

# Development and Psychometric Properties of the Transformational Teaching Questionnaire

MARK R. BEAUCHAMP  
*The University of British Columbia, Canada*  
JULIAN BARLING  
*Queen's University, Canada*  
ZHEN LI  
*The University of British Columbia, Canada*  
KATIE L. MORTON  
*The University of British Columbia, Canada*  
SHARON E. KEITH  
*The University of British Columbia, Canada*  
BRUNO D. ZUMBO  
*The University of British Columbia, Canada*

**ACKNOWLEDGEMENTS.** This research was supported by a career investigator award from the Michael Smith Foundation for Health Research and a Social Sciences and Humanities Research Council of Canada research grant (Grant # 410-2006-0389) awarded to Mark Beauchamp.

**COMPETING INTERESTS:** None declared.

**ADDRESS.** Correspondence should be directed to:  
MARK BEAUCHAMP, School of Human Kinetics, University of British Columbia, 6081 University Boulevard, Vancouver, V6T 1Z1, Canada.  
[Tel.: +1 (604) 822 4264; Fax: +1 (604) 822 5884;  
email: mark.beauchamp@ubc.ca]



*Journal of Health Psychology*  
Copyright © 2010 SAGE Publications  
Los Angeles, London, New Delhi,  
Singapore and Washington DC  
www.sagepublications.com  
Vol 15(8) 1123–1134  
DOI: 10.1177/1359105310364175

## Abstract

We draw from transformational leadership theory (Bass & Riggio, 2006) to develop a reliable and valid measure of *transformational teaching*, for use within school-based physical education contexts. In Phase 1, we utilized established instrument development procedures, involving teachers, students, and experts in transformational leadership theory to ensure that items exhibited sound content validity, and were developmentally appropriate. In Phase 2, multilevel confirmatory factor analytic procedures with 2761 adolescents supported the factorial validity of the Transformational Teaching Questionnaire. In Phase 3, concurrent validity of the TTQ was supported by positive relationships between transformational teaching and adolescent self-determined motivation and positive affect.

## Keywords

- *transformational leadership*
- *health psychology*
- *measurement*
- *multilevel confirmatory factor analysis*
- *physical education*

Physical inactivity in childhood and adolescence is now an issue of particular concern (Hills, King, & Armstrong, 2007). With evidence that physical inactivity during this formative period is linked with physical and mental health problems that extend across the lifespan (Menschik, Ahmed, Alexander, & Blum, 2008), it is unsurprising that physical activity has been identified as an imperative for public health (Sparling, Owen, Lambert, & Haskell, 2000). Involvement in school-based *physical education* has been identified as an influential mechanism through which physical activity behaviours both within school and beyond can be fostered (Standage, Duda, & Ntoumanis, 2003). Despite this, less than 50 per cent of children and adolescents in North America are sufficiently active to accrue the necessary health benefits (Shanklin et al., 2008).

A potentially useful paradigm that has yet to be systematically applied to education and health promotion contexts is transformational leadership theory (Bass & Riggio, 2006). Transformational leadership involves the demonstration of behaviours that empower and inspire others, that transcend one's own self-interests, and give others the confidence to achieve higher levels of functioning. Transformational leadership is comprised of four dimensions, namely: *idealized influence*; *inspirational motivation*; *intellectual stimulation*; and *individualized consideration* (Bass & Riggio, 2006). Idealized influence takes place when leaders foster trust and respect among those that they lead, and model ethically desirable behaviours through the demonstration of personally held beliefs. Inspirational motivation involves the communication of high expectations to followers, whereby leaders inspire and energize others to achieve their goals. Intellectual stimulation involves encouraging people to see issues from multiple perspectives, and question their own and others' commonly held assumptions. Lastly, individualized consideration takes place when leaders recognize and act on the personal and psychological needs of others, display a genuine sense of care and concern and celebrate the successes of others (Bass & Riggio, 2006).

Transformational leadership has been studied extensively in a diverse range of work settings (Barling, Christie, & Hopton, in press). Although transformational leadership theory has also been applied to educational contexts, research in this area has primarily focused on the effects of school principals' behaviours on teachers (e.g. Koh, Steers, & Terborg, 1995); the influence of teachers'

transformational behaviours in relation to the cognitions, emotions, and actions of students has yet to be the primary focus of study. Nevertheless, transformational leadership theory holds considerable potential for informing our understanding of the effects of teaching behaviours in relation to adolescents' involvement in school-based physical education and health promotion, for three major reasons. First, most contemporary definitions of leadership suggest that leadership represents the influence of one person over a set of other people within a group to achieve a desired set of objectives (Northouse, 2001). Thus, in many respects, effective leadership is synonymous with effective teaching, and vice versa. Second, an extensive body of empirical evidence has accumulated outside of educational contexts, which has consistently found transformational leadership to be associated with a variety of adaptive psychological states among followers, including elevated self-confidence (Kark, Shamir, & Chen, 2003), self-determined motivation (Charbonneau Barling, & Kelloway, 2001), and improved affect (Judge & Piccolo, 2004). Finally, and of particular relevance to school-based education and health promotion settings, field-based quasi-experimental research has demonstrated that transformational leadership can be developed through intervention (Barling, Weber, & Kelloway, 1996).

Despite of the potential application of transformational leadership theory to inform educational and health promotion research, one likely reason for the paucity of studies in this area relates to the fact that at present there is no reliable and valid measure of *transformational teaching*; even when research has been conducted in educational contexts, standard instruments developed within and for industrial contexts were used (Koh et al., 1995). Several measures of transformational leadership have been developed for adult populations (Alimo-Metcalfe & Alban-Metcalfe, 2001; Bass & Avolio, 1995; Podsakoff, MacKenzie, Moorman, & Fetter, 1990), although no such measures have been developed for use with adolescents or with education in mind. Perhaps the most widely used measure of transformational leadership remains Bass and Avolio's (1995) Multifactor Leadership Questionnaire (MLQ). While some research has used the MLQ with adolescents (e.g. Zacharatos, Barling, & Kelloway, 2000), the MLQ items are more applicable to organizational contexts than the classroom (e.g. 'emphasizes the importance of having a collective sense of mission') and the language is not well suited for use with adolescents. As

one indicator of this, the MLQ has a Flesch (1948) Reading Ease Score of 52.5, which is considered 'fairly difficult' (D'Alessandro, Kingsley, & Johnson-West, 2001).

With this in mind, the primary purpose of our research was to develop a measure of transformational teaching for use within school-based physical education settings, and evaluate its reliability and validity. In doing so, we take a construct validity approach (Marsh, 1997), in which we draw from theory and research to develop an operational definition of our focal construct (transformational teaching), and empirical research is used to test both the theory and the measure of interest. This is consistent with the *Standards for Educational and Psychological Testing* (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999) who consider validity as 'the degree to which evidence and theory support the interpretations of test scores entailed by the proposed use of tests' (p. 9). Specifically, in Phases 1 and 2 we use standard instrument development procedures (Clark & Watson, 1995) to develop a conceptually sound and psychometrically robust measure of transformational teaching; in Phase 3 we examine the concurrent validity of the transformational teaching construct in relation to theoretically-relevant outcomes for students within school physical education settings.

### Phase 1: item generation and content validity

The overall purpose of Phase 1 was to develop an extensive battery of items that reflected the breadth of the theorized content domain of interest, namely transformational teaching. To accomplish this, a comprehensive literature review (on transformational leadership across different cognate domains) was first conducted to ensure that our potential item pool would be 'broader and more comprehensive than one's own theoretical view of the target construct' (Clark & Watson, 1995, p. 311). In addition, we conducted a series of focus groups with adolescents to: (a) examine the extent to which the behaviours used by teachers within physical education settings can be understood and conceptualized within a transformational leadership theory framework; and (b) ensure that the resultant item pool demonstrated good content validity for our target population of adolescents. The eight focus groups involved 62 adolescents

(22 males and 40 females) aged 13–15, and was designed to examine students' perceptions of the behaviours *currently* used by their physical education teachers, as well as the *ideal* behaviours utilized by school physical education teachers.

The results revealed that students described a range of teaching behaviours in their own words, that paralleled the use of transformational leadership behaviours in other workplace contexts (Bass & Riggio, 2006), and also provided contextual insight into how these behaviours are used within education settings. A full, detailed description of the results of the focus groups have been presented elsewhere (Morton, Keith, & Beauchamp, 2010). Drawing from the broad literature review and these focus groups, we developed an extensive battery of items ( $n = 55$  items) that was subsequently reviewed by students in a series of follow-up focus groups. Specifically, three groups of students ( $N = 30$ ), that took part in the initial focus groups were invited to provide feedback on the items, both with regard to item-content and item-wording. In addition, five physical education teachers were invited to review and provide feedback on the items. Any problematic items were rephrased or were removed from the item pool, resulting in 25 items.

To ensure that the items were representative of the four a priori transformational teaching dimensions, this trimmed item-pool was subsequently reviewed by three experts in transformational leadership theory, using the three-step item review process outlined by Estabrooks and Carron (2000). The resultant pool of items from this distillation processes consisted of 16 items across the four dimensions of transformational teaching (four items per dimension). These 16 items, hereafter referred to as the Transformational Teaching Questionnaire (TTQ), demonstrated a Flesch (1948) Readability score of 78.6, which is considered 'fairly easy' (Grade 4 reading ability). As with the original MLQ, items on the TTQ were anchored on a Likert-type rating scale: 0 (*Not at all*), 1 (*Once in a while*), 2 (*Sometimes*), 3 (*Fairly often*), and 4 (*Frequently*). All items (see Table 1) were prefixed by 'My physical education teacher ...'.

### Phase 2: factorial validity

The overall purpose of this phase of research was to examine the factor structure of the transformational teaching measure (TTQ). The use of factor analytic procedures is an important step in test construction

Table 1. Transformational Teaching Questionnaire items, ICCs and design effects

	ICC	Design effect
1. Shows that s/he cares about me	.24	5.47
2. Acts as a person that I look up to	.18	4.54
3. Creates lessons that really encourage me to think	.15	3.98
4. Demonstrates that s/he believes in me	.19	4.72
5. Treats me in ways that build my respect	.19	4.82
6. Is enthusiastic about what I am capable of achieving	.18	4.62
7. Provides me with tasks and challenges that get me to think in different ways	.12	3.41
8. Motivates me to try my hardest	.15	4.13
9. Tries to know every student in the class	.18	4.50
10. Gets me to question my own and others' ideas	.12	3.33
11. Tries to help students who might be struggling	.18	4.73
12. Talks about his/her personal values	.22	4.93
13. Encourages me to look at issues from different sides	.15	3.88
14. Recognizes the needs and abilities of each student in the class	.17	4.39
15. Is optimistic about what I can accomplish	.19	4.78
16. Behaves as someone I can trust	.19	4.74

Note: Idealized Influence (II items: 2, 5, 12, and 16); Inspirational Motivation (IM items: 4, 6, 8, and 15); Intellectual Stimulation (IS items: 3, 7, 10, and 13); and Individualized Consideration (IC items: 1, 9, 11, and 14)

and validation procedures (Clark & Watson, 1995) and in the context of this study was used to ascertain whether our conceptual model of transformational teaching was supported.

## Phase 2: method

### Participants

In total, 2761 students volunteered to participate in this study. As with Phase 1, students in this study were in grades 8–10 ( $M_{\text{age}} = 14.33$  yrs; 1210 males, 1527 females, with 24 who did not specify their gender). Students emanated from 133 physical education classes (taught by 42 teachers), from six schools in the Lower Mainland of British Columbia (Canada), and represented a diverse range of ethnic backgrounds. The average within-class size was  $n_g = 20.76$ .

### Procedures

Prior to conducting the study, ethical approval was obtained from the lead author's institutional review board, as well as agency approval from the two school boards responsible for the oversight of the schools within this study. Students and their parents were provided with a letter informing them of the purpose of this study. Students were subsequently invited to participate in the study upon receipt of both parental and student informed consent. Students were assured that their participation was

voluntary, their responses would remain confidential, and that they could withdraw at any time without incurring negative consequences. Data collection took place mid-way through the school year to: (a) ensure that students had sufficient information upon which to evaluate their teachers' behaviours; and (b) minimize any honeymoon biases that may occur at the start of students' relationships with their 'new teachers' at the beginning of the school year (cf. Barling et al., in press).

## Phase 2: results

### Multilevel confirmatory factor analysis

In light of the fact that students are nested (or clustered) within classes, and were invited to rate the behaviours of the same referent (i.e. all students in a given class rated the same teacher), the data are likely to be non-independent. Conventional (i.e. single-level) statistical methods are unable to account for the variability and interdependence that occurs within and between clusters (Snijders & Bosker, 1999), and thus are likely to result in biased estimated parameters and standard errors, and an increased likelihood of Type I error (Bliese & Hanges, 2004). The same is also the case when conducting factor analysis, necessitating multilevel confirmatory factor analytic (MCFAs) procedures (Muthén, 1991).

Consistent with procedures outlined by Muthén and Sartora (1995) and Grilli and Rampichini (2007), item-level intra-class correlations (ICC) and design effects (DEFF) were initially calculated to determine if a multilevel approach is empirically justified. ICCs greater than .20 and DEFFs greater than 2 suggest the clustering should not be ignored (Muthén & Sartora, 1995). Item-level ICCs ranged from .12 to .24, and DEFFs ranged between 3.33 and 5.47 (see Table 1), which together suggest the need for a multilevel approach to determining the factorial validity of the TTQ. In the present study, a Robust Full Information Maximum Likelihood (FIML) method of estimation was used, involving the *Mplus* Version 4.1 software (Muthén & Muthén, 2006).

As with single-level CFA procedures, multi-level factor models can be assessed for model fit through a variety of fit indices (Bentler, 1990). In this study, the  $\chi^2$  test was considered. However, numerous authors have suggested that a non-significant  $\chi^2$  statistic is unrealistic (Hu & Bentler, 1995), and that supplemental fit indexes should also be considered. Thus, we also calculated the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and the Standard Root Mean Square Residual (SRMR). Hu and Bentler (1999) suggest that under maximum likelihood estimation procedures, there is a good fit between the hypothesized model and the data when RMSEA values are equal to or below .06, SRMR values are equal to or below .08, and TLI and CFI values are close to or greater than .95.

When employing an FIML approach to model estimation any missing data are treated in the estimation algorithm. Initially, a four factor MCFA measurement model was tested with the four transformational teaching dimensions specified as correlated first-order latent factors. This measurement model provided evidence of close model fit:  $\chi^2(197) = 2259.736, p < .001, CFI = .939, TLI = .926, RMSEA = .062, SRMR_{within} = .037$ , and each of the subscales were found to demonstrate good internal consistency ( $\alpha s > .85$ ). However, in this model each of the four factors were found to be highly correlated ( $.86 < r < .96$ ). This finding is consistent with a large body of empirical evidence from the organizational domain involving the MLQ which has consistently reported high inter-factor correlations among these four dimensions (e.g. Bycio, Hackett, & Allen, 1995; Carless, 1998). As an explanation for this, Barling et al. (in press) suggested that

when leaders are transformational and make use of any one of these behaviours, it is likely that they will *also* make use of one or more of the other three behaviours. Parenthetically, and consistent with this perspective, Carless, Wearing, and Mann (2000) provided empirical evidence for a unidimensional operationalization of transformational leadership.

In light of this evidence, and consistent with: (a) the conceptual model presented by Bass and Riggio (2006) in which transformational leadership is theorized to comprise the above four dimensions; and (b) empirical evidence suggesting that these four dimensions are highly inter-related, we examined a second-order multilevel model, in which four first-order latent factors were specified as contributing towards a higher order construct, termed transformational teaching.<sup>1</sup> This two-level (student, class) second-order (four first order dimensions contributing to a higher-order latent variable) model of transformational teaching provided evidence of close model fit:  $\chi^2(201) = 2258.410, p < .001, CFI = .940, TLI = .928, RMSEA = .061, SRMR_{within} = .037$ . Parameter estimates for this model are available from the first author upon request. The higher-order measurement model (including all 16 items) was found to demonstrate good internal consistency ( $\alpha = .96$ ). In sum, data derived from the TTQ was found to demonstrate good model fit (with the second-order model representing the most parsimonious operationalization), as well as good reliability.

### Phase 3: concurrent validity

The development of a conceptually sound and psychometrically robust measure of transformational teaching represents an important step to enable researchers to examine the extent to which transformational leadership theory can be applied to educational and health promotion contexts. Initially (Phase 1) we sought to ensure that items demonstrated good content validity, were conceptually sound, and were developmentally appropriate. In Phase 2 we sought to examine the psychometric properties of the TTQ. The results of Phase 2 revealed that data derived from the TTQ were found to demonstrate good model fit and were reliable. Of course, acceptable data fit for a measurement model provides no insight into whether and how the focal construct(s) might be related to salient external variables. In addition to within-network investigations like those presented within Phase 2, between-network

investigations reflect an important step in establishing the validity of a measure (Marsh, 1997). Thus, the goal of Phase 3 was to examine the relationships between transformational teaching and two theoretically relevant outcomes, namely students' self-determined motivation, and affect.

Research within physical education shows consistently that self-determined motivation (cf. Deci & Ryan, 1991) is associated with positive physical activity outcomes, including teacher ratings of students' improved effort and persistence (Standage, Duda, & Ntoumanis, 2006), greater enrolment in optional physical education (Ntoumanis, 2005), and objective measures of improved physical activity behaviour (Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009). Recently, Sheldon, Turban, Brown, Barick, and Judge (2003) theorized *how* transformational leadership may be a contextual predictor of self-determined motivation. Drawing from conceptual bases and empirical evidence, Sheldon et al. theorized that transformational leadership results in the satisfaction of followers' needs for autonomy, competence, and relatedness, and 'emphasize[s] the search for meaning, excellence, and self-expression' (p. 372). Consistent with this theoretical perspective, Charbonneau et al. (2001) examined the relationships between coaches' leadership behaviours and athletes' subsequent cognitions, and showed that coaches' transformational behaviours predicted athletes' intrinsic motivation. Thus, consistent with theorizing by Sheldon et al., as well as empirical findings by Charbonneau et al., we hypothesized that transformational teaching would be positively related to self-determined motivation among students.

We focus on student affect as a separate possible correlate of transformational teaching. Transformational leadership behaviours in workplace settings are positively associated with affective responses (Judge & Piccolo, 2004). Research within health promotion contexts has also sought to examine the determinants of personal affect (Ryff & Singer, 1998), largely on the basis that: (a) the level of affect experienced in a given situation is a consistent predictor of the amount of time people choose to spend in that situation (Emmons & Diener, 1986); and (b) positive affect experienced across various life contexts predicts a number of pro-social outcomes, including success (Lyubomirsky, King, & Diener, 2005). In this study, we hypothesized that transformational teaching would be positively related to student positive affect within physical education classes.

### Phase 3: methods

#### Participants and procedures

Questionnaires were administered to 2761 students as part of the data collection described in Phase 2. Specifically, the procedures (including the institutional review board and agency approval, as well as procedures related to parental and student consent) and measurement of transformational teaching are as described in the previous section. In addition to the TTQ, students also completed measures of self-determined motivation and affect.

#### Measures

**Motivational regulation** Students' self-determined motivation was assessed using the 20-item Perceived Locus of Causality Scale (PLOC) developed by Goudas, Biddle, and Fox (1994). To ensure contextual relevance, items in the PLOC were prefaced by 'I take part in this PE class ...', and a 7-point Likert-type response, anchored by 1 (strongly disagree) and 7 (strongly agree), was used. The PLOC includes five 4-item subscales designed to assess *intrinsic motivation* (e.g. 'because PE is exciting'), *identified regulation* (e.g. 'because it is important for me to do well in PE'), *introjected regulation* (e.g. 'because I want other students to think I'm skilful'), *external regulation* (e.g. 'because that's the rule'), and *amotivation* (e.g. 'but I can't see what I'm getting out of PE'). Previous research involving adolescents within physical education has found support for the factorial validity and reliability of this scale (Standage, Duda, & Ntoumanis, 2006). In this study, each of the subscales of the PLOC were found to demonstrate acceptable internal consistencies (intrinsic motivation  $\alpha = .89$ ; identified regulation  $\alpha = .85$ ; introjected regulation  $\alpha = .73$ ; external regulation  $\alpha = .80$ ; amotivation  $\alpha = .83$ ). Consistent with procedures outlined by Vallerand, Fortier, and Guay (1997) an overall 'score' of self-determination was calculated through use of a self-determination index (SDI), with positive scores indicating greater self-determined motivation and negative scores indicating more controlled types of regulation (i.e. less self-determination). Specifically, the SDI is calculated by the following equation:  $SDI = 2 \times \text{intrinsic motivation} + \text{identified regulation} - \text{introjected regulation} - 2 \times \text{external regulation}$ .

**Affect** Positive affect was assessed using the five-item scale developed by Ebbeck and Weiss

(1998). Each item is an adjective (e.g. happy) that is preceded by the stem 'In this PE class I feel ...'. All items are assessed on a 5-point scale, anchored by 1 (not at all) and 5 (always). This measure has been used in previous physical education research in schools (e.g. Standage et al., 2006), and in the present study demonstrated acceptable internal consistency ( $\alpha > .82$ ).

**Phase 3: results**

Consistent with procedures outlined by Rasbash, Steele, Browne and Goldstein (2009), both the explanatory and dependent variables were grand-mean centred. We used MLwiN Version 2.10 (Rasbash, Charlton, Browne, Healy, & Cameron, 2009) to estimate two sets of models (self-determined motivation, positive affect), and allowed for varying class-level intercept and slope contributions. In the MLwiN software, estimates are obtained using the iterative generalized least squares (IGLS) procedure (Goldstein & Rasbash, 1992).

**Student self-determined motivation**

Table 2 presents the results of the multilevel models for self-determined motivation. The first model

(Model A) was an empty model without any predictors specified. This model enables identification of the unexplained variance in self-determined motivation (SDM) at both the student and class levels. The intra-class correlation (ICC) revealed that 5.62 per cent of the variance in SDM was explained at the class level, with 94.38 per cent explained at the individual level. In the second model (Model B), transformational teaching was added as an explanatory variable at both the student and class levels (random intercepts only model). When this model was further extended (Model C) to allow slopes to vary, a significant reduction in the  $\chi^2$  statistic ( $\Delta\chi^2 = 6.605$ ,  $p < .05$ ) indicated that fitting random slopes improved on the random intercept model. In this model, transformational teaching was found to be a significant predictor of SDM ( $\beta = .119$ ,  $p < .001$ ). Assessing the contribution of transformational teaching as a predictor of SDM at the individual level (Level 1) involves subtracting the unexplained student-level variance in SDM in Model C from the unexplained variance in SDM in Model A. Thus, 8.88 per cent (23.931–21.804/23.931) of the individual-level variance in SDM was explained by transformational teaching, which translates to 8.38 per cent (8.88 x 94.38/100) of the total variance in SDM being

Table 2. Random intercept and slopes models for self-determined motivation and positive affect

Parameter	Model A estimate (s.e.)	Model B estimate (s.e.)	Model C estimate (s.e.)
<i>Self-determined motivation</i>			
Fixed			
Intercept	-.010(.14)	.012 (.124)	-.028 (.123)
Transformational teaching	—	.116 (.007)**	.119(.008)**
Random			
Class-level variance	1.425(.319)**	.947(249)**	.874 (.249)**
Student-level variance	23.931(.660)**	22.102 (.609)**	21.804(.612)**
Intra-class correlation (ICC)	.0562	.0411	.0385
Log likelihood ( $\chi^2$ )	16720.144	16478.292	16471.687
$\Delta\chi^2$	—	241.852**	6.60*
<i>Positive affect</i>			
Fixed			
Intercept	-.01(.14)	.004(.019)	-.005(.019)
Transformational Teaching	—	.025(.001)**	.026(.001)**
Random			
Class-level variance	.038(.008)**	.023(.006)**	.021(.006)**
Student-level variance	.576(.016)**	.484(.013)**	.478(.013)**
Intra-class correlation (ICC)	.0619	.0454	.0423
Log likelihood ( $\chi^2$ )	6429.502	5926.824	5917.848
$\Delta\chi^2$	—	502.678**	8.976*

\* $p < .05$ ; \*\* $p < .001$

explained by transformational teaching at the individual level. At the class level, 38.62 per cent (1.424–.874/1.424) of the class-level variance in SDM was explained by transformational teaching. This equates to 2.17 per cent ( $38.62 \times 5.62/100$ ) of the total variance in SDM being accounted for by transformational teaching at the class level. In sum, the total residual (unexplained) variance in SDM was reduced by 10.55 per cent (Level 1 = 8.38% plus Level 2 = 2.17) with the introduction of transformational teaching as an explanatory variable.

### *Student positive affect*

The results of the multilevel models for positive affect (PA) are also presented in Table 2. In the empty model (Model A) 6.19 per cent of the unexplained variance in PA was accounted for at the class level and 93.81 per cent was accounted for at the student level. In the second model (Model B), transformational teaching was again added as an explanatory variable at both the student and class levels (random intercepts only model). When the model was further extended (Model C) to allow slopes to vary, a significant reduction in the  $\chi^2$  statistic ( $\Delta\chi^2 = 8.976, p < .05$ ) indicated that fitting random slopes improved on the random intercept only model. The results from Model C revealed that transformational teaching was a significant predictor of PA ( $\beta = .026, p < .001$ ). Using the same procedures described above for SDM, 17.36 per cent (.576–.476/.576) of the individual-level variance in PA was explained by transformational teaching. That is, 16.29 per cent ( $17.36 \times 93.81/100$ ) of the total variance in PA was explained by transformational teaching at the individual level. 44.74 per cent (.038–.021/.038) of the class-level variance in PA was explained by transformational teaching, which equates to 2.77 per cent ( $44.74 \times 6.19/100$ ) of the total variance in PA being accounted for by transformational teaching at the class level. In sum, the total residual (unexplained) variance in PA was reduced by 19.06 per cent (Level 1 = 16.29% plus Level 2 = 2.77%) with the introduction of transformational teaching as an explanatory variable.

## **Discussion**

The overall purpose of this research was to develop a conceptually sound and psychometrically robust measure of transformational teaching for use within physical education settings in schools. The three phases of research outlined in this paper drew from

established instrument development procedures, and together support the reliability and validity of the TTQ. To our knowledge, this is the first time that transformational leadership theory has been used to develop a measure with children or adolescents specified as the target population, and several points are worthy of note regarding the construct validity of the TTQ. First, in Phase 1 we sought to ensure that the TTQ demonstrated good *content validity*, through the input of adolescents, physical education teachers, and experts in transformational leadership theory in the development of the items. Second, we sought to ensure that the items in the TTQ were developmentally appropriate, and from a *consequential validity* perspective (Messick, 1989), the TTQ was shown to be appropriate for use with students possessing a Grade 4 (aged 9) reading age or above. Third, the results from Phase 2 revealed that the TTQ demonstrated good reliability as well as sound *factorial validity*, with a two-level second-order factor operationalization providing good evidence of model fit. Finally, the TTQ was found to demonstrate good *concurrent validity* in Phase 3, insofar as the transformational teaching construct predicted two theoretically meaningful constructs, namely student self-determined motivation and positive affect.

A central tenet of transformational leadership theory is that when people lead through the demonstration of transformational behaviours, they go beyond their own self interests and elevate the motives, emotions, and behaviours of those that they lead (Bass, 1998). In Phase 3, and consistent with theorizing by Sheldon et al. (2003), when teachers were reported by students to demonstrate transformational behaviours, students reported greater self-determined motivation towards physical education. Perhaps unsurprisingly the majority of unexplained (residual) variance in student motivation was explained at the student level and only 5.62 per cent of the variance was explained at the class level. It is particularly interesting, however, that students' perceptions of transformational teaching were able to explain significant variance in student motivation at both the individual and class levels. This suggests two potential mechanisms through which transformational teaching behaviours might influence student motivation. Specifically, on the one hand teachers may be able to foster more autonomous motives through their personal or direct (one-to-one) interactions with students. However, on the other hand, such transformational teaching behaviours might also be able to



foster class-level increments in student motivation, or what might also be characterized as a motivational climate of self-determination (Standage et al., 2003).

Interestingly, the findings for positive affect largely mirrored those for student self-determination and, in total, students' perceptions of their teachers' transformational behaviours were able to explain 19.06 per cent of the variance in positive affect among students. The majority of residual variance in student affect was similarly explained at the student level, but as with student self-determination, the results revealed that teachers' use of transformational behaviours was able to explain unique variance at both the student and class levels. Again, this suggests that teachers might be able to enhance students' enjoyment of their physical education experiences through: (a) their personal (dyadic) interactions with students; and (b) the general affective climate created within the class as a whole.

Despite the multilevel evidence of concurrent validity derived in Phase 3, it is important to emphasize that measurement validation is an on-going process and we recognize that both prospective (longitudinal) and experimental research will be required to ascertain the predictive validity of the transformational teaching construct. One avenue for future research would be to investigate whether transformational teaching behaviours prospectively influence important health-enhancing cognitions and objective measures of behaviour among adolescents. Given that a significant amount of variance in both student motivation (10.55%) and positive affect (19.06%) was explained by students' perceptions of their teachers' behaviours, this also points towards two potential mediational mechanisms (operating at both the individual and class levels) that could be targeted in future observational and experimental research. Specifically, a growing body of evidence has accumulated in the health promotion literature, which indicates that adolescent self-determination (Lonsdale et al., 2009) and positive affect (Williams et al., 2008) are important predictors of health-promoting behaviour (e.g. physical activity). It would seem logical in future research to assess whether any effects of transformational teaching behaviours on effortful and persistent behaviours in physical education contexts are mediated by self-determination and affect.

From an applied perspective, a growing body of evidence within the organizational psychology literature suggests that transformational behaviours can be developed through short-term interventions, including one-day workshops (Barling et al., 1996).

Given the cost effective and sustainable means of delivering such training opportunities with teachers (through continuing professional development and in-service training), and the ubiquity of one-day professional development courses for teachers, research designed to test the efficacy of such interventions not only represents an opportune means to test of the predictive utility of the transformational teaching construct, but also represents a theoretically sound means through which adolescent involvement in active and healthy lifestyles can be fostered.

Beyond encouraging the use of both prospective and experimental research investigation, further research is also encouraged that examines the extent to which transformational teaching behaviours displayed by school physical education teachers translate to influence physical activity and healthy lifestyle behaviours outside of school hours. A central tenet of transformational leadership theory is that transformational leaders provide others with a compelling vision of the future and the confidence to go beyond minimally accepted standards (Bass & Riggio, 2006). Recent qualitative research suggests that transformational teachers encourage students to pursue greater involvement in leisure time physical activity outside of school hours (Morton et al., 2010, Study 2). Extending the results of the current study, research might also focus on whether transformational teaching behaviours influence other aspects of children's performance (e.g. academic performance, attendance). In conclusion, the results of the current research support the reliability and validity of the TTQ as a measure of transformational teaching behaviour. What is now required is research that tests the predictive validity of transformational teaching, and across the full developmental spectrum within schools.

### Note

1. We also conducted an MCFA with all 16 items contributing towards a single latent factor. This model demonstrated comparable support for model fit to the second-order model:  $\chi^2(208) = 2994.077, p < .001$ , CFI = .920, TLI = .907, RMSEA = .069, SRMR<sub>within</sub> = .041. It is important to note that from measurement perspective data derived from either the second-order or unidimensional conceptualizations of the TTQ result in the same scores. Conceptually speaking, however, the second-order model recognizes that the first-order factors, while highly correlated, are conceptually distinct aspects of transformational teaching that together contribute to the overall construct of transformational teaching.

## References

- Alimo-Metcalfe, B., & Alban-Metcalfe, R. J. (2001). The development of a new Transformational Leadership Questionnaire. *Journal of Occupational & Organizational Psychology, 74*, 1–27.
- American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association.
- Barling, J., Christie, A., & Hopton, C. (in press). Leadership. In S. Zedeck (Ed.), *Handbook of Industrial and Organizational Psychology*. Washington, DC: APA Books.
- Barling, J., Weber, T., & Kelloway, E. K. (1996). Effects of transformational leadership training on attitudinal and financial outcomes: A field experiment. *Journal of Applied Psychology, 81*, 827–832.
- Bass, B. M. (1998). *Transformational leadership: Industry, military, and educational impact*. Mahwah, NJ: Erlbaum.
- Bass, B. M. & Avolio, B. J. (1995). *MLQ Multifactor Leadership Questionnaire*, 2nd edn. Redwood City, CA: Mind Garden.
- Bass, B. M., & Riggio, R. E. (2006). *Transformational leadership*, 2nd edn. Mahwah, NJ: Erlbaum.
- Bentler, P. M. (1990). Comparative fit indices in structural models. *Psychological Bulletin, 107*, 238–246.
- Bliese, P. D., & Hanges, P. J. (2004). Being both too liberal and too conservative: The perils of treating grouped data as though it is independent. *Organizational Research Methods, 7*, 400–417.
- Bycio, P., Hackett, R. D., & Allen, J. S. (1995). Further assessments of Bass's (1985) conceptualization of transactional and transformational leadership. *Journal of Applied Psychology, 80*, 468–478.
- Carless, S. A. (1998). Assessing the discriminant validity of transformational leadership behaviour as measured by the MLQ. *Journal of Occupational and Organizational Psychology, 71*, 353–358.
- Carless, S. A., Wearing, A. J., & Mann, L. (2000). A short measure of transformational leadership. *Journal of Business and Psychology, 14*, 389–405.
- Charbonneau, D., Barling, J., & Kelloway, E. K. (2001). Transformational leadership and sports performance: The mediating role of intrinsic motivation. *Journal of Applied Social Psychology, 31*, 1521–1534.
- Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. *Psychological Assessment, 7*, 309–319.
- D'Allessandro, D. M., Kingsley, P., & Johnson-West, J. (2001). The readability of pediatric patient education materials on the World Wide Web. *Archives of Pediatrics and Adolescent Medicine, 155*, 807–812.
- Deci, E. L., & Ryan, R. M. (1991). A motivational approach to self: Integration in personality. In R. A. Dienstbier (Ed.), *Nebraska symposium on motivation: Perspectives on motivation* (Vol. 38, pp. 237–288). Lincoln: University of Nebraska.
- Ebbeck, V., & Weiss, M. R. (1998). Determinants of children's self-esteem: An examination of perceived competence and affect in sport. *Pediatric Exercise Science, 10*, 285–298.
- Emmons, R. A., & Diener, E. (1986). A goal-affect analysis of everyday situational choices. *Journal of Research in Personality, 20*, 309–326.
- Estabrooks, P. A., & Carron, A. V. (2000). The physical activity group environment questionnaire: An instrument for the assessment of cohesion in exercise classes. *Group Dynamics: Theory, Research, and Practice, 4*, 230–243.
- Flesch, R. F. (1948). A new readability yardstick. *Journal of Applied Psychology, 32*, 221–233.
- Goldstein, H., & Rasbash, J. (1992). Efficient computational procedures for the estimation of parameters in multilevel models based on iterative generalised least squares. *Computational Statistics and Data Analysis, 13*, 63–71.
- Goudas, M., Biddle, S., & Fox, K. (1994). Perceived locus of causality, goal orientations, and perceived competence in school physical education classes. *British Journal of Educational Psychology, 64*, 453–463.
- Grilli, L., & Rampichini, C. (2007). Multilevel factor models for ordinal variables. *Structural Equation Modeling, 14*, 1–25.
- Hills, A. P., King, N. A., & Armstrong, T. P. (2007). The contribution of physical activity and sedentary behaviours to the growth and development of children and adolescents: Implications for overweight and obesity. *Sports Medicine, 37*(6), 533–545.
- Hu, L., & Bentler, P. M. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural Equation Modeling: Concepts, issues, and applications*. Thousand Oaks, CA: Sage.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1–55.
- Judge, T. A., & Piccolo, R. F. (2004). Transformational and transactional leadership: A meta-analytic test of their relative validity. *Journal of Applied Psychology, 89*, 755–768.
- Kark, R., Shamir, B., & Chen, G. (2003). The two faces of transformational leadership: Empowerment and dependency. *Journal of Applied Psychology, 88*, 246–255.
- Koh, W. L., Steers, R. M., & Terborg, J. R., (1995). The effects of transformational leadership on teacher attitudes and student performance in Singapore. *Journal of Organizational Behavior, 16*, 319–333.
- Lonsdale, C., Sabiston, C. M., Raedeke, T. D., Ha, A. S. C., & Sum, R. K. W. (2009). Self-determined motivation and students' physical activity during structured physical education lessons and free choice periods. *Preventive Medicine, 48*, 69–73.

- Lyubomirsky, S., King, L. A., & Diener, E. (2005). The benefits of frequent positive affect: Does happiness lead to success? *Psychological Bulletin*, *131*, 803–855.
- Marsh, H. W. (1997). The measurement of physical self-concept: A construct validation approach. In K. R. Fox (Ed.), *The physical self: From motivation to well-being* (pp. 27–58). Champaign, IL: Human Kinetics.
- Menschik, D., Ahmed, S., Alexander, M., & Blum, R. (2008). Adolescent physical activities as predictors of young adult weight. *Archives of Pediatrics & Adolescent Medicine*, *162*(1), 29–33.
- Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement*, 3rd edn (pp. 13–103). New York: Macmillan.
- Morton, K. L., Keith, S. E., & Beauchamp, M. R. (2010). Transformational teaching and physical activity: A new paradigm for adolescent health promotion? *Journal of Health Psychology*, *15*, 248–257.
- Muthén, B. O. (1991). Multilevel factor analysis of class and student achievement components. *Journal of Educational Measurement*, *28*, 338–354.
- Muthén, B. O., & Satorra, A. (1995). Complex sample data in structural equation modeling. In P. Marsden (ed.), *Sociological Methodology*, 216–316.
- Muthén, L. K., & Muthén, B. O. (2006). *Mplus User's Guide*, 4th edn. Los Angeles, CA: Muthén & Muthén.
- Northouse, P. G. (2001). *Leadership theory and practice*, 2nd edn. Thousand Oaks, CA: Sage.
- Ntoumanis, N. (2005). A prospective study of participation in optional school physical education using a self-determination theory framework. *Journal of Educational Psychology*, *97*, 444–453.
- Podsakoff, P. M., MacKenzie, S. B., Moorman, R. H., & Fetter, R. (1990). Transformational leader behaviors and their effects on followers' trust in leader, satisfaction, and organizational citizenship behaviors. *Leadership Quarterly*, *1*, 107–142.
- Rasbash, J., Charlton, C., Browne, W. J., Healy, M., & Cameron, B. (2009). *MLwiN Version 2.10*. Centre for Multilevel Modelling, University of Bristol.
- Rasbash, J., Steele, F., Browne, W. J., & Goldstein, H. (2009). *A User's Guide to MLwiN Version 2.10*. Centre for Multilevel Modelling, University of Bristol.
- Ryff, C. D., & Singer, B. (1998). The contours of positive human health. *Psychological Inquiry*, *9*, 1–28.
- Shanklin, S., Brener, N. D., Kann, L., Griffin-Blake, S., Ussery-Hall, A., Easton, A. et al. (2008). *Youth risk behavior surveillance: selected steps communities, United States, 2007*. Atlanta, GA: Centers for Disease Control & Prevention. <http://www.cdc.gov/mmwr/PDF/ss/ss5712.pdf> (accessed 27 October 2009).
- Sheldon, K. M., Turban, D. B., Brown, K. G., Barick, M. R., & Judge, T. A. (2003). Applying self-determination theory to organizational research. *Research in Personnel and Human Resources Management*, *22*, 357–393.
- Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. London: Sage.
- Sparling, P. B., Owen, N., Lambert, E. V., & Haskell, W. L. (2000). Promoting physical activity: The new imperative for public health. *Health Education Research*, *15*, 367–76.
- Standage, M., Duda, J. L., & Ntoumanis, N. (2003). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of Educational Psychology*, *95*, 97–110.
- Standage, M., Duda, J. L., & Ntoumanis, N. (2006). Students' motivational processes and their relationship to teacher ratings in school physical education: A self-determination theory approach. *Research Quarterly for Exercise and Sport*, *77*, 100–110.
- Vallerand, R. J., Fortier, M. S., & Guay, F. (1997). Self-determination and persistence in a real-life setting: Toward a motivational model of high-school drop out. *Journal of Personality and Social Psychology*, *72*, 1161–1176.
- Williams, D. M., Dunsiger, S., Ciccolo, J. T., Lewis, B. A., Albrecht, A. E., & Marcus, B. A. (2008). Acute affective response to a moderate-intensity exercise stimulus predicts physical activity participation 6 and 12 months later. *Psychology of Sport & Exercise*, *9*(3), 231–245.
- Zacharatos, A., Barling, J., & Kelloway, E. K. (2000). Development and effects of transformational leadership in adolescents. *Leadership Quarterly*, *11*(5), 211–226.

### **Author biographies**

MARK R. BEAUCHAMP is a Michael Smith Foundation for Health Research Scholar (Population Health) and Assistant Professor in the School of Human Kinetics at The University of British Columbia.

JULIAN BARLING holds a Queen's Research Chair, and is a Professor of Organizational Behaviour and Psychology in the Queen's School of Business. He also serves as the Associate Dean (PhD and MSc Programs; and Research) at the Queen's School of Business.

ZHEN LI recently received her PhD from the Department of Educational and Counselling Psychology at The University of British Columbia,

and is now a statistician with the Ministry of Education of the Province of Newfoundland and Labrador.

KATIE L. MORTON is a Doctoral candidate in the School of Human Kinetics at The University of British Columbia.

SHARON E. KEITH is a Master's student in the School of Human Kinetics at The University of British Columbia, Vancouver, Canada.

BRUNO D. ZUMBO is Professor of Measurement, Evaluation, and Research Methodology in the Department of Educational and Counselling Psychology at The University of British Columbia.

---