-TA factors and scores on self-efficacy and sensation seeking measures are displayed in Table 4. Results show that there were significant, and often meaningful ($\geq .30$) positive relationships between positive attitudes towards all time periods and scores on academic, social and emotional self-efficacies, with the reverse true for negative attitudes

towards past, present and future. There were no meaningful relationships between time attitudes and scores on sensation seeking.

4. Discussion

This study examined the structural validity, internal consistency and concurrent validity of ATI-TA scores and the extent to which these measurement characteristics were invariant across two large and diverse samples of UK school children. These findings are useful given increased interest in time constructs, such as time attitudes, in adolescents (Mello & Worrell, 2015), and measurement concerns with other scales including the CFC (McKay et al., 2015a; McKay et al., 2015b) and the ZTPI (McKay et al., 2015a; McKay et al., 2014b; Sircova et al., 2014; Worrell & Mello, 2007).

All analyses supported the theoretical model underpinning the scale construction. The six-factor model provided better fit than alternative model formulations, such as a two-factor solution based on attitudinal valence (positive/negative) and a three-factor solution based on time orientation (past/present/future). The six-factor model also demonstrated large loadings across all factors, high internal consistency (all ω values in excess of 0.77) and strong measurement invariance between the two adolescent samples (Northern Ireland and Scotland).

Results showed modest correlations between ATI-TA scores and scores on academic, social, and emotional self-efficacies. The finding concerning the academic domain is similar to past research with

Table 2
Fit indices for ATI-TA Scores derived from confirmatory factor analyses (WLSMV).

Model	χ^2 s–b	df	CFI	TLI	RMSEA	(90% C.I.)
<i>Northern Ireland (N = 1580)</i>						
1. Null	47,232.68*	435				
2. 2-Factor (valence)	9239.05*	404	.811	.797	.118	.116, .120
3. 3-Factor (time periods)	4436.29*	402	.914	.907	.080	.077, .082
4. 6-Factor (theorized)	2416.19*	390	.957	.952	.057	.055, .060
<i>Scotland (N = 807)</i>						
5. Null	20,698.20*	435				
6. 2-Factor (valence)	3585.76*	404	.843	.831	.098	.095, .101
7. 3-Factor (time periods)	2683.85	402	.887	.878	.084	.081, .087
8. 6-Factor (theorized)	1405.11*	390	.950	.944	.057	.053, .060
Invariance (Northern Ireland & Scotland)					Model Comparison	
9. Configural invariance	3736.97*	780	.956	.951	.056	.054, .058
10. Metric invariance	3738.07*	804	.956	.953	.055	.053, .057
11. Scalar invariance	3610.40*	888	.960	.960	.051	.049, .052
						10–9
						11–9
						.00
						.004

Note. ATI-TA = Adolescent Time Inventory–Time Attitudes; CFI = Comparative Fit Index; TLI = Tucker–Lewis Index; RMSEA = robust root mean square error of approximation; C.I. = confidence interval (for RMSEA).

* $p < .001$.

Table 3
Standardized coefficients for the six-factor structure.

	Northern Ireland		Scotland	
	Coefficients	R ²	Coefficients	R ²
<i>Past positive</i>				
3	.68	.46	.43	.18
9	.73	.53	.66	.44
21	.78	.61	.79	.62
24	.79	.62	.76	.58
30	.80	.64	.85	.72
<i>Past negative</i>				
6	.72	.52	.68	.46
12	.78	.61	.79	.62
15	.80	.64	.78	.61
18	.82	.67	.83	.69
27	.73	.53	.64	.41
<i>Present positive</i>				
5	.74	.55	.73	.53
11	.81	.66	.78	.61
14	.71	.50	.60	.36
17	.71	.50	.79	.62
26	.81	.66	.84	.71
<i>Present negative</i>				
2	.72	.52	.65	.42
8	.65	.42	.67	.45
20	.74	.55	.78	.61
23	.79	.62	.82	.67
29	.74	.55	.76	.58
<i>Future positive</i>				
1	.66	.44	.64	.41
7	.76	.58	.71	.50
13	.81	.66	.82	.67
19	.84	.71	.78	.61
28	.75	.56	.76	.58
<i>Future negative</i>				
4	.54	.29	.58	.34
10	.59	.35	.64	.41
16	.71	.50	.75	.56
22	.75	.56	.76	.58
25	.61	.37	.61	.37

profiles of time attitude scores that have shown relationships with academic achievement in adolescents (Andretta, Worrell, & Mello, 2014), and to a study with college students that reported a positive association between the ZTPI-future subscale and self-reported hours studying per week (Zimbardo & Boyd, 1999). Further, we showed associations with social and emotional self-efficacies. This finding extends research on time perspective to a new area and strengthens the field. Relational

Table 4
Pearson's correlations between summed scores on the ATI-TA and scores on self-efficacy and sensation seeking measures.

		ASE	SSE	ESE	SS
Past positive	Northern Ireland	.26**	.30**	.25**	-.03
	Scotland	.27**	.31**	.29**	.02
Past negative	Northern Ireland	-.25**	-.22**	-.21**	.10**
	Scotland	-.26**	-.22**	-.25**	.10**
Present positive	Northern Ireland	.30**	.33**	.31**	-.01
	Scotland	.15**	.29**	.30**	.06
Present negative	Northern Ireland	-.32**	-.30**	-.33**	.12**
	Scotland	-.34**	-.35**	-.34**	.08*
Future positive	Northern Ireland	.29**	.34**	.29**	.06*
	Scotland	.27**	.30**	.30**	.10**
Future negative	Northern Ireland	-.30**	-.26**	-.28**	.07*
	Scotland	-.29**	-.27**	-.20**	.03

Note: ASE = academic self-efficacy; SSE = social self-efficacy; ESE = emotional self-efficacy; SS = sensation seeking.

* $p < .05$.

** $p < .01$.

skills, such as social and emotional self-efficacies, are especially important in adolescence, given the salience of peers in this developmental period (Brown & Larson, 2009).

However, analyses did not support associations between time attitudes and sensation-seeking. This is contrary to Zimbardo and Boyd's (1999) study that showed positive relationships with sensation seeking and present-hedonism and present-fatalism subscales and a negative relationship with the future subscale. This discrepancy may be due to the differences in the ages of the participants in the two studies (i.e., adolescents versus adults) or to measurement variation. Specifically, the ATAS includes items pertaining to time periods and attitudes exclusively, whereas the ZTPI simultaneously measures behaviors and an orientation towards time. Indeed, researchers measuring time in terms of the importance and relationship among the past, the present, and future have shown meaningful relationships with risk-taking in adolescents (Mello, Finan, & Worrell, 2013). Thus, it will be useful for future research to consider the multiple ways that time may be measured in relationship to sensation-seeking.

Advantages of the ATI-TA include a simple and consistent factor structure, with strong item coefficients across all factors (only one item in one sample loading below 0.5) assessing both negative and positive attitudes across three time periods (past, present and future). These findings indicate that the ATI-TA is a measure of time attitudes in adolescents that avoids many of the psychometric complexities (for example, correlated errors or bi-factor solutions) found in other alternative temporal measures. The six-factor structure identified in this study confirmed that reported in other European, U.S. and New Zealand adolescent samples (see Alansari et al., 2013; Worrell et al., 2013). The ATI-TA lends itself to direct application within both research and non-research settings, for example, within prevention interventions or therapeutic work with adolescents, which necessitate a simple scoring system for practitioners rather than the estimation of a complex measurement model.

The six-factor solution further supports the theoretical position that negative and positive attitudes towards specific time periods represent distinct, although related, attitudinal dimensions rather than opposite ends of a single dimension. It is possible for adolescents to be looking forward to the future (positive future attitude) while simultaneously holding doubts and concerns about what the future may hold for them (negative future attitude).

4.1. Limitations and future directions

The study had several limitations. Both samples were from specific geographical locations within each country and, as a result, the samples cannot be considered to be nationally representative. Also, although the Northern Ireland sample contained both urban and rural schools, the Scottish sample was mainly drawn from schools within an urban city location. The sample was also drawn from a single school year group within each school and consisted only of children aged 12 to 13 years old. These sample characteristics restrict opportunities to study the application of the ATI-TA within specific subgroups. Further work is required to assess the reliability and validity across different adolescent populations. The concurrent validity of the ATI-TA was only assessed in relation to self-efficacy and sensation seeking. Future research should examine that relationship between time attitudes and other important adolescent characteristics (for example, educational outcomes, risk-taking behaviors, and self-regulation).

The emergence of the ATI-TA as a robust measure of time attitudes in adolescents opens new opportunities for the investigation of developmental aspects of time attitudes. These include the examination of intra-individual change in time attitudes with age, the individual and environmental antecedents of specific time attitudes, and the contribution of time attitudes to developmental pathways to significant adult outcomes.

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