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Validation of the Teacher Stress Inventory (TSI) in a multicultural context: The SABPA study

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The aim of this study was to validate the Teacher Stress Inventory (TSI) for use in a South African context. The process of scale validation also sheds significant light on this culturally diverse group of participants' levels of psychological well-being and physical health, and its association with the level of stress that teachers reported. Using a cross-sectional survey design, Caucasian (n = 209) and African (n = 200) educators' subsiding in the North-West Province of South Africa, completed the TSI, together with a number of self-report and physiological measures of stress and well-being. In contrast to the five factors of the TSI identified in US samples, statistical analysis yielded a two-factor model (i.e. *General circumstance-related stress and Learner-related stress*) with satisfactory reliability indices. Significant correlation with measures of psychological and physiological health also reflected positively on the criterion-related validity of the scale. The TSI proved to be a useful, brief self-report questionnaire for the assessment of teacher stress in this cohort of South African teachers.

Keywords: psychological well-being; reliability; South African context; stress; Teacher Stress Inventory (TSI); validity

Introduction

The teaching profession is known internationally to provide high levels of job satisfaction, but to also pose significant challenges (Beck & Garguilo, 1983; Billingsley, 2004; Chaplain, 2008; Mearns & Cain, 2003; Näring, Briët & Brouwers, 2006; Schwarzer & Hallum, 2008; Sharplin, O'Neill & Chapman, 2011; Skinner & Beers, 2016). Research on local fronts (Brown, Howcroft & Jacobs, 2009; Engelbrecht, Oswald, Swart & Eloff, 2003; Ngidi & Sibaya, 2002; Olivier & Venter, 2003; Vandeyar, 2005; Williams, 2003) proved the South African context to offer no exception. Engelbrecht et al. (2003) described the associated stress that teachers experienced as a complex process, involving interaction between the teacher and the environment.

Job demands that are perceived by teachers as a threat to their psychological or physical well-being, have long been known to lead to negative affective experiences, such as frustration and anxiety (Kyriacou, 1987; Kyriacou & Sutcliffe, 1978). These could ultimately cause burnout, emotional exhaustion and have been reported to contribute desistence rates of more than 30% (Skinner & Beers, 2016). Stressors often include unsatisfactory working conditions, workload, pupil behaviour and attitudes, lack of promotional prospects and poor colleague relationships (Travers & Cooper, 1996). Within the South African teaching context various challenges have been reported to add to the stress that educators need to overcome in order to maintain their psychological well-being (Ferreira, 2008; Lund & Flisher, 2006). These include: historical and socio-economic disparities (Møller, 2007); the challenges of coping with the human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS); the downsizing of the number of teachers in schools (Olivier & Venter, 2003); and the fact that, in many instances, South African teachers have to cope with multi-racial classrooms, teach in their second language, and work with individuals from other cultures, whose backgrounds they do not fully understand (Vandeyar, 2005).

Teachers in South Africa are under immense pressure to lead their students to better performance in international assessments, such as the Progress in International Reading Literacy Study (PIRLS) and the Trends in International Mathematics and Science Study (TIMSS). Van Staden and Brosker (2014) called the prePIRLS 2011 results a grim reminder of the poor performance of South African students in the global arena. Furthermore, as is the situation in the United States (US) and other countries, teachers in South Africa work in an environment where standardised testing and the pressures associated with it are at the order of the day. There is no doubt that these aspects add to teachers' lack of motivation and increased levels of stress. In a study conducted in North Carolina (US), Nassar-McMillan, Karvonen and Young (2006) asked for enhanced competencies to be acquired by teachers in multicultural contexts in order to confront the stress of a diverse classroom. It is evident that the South African multicultural context and the stress that teachers encounter as a result, are elements found to be globally challenging to teachers.

If not managed properly, stress can become a disabling problem that can affect teachers' job satisfaction and have a negative impact on teachers' overall effectiveness with learners (Borg, Riding & Falzon, 1991). Mental and physical illness is another common result of stress, which could further impair the working relationship between teachers and students, as well as the general quality of teaching (Blase, 1982; Kyriacou, 1987). Persistent psychosocial stress has also been associated with symptoms of physical illness. This may include increase in blood pressure, over-activity of the sympathetic nervous system (SNS), and excessive risk for cardiovascular disease (Malan, Hamer, Von Känel, Schlaich, Reimann, Frasure-Smith, Lambert, Vilser, Harvey, Steyn & Malan, 2016; Malan, Malan, Wissing & Seedat, 2008; Malan, Schutte, Malan, Wissing, Vorster, Steyn, Van Rooyen & Huisman, 2006), as well as the metabolic syndrome (Rosmond, 2005). It is therefore evident that the level of teacher stress is an important co-determinant of not only teachers' job performance, but their overall psychological well-being and physical health as well.

In an attempt to measure the level of occupational stress in teachers, Boyle, Borg, Falzon and Baglioni (1995) formulated the 20-item TSI. These items were derived from 51 sources of teacher stress identified and discussed by Kyriacou and Sutcliffe (1978), and were grouped into five factors representing the main sources of teacher stress, namely workload, student misbehaviour, poor colleague relations, professional recognition, and time/resource difficulties (Boyle et al., 1995).

In spite of the TSI's proven worth in Western, individualistic contexts, recent research has emphasised the direct impact of cultural and contextual factors on both the construction and experience of phenomena like psychological well-being (Temane & Wissing, 2008; Wissing, JAB, Wissing, Du Toit & Temane, 2006; Wissing, MP & Temane, 2008). The South African context, which can be characterised as being both collectivistic and individualistic (Malan et al., 2008; Wissing, MP & Temane, 2008), adds various unique challenges to the maintenance of psychological well-being and the understanding of factors that influence it. It can therefore not be assumed that the TSI, as initially developed by Boyle et al. (1995), would be a valid measure of stress in a South African teaching context. This paper aims at investigating the psychometric properties of the TSI as a measure of teacher stress in a multicultural sample of South African educators.

Method

Design

This study forms part of the Sympathetic Activity and Ambulatory Blood Pressure in Africans (SABPA) project. Quantitative data was collected through a cross-sectional design with a purposively selected study population.

Participants

The research sample consisted of 409 participants, subdivided into Caucasian (n = 209; 108 females) and African (n = 200; 99 females) subgroups of urbanised educators residing in the North-West Province. Exclusion criteria consisted of the following: pregnancy, lactating, usage of alpha- and beta-blockers or psychotropic substances, not having been vaccinated in the previous three months and temperatures above 37° Celsius (Malan, Hamer, Frasure-Smith, Steyn & Malan, 2015; Mashele, Van Rooyen, Malan & Potgieter, 2010).

Procedure

In order to avoid the possible effects of seasonal change on the physiological measures, data-collection was completed within a period of 50 days for the two groups, respectively. During this period, data was gathered from a maximum of four participants per day. On the first day of data gathering each participant was fitted, at the schools where they were employed, with a Cardiotens® apparatus (Meditech CE0120, Budapest, Hungary), which measures 24-hour ambulatory blood pressure. They were transported to the Metabolic Unit Research Facility of the institution, where the research was conducted, where they were welcomed and familiarised with the experimental setup, before completing a battery of psychosocial tests. One part of the battery was completed before dinner and the last part after dinner in order to avoid the effects of participant fatigue. Psychological data was gathered by fieldworkers with post-graduate training in psychology, working under supervision of registered psychologists.

Completion of the test battery took approximately 90 minutes. Participants fasted overnight for the collection of physiological data the following day, after which they received breakfast, and were transported back to their schools. Feedback on psychological data was given at a later date in the form of an information session, followed by a workshop that focused on stress management.

Measures

The following measuring instruments were used for the purposes of this study.

The Teacher Stress Inventory (TSI; Boyle et al., 1995)

The TSI is a 20-item self-report scale that uses a five-point Likert-type response format to measure the occupational stress in teachers (Boyle et al., 1995). These authors derived the TSI from the 51 sources of stress identified by Kyriacou and Sutcliffe (1978). Participants were presented with a

list of potential work-related stressors, and then used response options ranging from *No stress* to *Extreme stress* to indicate its severity. Factor analysis conducted by Boyle et al. (1995) produced five subscales that included workload, student misbehaviour, poor colleague relations, professional recognition, and time/resource difficulties.

The General Health Questionnaire (GHQ; Goldberg & Hillier, 1979)

The GHQ is a 28-item self-report scale aimed at detecting common symptoms, which can be used to differentiate individuals with psychopathology as a general class from those who are considered to be healthy (Goldberg & Hillier, 1979). In addition to the total score, subscale scores are obtained for somatic symptoms (SS), anxiety and insomnia (AS), social dysfunction (SD), and severe depression (DS). Goldberg and Hillier (1979) reported internal consistency coefficients for subscales ranging from 0.69 to 0.90. Good reliability and validity indices reported for the GHQ across various cultures (Goldberg, Gater, Sartorius, Ustun, Piccinelli, Gureje & Rutter, 1997) were reproduced in South African (Wissing, MP & Van Eeden, 2002), and specifically Setswana-speaking participant groups in the North-West Province of South Africa. The GHQ was correlated with the TSI to shed light on its criterion-related validity.

The Mental Health Continuum – Short Form (MHC-SF; Keyes, 2006)

The MHC-SF is a 14-item self-report questionnaire that measures positive mental health (Keyes, 2006) and, more specifically, the degree of emotional (EWB), social (SWB) and psychological well-being (PWB) experienced by participants, using a seven-point Likert-type response format. Factor analysis revealed that the MHC-SF replicated the three-factor structure found in the US samples. Furthermore, the internal reliability of the overall MHC-SF scale in a random sample of Setswana-speaking adults in the North-West Province of South Africa was 0.74 (Keyes, Wissing, Potgieter, Temane, Kruger & Van Rooy, 2008). The MHC-SF was also included to shed light on the TSI's criterion-related validity.

Physiological measures of stress

A number of anthropometric measurements were taken for the calculation of body mass index (body mass/height^2). Standardised measurements were used, and taken in triplicate to the nearest 0.1 cm by registered biokineticists. Height was measured by making use of a stadiometer and body mass was measured to the nearest 0.1 kg using a Krups scale with the participants wearing minimal clothing. Inter- and intra-observer variation was less than 10%. The Actical® (Mini Mitter, Bend OR, Montréal, Québec), an omnidirectional accelerometer monitor, was used to assess physical activity over 24 hours by taking into account the metabolic rate (kcal/h). Hereafter, educators were in a semi-recumbent positon for 30 minutes before blood sampling. Fasting blood samples were obtained from the ante-brachial vein branches with a winged infusion set by a registered nurse using standardised protocol and storage at -80°C until batch assay. Gamma glutamyl transferase (γ-GT) levels were used as proxy biomarkers for alcohol habits. Sequential multiple analysers assessed NaF glucose and serum γ-GT (Konelab 20i; Thermo Scientific, Vantaa, Finland; Unicel DXC 800- Beckman and Coulter®, Germany and the Integra 400, Roche, Switzerland).

The Cardiotens apparatus (Meditech CE0120®) was used to obtain 24-hour ambulatory blood pressure readings. Every working day of the week, the Cardiotens® were fitted to the non-dominant arms of four teachers, using an appropriately rectangular cuff size. Blood pressure measures were obtained every 30 minutes during the day (08:00–22:00) and hourly during the night (22:00–06:00). Participants continued their usual daily activities and were asked to record occurrences of stress, physical activity, headache, syncope, dizziness, nausea, palpitations, hot flushes and visual disturbances on their ambulatory diary card. The mean successful inflation rate was lower in the African participants (72.7%) compared to the Caucasian participants (84.5%).

These physiological stress-related measures (i.e., blood pressure and blood glucose levels), were also correlated with the TSI-results to determine criterion-related validity.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of the North-West University, Potchefstroom Campus (NWU-00036-07-S6) to conduct this research. The study conformed to the declaration of Helsinki for research on human participants (revised 2004). Participants were given participant numbers in order to conceal their identities and to ensure confidentiality. After being informed of all aspects of the research and given the opportunity to ask questions, consent forms for collection of physiological and psychological data was signed by all participants. All physiological data was gathered by adequately trained practitioners. Psychological data was gathered by fieldworkers with post-graduate training in psychology, working under supervision of registered psychologists. Participants received feedback on the results of the psychological survey in the form of an information session, followed by a workshop focused on stress management.

Data Analysis

The Statistical Package for the Social Science (SPSS Inc., 2009) computer software package was used to conduct both descriptive and inferential statistics. According to Clark and Watson (1995) and Paunonen and Ashton (1998), there are specific psychometric properties that need to be considered when determining the cross-cultural applicability of scales. These properties include scale means, variances, reliability indices, criterion-related validity and factor structure (Clark & Watson, 1995; Paunonen & Ashton, 1998). To this end, means, standard deviations and reliability coefficients, such as Cronbach's coefficient alphas, mean inter-item and item-total correlations, were computed as indicators of internal consistency and homogeneity of the TSI. Secondly, the factor structure of the TSI was examined by conducting both confirmatory and exploratory factor analyses of the data and relevant indices of fit, such as Chi-square statistic, Root Mean Square Error of Approximation (RMSEA) and Comparative Fit Index (CFI). Thirdly, criterion-related validity was determined by correlating the TSI with the General Health Questionnaire (GHQ), the Mental Health Continuum – Short Form (MHC-SF) and physiological determinants of stress.

Results

Descriptive Statistics

Descriptive statistics and the *t*-test *p*-values for the difference between the African and Caucasian groups in terms of their levels of stress, as well as mental and general health, are reported in Table 1. For the purpose of this study, differences with *d*-values of approximately 0.5 and larger will be considered as practically significant, as suggested by Steyn and Ellis (2009).

Table 1 Descriptive statistics of the study population and the *t*-test *p*-values for the differences between ethnic groups

	African (n = 200)		Caucasian (n = 209)		*t*-test	
	M	*SD*	*M*	*SD*	Effect size	*p*-values
TSI_Total	77.66	12.86	66.00	15.56	0.75	< 0.001
GHQ_AS	2.63	2.43	1.32	1.93	0.54	< 0.001
GHQ_SD	2.01	2.12	0.82	1.46	0.56	< 0.001
GHQ_DS	1.11	1.86	0.22	0.93	0.48	< 0.001
GHQ_T	8.26	6.50	3.75	4.69	0.69	< 0.001
MHC_EWB	10.14	3.01	11.63	2.28	0.50	< 0.001
MHC_SWB	14.91	5.32	13.80	4.74	0.21	0.026
MHC_PWB	23.24	4.99	22.44	4.42	0.16	0.086
MHC_T	48.30	10.94	47.86	9.88	0.04	0.674
AGE (years)	44.28	8.01	44.92	10.86	0.06	0.494
BMI (kg/m^2)	30.13	7.01	27.60	5.94	0.36	< 0.001
METS (kcal/d)	2680.87	793.69	3017.56	813.83	0.41	< 0.001
GGT (µ/ℓ)	66.33	82.39	26.87	34.43	0.48	< 0.001
GLUCOSE (mmol/ℓ)	5.64	2.06	5.67	0.81	0.02	0.821
DBP (mmHg)	83.46	10.70	76.50	8.01	0.65	< 0.001
SBP (mmHg)	133.19	16.18	124.00	12.06	0.57	< 0.001
*24h Hypertension (%)	66.00		39.23			

Note. *M* = Mean; *SD* = Standard Deviation; GHQ_SS = General Health Questionnaire Somatic Symptoms; GHQ_AS = GHQ Anxiety and Insomnia; GHQ_SD = GHQ Social Dysfunction; GHQ_DS = GHQ Severe Depression; GHQ_T = GHQ Total; MHC_EWB = Mental Health Continuum Emotional well-being; MHC_SWB = MHC Social well-being; MHC_PWB = MHC Psychological well-being; MHC_T = MHC Total; TSI_Total = Teacher Stress Inventory Total; BMI = Body Mass Index; METS = "Metabolic equivalent for task"/Physical activity; GGT = Gamma-glutamyl transferase; DBP = Diastolic Blood Pressure and SBP = Systolic Blood Pressure.

*European Society of cardiology Guidelines (Piepoli, Hoes, Agewall, Albus, Brotons, Catapano, Cooney, Corrà, Cosyns, Deaton, Graham, Hall, Hobbs, Løchen, Löllgen, Marques-Vidal, Perk, Prescott, Redon, Richter, Sattar, Smulders, Tiberi, Van der Worp, Van Dis, Verschuren, Binno & ESC Scientific Document Group, 2016).

In comparison to their Caucasian counterparts, the African group reported significantly higher levels of occupational stress as measured with the TSI. This was in line with the higher scores that the African group obtained on measures of symptomatology, as reflected by the GHQ total and subscale scores, as well as a lower level of emotional well-being as measured with the MHC-SF. Differences between the African and Caucasian groups that reached practical significance were also evident on indices of physiological health. The African group showed a higher mean body mass index, and higher levels of mean systolic, diastolic and hypertension prevalence values when compared to the Caucasian group. The levels of Gamma-glutamyl transferase (GGT), which is a liver enzyme indicating hepatic dysfunction, and that could be associated with alcohol use (Hastedt, Büchner, Rothe, Gapert, Herre, Krumbiegel, Tsokos, Kienast, Heinz & Hartwig, 2013), were also elevated in the African group. Conversely, the Caucasian group showed higher levels of physical activity than the African group. In combination, these results suggest the African group to be

significantly worse off in terms of their general physical health and psychological well-being. The differences in self-reported stress were also reflected on item level, when the descriptive statistics of the TSI (Table 2) are considered.

Table 2 Descriptive statistics for the TSI

	African (n = 200)				Caucasian (n = 209)			
Item	*M*	*SD*	Skew	Kur	*M*	*SD*	Skew	Kur
TSI1	3.68	1.11	-0.70	0.00	3.21	1.10	-0.23	-0.49
TSI2	3.71	1.12	-0.69	-0.27	3.55	1.15	-0.42	-0.67
TSI3	3.88	1.07	-0.78	-0.05	3.27	1.14	-0.27	-0.69
TSI4	3.88	1.12	-0.87	0.08	3.55	0.96	-0.41	-0.14
TSI5	3.90	1.11	-0.77	-0.23	3.63	1.15	-0.53	-0.61
TSI6	3.22	1.26	-0.21	-0.95	2.86	1.19	0.06	-0.81
TSI7	4.37	0.81	-1.35	1.83	3.71	1.08	-0.67	-0.16
TSI8	4.52	0.82	-1.78	2.68	3.75	1.20	-0.57	-0.72
TSI9	4.27	0.91	-1.39	1.80	3.62	1.04	-0.52	-0.16
TSI10	4.37	0.91	-1.51	1.79	3.49	1.26	-0.56	-0.66
TSI11	3.56	1.20	-0.53	-0.60	3.20	1.17	-0.24	-0.79
TSI12	3.58	1.17	-0.44	-0.58	3.44	1.13	-0.31	-0.57
TSI13	3.18	1.27	-0.21	-0.95	2.92	1.14	-0.08	-0.76
TSI14	3.84	1.07	-0.56	-0.55	3.12	1.08	-0.09	-0.61
TSI15	4.12	1.00	-1.18	1.20	3.34	1.16	-0.22	-0.81
TSI16	4.42	0.83	-1.46	1.85	2.84	1.20	0.18	-0.88
TSI17	3.51	1.12	-0.27	-0.71	2.90	1.18	0.07	-0.79
TSI18	3.97	1.03	-0.60	-0.72	3.49	1.14	-0.44	-0.67
TSI19	3.84	1.16	-0.78	-0.29	3.05	1.14	-0.01	-0.82
TSI20	3.85	1.26	-0.82	-0.44	3.08	1.29	-0.13	-1.04

Note. TSI = Teacher Stress Inventory; *M* = Mean; *SD* = Standard deviation; Skew = Skewness; Kur = Kurtosis.

As indicated in Table 2, the mean scores for the African group were higher than for the Caucasian group on all items, with the highest item means for the African group yielding values of above 4.00 (Items 7, 8, 9, 10, 15 and 16). The largest deviation from normality, as indicated by kurtosis and skewness values was found in the African group, with all items in this group negatively skewed. Within the Caucasian group, kurtosis yielded values that ranged between -1.04 and -0.14, and most items, excluding items 6, 16 and 17, were also negatively skewed, although showing smaller deviations from normality.

Exploratory Factor Analysis

Exploratory factor analysis and item analysis were conducted separately for the different ethnic groups. In both cases, items 1, 3 and 6 did not load significantly on any of the extracted factors. The possible reasons and implication hereof will receive further attention during the discussion of the results. Items 1, 3 and 6 were, however, omitted from further factor analysis.

A principal component analysis with oblimin rotation and Kaiser Normalisation was subsequently conducted on the total group. This analysis revealed two factors, as extracted according to Kaiser's criteria, which explained 54.6% of the total variance. The results of the factor analysis are provided in Table 3. The same factor structure was confirmed when using both the principal axis and maximum likelihood methods of factor extraction.

Items 12 and 18, which loaded on both factors, were classified according to best interpretability. The two extracted factors lent themselves to theoretical interpretation, and can be described as follows: (1) *General circumstance-related stress* consisting of 10 items ($\alpha = 0.89$), and (2) *Learner-related stress* consisting of seven items ($\alpha = 0.87$). Elaboration on the content of this two-factor model will follow in the discussion.

In addition to the theoretical interpretability of these factors, they could also be considered statistically robust. A sufficient amount of variance was explained by these factors, and with communalities varying between 0.41 and 0.65, the results of the factor analysis could be considered meaningful, and support the construct validity of the TSI. A correlation of 0.53 was found to exist between the two factors which, according to the guideline values proposed by Steyn and Ellis (2009), is indicative of a strong relationship, especially within the human sciences.

Reliability

The reliability indices and mean inter-item correlations for the total group, as well as for each ethnic group, are provided in Table 4.

Table 3 Pattern Matrix of Exploratory Factor Analysis using the Principal Components Method of Factor Extraction, with Oblimin Rotation

	Factor Loading	
Variable	Factor 1	Factor 2
17. Attitudes and behaviour of other teachers.	0.819	
19. Pressure from principal and education officials.	0.804	
16. Shortage of equipment and poor facilities.	0.801	
14. Ill-defined syllabuses (e.g., not detailed enough).	0.783	
15. Lack of time to spend with individual learners.	0.701	
20. Having extra learners because of absent teachers.	0.624	
13. Pressure from parents.	0.615	
8. Inadequate salary.	0.541	
9. Too much work to do.	0.540	
18. Learners' impolite behaviour or cheek.	0.435	0.349
5. Noisy learners.		0.915
2. Difficult class.		0.835
11. Maintaining class discipline.		0.676
4. Responsibility for learners (e.g. exam success).		0.643
7. Learners' poor attitudes to work.		0.572
10. Having a large class (i.e., too many learners).		0.542
12. Administrative work (e.g., filling in forms).	0.352	0.383

Note. Values less than 0.35 are not displayed.

Table 4 Reliability indices and Mean inter-item correlations for the study population and subgroups

	CA			MIIC		
	Total group	Caucasian	African	Total group	Caucasian	African
Factor 1: General	0.89	0.89	0.84	0.45	0.45	0.35
Factor 2: Learner	0.87	0.89	0.82	0.48	0.52	0.39

Note. Factor 1: General circumstance related to stress; Factor 2: Learner-related stress; CA = Cronbach's Alpha and MIIC = Mean inter-item correlation.

According to Nunnally and Bernstein (1994), Cronbach's coefficient alpha estimates the reliability of a scale by determining the internal consistency, or the average correlation between interrelated items within that test. Although a modest reliability of 0.7 could be regarded as sufficient during the early stages of scale validation, a Cronbach's coefficient alpha of above 0.7 is desired (Nunnally & Bernstein, 1994). As indicated in Table 4, the Cronbach's alpha indices for both factors in the total participant group and the two subgroups were well above 0.7, indicating the reliability of the instrument.

The mean inter-item correlation also serves as an indicator of internal consistency (Clark & Watson, 1995). Mean inter-item correlations for the study population and subgroups yielded values ranging from 0.35 to 0.52. With all items yielding values that fall within the desired range of 0.15 to 0.55, as indicated by Clark and Watson (1995), it can be concluded that the internal consistency of the TSI in this context is satisfactory.

Table 5 Item analysis of the TSI items

		African		Caucasian	
	Item	Item Total	CA ID	Item Total	CA ID
Factor 1: General	TSI12	0.44	0.84	0.66	0.88
	TSI13	0.68	0.81	0.60	0.88
	TSI14	0.68	0.81	0.67	0.88
	TSI15	0.64	0.82	0.70	0.87
	TSI16	0.53	0.83	0.63	0.88
	TSI17	0.41	0.84	0.57	0.88
	TSI20	0.57	0.82	0.57	0.88
	TSI19	0.62	0.82	0.70	0.87
	TSI8	0.40	0.84	0.56	0.88
	TSI9	0.44	0.84	0.65	0.88
Factor 2: Learner	TSI2	0.57	0.79	0.70	0.87
	TSI4	0.49	0.81	0.57	0.88
	TSI7	0.50	0.80	0.65	0.87
	TSI10	0.55	0.80	0.68	0.87
	TSI11	0.61	0.79	0.80	0.85
	TSI18	0.51	0.80	0.59	0.88
	TSI5	0.70	0.77	0.77	0.86

Note. Factor 1: General circumstances related to stress; Factor 2: Learner-related stress; Item Total = Correlation between item and subscale total; CA ID = Cronbach's Alpha if item deleted.

As indicated in Table 5, the correlation of all items contributing to a specific factor with its total score was larger than 0.3, indicating that each item contributes significantly to its relevant subscale. The results also show that all items contribute meaningfully to their respective factors, as Cronbach's coefficient alpha decreased when individual items were removed.

Confirmatory Factor Analysis

Results of the confirmatory factor analysis performed for the two-factor model are reported in Table 6.

Table 6 Goodness of fit indices for different structural equation models

Model	CMIN/*df*	CFI	RMSEA [95% CI]
Two-factor model	4.463	0.874	0.092 [0.084; 0.100]
One-factor model	5.436	0.811	0.104 [0.098; 0.111]
Between African and Caucasian groups model	2.808	0.857	0.067 [0.061; 0.073]

Note. CMIN = Minimum Sample Discrepancy, *df* = Degrees of Freedom, CFI = Comparative Fit Index, RMSEA = Root Mean Square Error Approximation, CI = Confidence Interval.

Because the Chi-square test is viewed by some as an overly strict indicator of model fit, given its power to detect even trivial deviations from the proposed model (Hancock & Mueller, 2010), Mueller (1996) has suggested that the Chi-square test statistic be divided by degrees of freedom. The two-factor model yielded a Minimum Sample Discrepancy divided by Degrees of Freedom (CMIN/*df*) value of 4.463. Interpretation of the size of this value depends to a large extent on the viewpoint of the investigator, but in practice some interpret ratios as high as 3, 4 or even 5 as still representing a good model fit (Mueller, 1996). It is, however, considered good practice to report multiple fit indices, typically from three broad classes (Hancock & Mueller, 2010). Mueller (1996) described values of above 0.9 as indicative of a good overall fit for a Comparative Fit Index. A relatively acceptable Comparative Fit Index (CFI) of 0.87 was found for the two-factor model, while a Root Mean Square Error Approximation (RMSEA) value of 0.09 with a 90% confidence interval of [0.08; 0.10] was obtained. Blunch (2008) stated that models with RMSEA values of 0.10 and larger should not be accepted.

As the confirmatory factor analysis estimated the correlation between the two factors as 0.79, indicating that one factor may have been sufficient, a confirmatory factor analysis was therefore done for a one-factor model. Results indicated a less acceptable fit than the original two-factor model with respect to all the fit indices (Table 6). Thus, despite the high correlation between the two factors, the reported indices of fit indicated the two-factor model to be the model of choice. Confirmatory factor analysis was also performed to test whether the two-factor model was the same in structure for the African and Caucasian groups, as well as to test if the regression weights were the same across these groups. The CMIN/*df* of 2.8 indicated that the difference between the Structural Equation Modelling (SEM) fit of the Caucasian and African groups for the two-factor model was not significant. This was also supported by a CFI of 0.857 and a RMSEA of 0.067 [0.061; 0.073]. It could thus be accepted that the factor structure (i.e., the two-factor model) for the African and Caucasian group did not differ in practice.

Criterion-Related Validity

Criterion-related validity was determined with the calculation of correlations between the TSI total and subscale scores and indicators of psychological health, namely the GHQ, as well as the MHC-SF and their respective subscales. The Spearman Rank Order correlation was used as a measure of this relationship, to account for deviations from normality in raw data. The results are reported in Table 7.

The TSI total score and that of its sub-constructs showed statistically significant correlations of 0.2 or larger with the GHQ and all its subscales within the total group, thus indicating a medium practical significance. Although not significant in all cases, this general trend of positive association between the TSI total and subscale scores, and indicators of symptomatology as measured with GHQ also applied in the two ethnic groups. In line with this, negative correlations of varying significance were found between TSI total and subscale scores and the MHC-SF and most of its sub-constructs. Interestingly, this was not the case in the African group, where correlations between the TSI total and subscale scores and the MHC-SF proved not to be of any significance.

Table 8 depicts the criterion-related validity of the TSI and its sub-constructs, as indicated by its correlations with physiological indicators of stress. The Spearman Rank Order correlation was again used as a measure of the relationship to account for deviations in normality in raw data.

Table 7 Criterion-related validity: Spearman correlation coefficients of the TSI components with other measure of psychological health

	GHQ_ SS	GHQ_ AS	GHQ_ SD	GHQ_ DS	GHQ_ T	MHC_ EWB	MHC_ SWB	MHC_ PWB	MHC_ T
Total Group (n = 409)									
TSI_Total	0.253**	0.313**	0.268**	0.237**	0.340**	-0.229**	-0.089	-0.055	0.313**
TSI_General	0.234**	0.289**	0.233**	0.245**	0.316**	-0.215**	-0.059	-0.026	-0.971*
TSI_Learner	0.240**	0.288**	0.258**	0.204**	0.319**	-0.185**	-0.101*	-0.080	-0.135**
African Group (n = 200)									
TSI_Total	0.112	0.231**	0.181*	0.118	0.207**	-0.019	-0.003	-0.019	-0.012
TSI_General	0.087	0.203**	0.151*	0.11	0.178*	0.016	0.039	0.013	0.027
TSI_Learner	0.12	0.221**	0.174*	0.136	0.208**	-0.012	-0.06	-0.036	-0.041
Caucasian Group (n = 209)									
TSI_Total	0.259**	0.262**	0.160*	0.147*	0.266**	-0.277**	-0.256**	-0.216**	-0.285**
TSI_General	0.213**	0.203**	0.074	0.135	0.192**	-0.235**	-0.226**	-0.149*	-0.236**
TSI_Learner	0.272**	0.279**	0.203**	0.152*	0.307**	-0.226**	-0.187**	-0.233**	-0.239**

Note. TSI_Total = Teacher Stress Inventory Total; TSI_General = TSI General Mean; TSI_Learner = TSI Learner Mean; GHQ_SS = General Health Questionnaire Somatic Symptoms; GHQ_AS = GHQ Anxiety and Insomnia; GHQ_SD = GHQ Social Dysfunction; GHQ_DS = GHQ Severe Depression; GHQ_T = GHQ Total; MHC_EWB = Mental Health Continuum Emotional well-being; MHC_SWB = MHC Social well-being; MHC_PWB = MHC Psychological well-being; MHC_T = MHC Total.
* = Correlation is significant at the 0.05 level (2-tailed). ** = Correlation is significant at the 0.01 level (2-tailed).

Table 8 Criterion-related validity: Spearman correlation coefficients of the TSI components with other measure of physiological health

	AGE	BMI	METS	GGT	Glucose	DBP	SBP
Total Group (n = 409)							
TSI_Total	0.03	0.18	-0.05	0.18	-0.17	0.13	0.14
TSI_General	0.02	0.21	-0.04	0.23	-0.14	0.16	0.16
TSI_Learner	0.05	0.13	-0.04	0.09	-0.15	0.09	0.10
African Group (n = 200)							
TSI_Total	0.14	0.19	0.11	-0.12	-0.14	-0.03	-0.02
TSI_General	0.14	0.22	0.13	-0.09	-0.09	-0.01	-0.01
TSI_Learner	0.11	0.15	0.07	-0.15	-0.15	-0.03	-0.01
Caucasian Group (n = 209)							
TSI_Total	-0.01	-0.02	-0.04	0.00	-0.06	0.03	0.05
TSI_General	-0.02	0.00	-0.01	0.03	-0.03	0.04	0.06
TSI_Learner	0.03	0.00	-0.02	0.00	-0.06	0.05	0.07

Note. TSI_Total = Teacher Stress Inventory Total Score; TSI_General = Teacher Stress Inventory General Mean; TSI_Learner = Teacher Stress Inventory Learner Mean; AGE = Advanced Glycation End products (AGE); BMI = Body Mass Index; METS = "Metabolic equivalent for task"/Physical activity; GGT = Gamma-glutamyl transpeptidase; DBP = Diastolic Ambulatory Blood Pressure and SBP = Systolic Ambulatory Blood Pressure.

In the total study group a number of small to medium correlations were evident between the TSI total and subscale scores with body mass index (BMI), the liver enzyme, gamma-glutamyl transferase (GGT), and blood glucose levels. No significant correlations were, however, visible within either the African or the Caucasian subgroups. The possible reasons and implication hereof will receive further attention during the discussion of the results.

Discussion

The aim of this study was to validate the TSI for use in a South African context by assessing psychometric properties, such as scale means, variances, reliability, criterion-related validity and factor structure (Clark & Watson, 1995; Paunonen & Ashton, 1998). In the process of scale validation, significant light was also shed on the levels of psychological well-being and physical health of this culturally diverse group of participants, and the association thereof with the level of stress that teachers reported.

Although the overall homogeneity of the TSI proved satisfactory, results at item-level revealed some elements that warrant further discussion. The fact that most items within both the African and Caucasian groups were negatively skewed, indicated that most individuals in these groups reported experiencing high levels of occupational stress. In comparison to the Caucasian group, item means for the African group was substantially higher, with many items showing an average above 4 ("much stress"). This may well be a true reflection of the African group's higher levels of occupational stress, as it is in line with findings from other Southern African studies conducted in the Eastern Cape (Olivier & Venter, 2003) and Transkei (Mwamwenda, Monyooe & Glencross, 1997). These higher scores could be explained by observations made by Antonovsky (1979) and Hobfoll and Lilly (1993) that common resistance resources are lower in historically black communities, and individuals from these communities are therefore prone to higher levels of stress. Another possibility is, however, that the African group's higher self-reported stress levels are an artefact of a more collectivistic cultural orientation, making them more prone to acquiesce when completing self-report measures because of a propensity to respond in a manner that they deem socially acceptable.

The prominent differences between the African and Caucasian groups in terms of their self-reported levels of stress and psychological well-being are of great significance when evaluating the cross-cultural validity of the TSI. Peng, Nisbett and Wong (1997) noted that people from different cultural groups used different points of reference in self-reports. For example, it may be that the Caucasian group evaluated themselves in comparison with other Caucasians, whereas the African group evaluated themselves with reference to other Africans. Heine, Lehman, Peng and Greenholtz (2002) termed this the "reference-group effect." Both these groups may likely have conflated their subjective experience with what they assume is true of their culture, thus projecting their subjective ways of thinking onto the rest of the teacher population (Heine et al., 2002). The fact that an important goal of cross-cultural validity is to explicitly assess the norms in different cultures (Clark & Watson, 1995; Paunonen & Ashton, 1998), undeniably emphasises the importance of the reference-group effect. It can thus not be concluded with confidence that the cultural similarities – or differences in this case – are valid, or merely due to artefacts of the TSI as a self-report questionnaire. The possible disadvantages of using subjective Likert-type instruments, such as the TSI in collectivistic cultural contexts, is a topic that warrants further research attention. However, the physiological profile of African educators' supports their poorer psychological profile, as a mean hypertensive status of 66% was demonstrated compared to the mean 39.2% status of Caucasian educators.

Exploratory factor analysis, which was conducted on the total group, yielded two robust factors, the content of which can be described as follows: Factor 1 (*General circumstance-related stress*) contains items that constitute stress related to a variety of general circumstances within the teaching environment. Item 17 ("*Attitudes and behaviour of other teachers*") and Item 16 ("*Shortage of equipment and poor facilities*") serve as good examples of the items included in this factor. Factor 2 (*Learner-related stress*) contains items that constitute stress more specifically related to learners, and especially the experience and management of poor learner attitude and misbehaviour. Item 5 ("*Noisy learners*") and Item 11 ("*Maintaining class discipline*") serve as good examples of the items included in this factor.

When comparing these two factor groupings with the five-factor model originally proposed by Boyle et al. (1995), some overlapping elements are evident. There is, for example, an apparent similarity between Factor 2 (*Learner-related stress*) in the current study, and what Boyle et al. (1995) described as Factor 3 (*Student misbehaviour*). However, while Boyle et al. (1995) identified *workload*, *poor colleague relations*, *professional recognition*, and *time/recourse difficulties* as four different factors, these aspects were grouped together in the current study in a single factor (*General circumstance-related stress*), which collectively represented aspects of occupational stress related to the working environment.

Exploratory factor analysis and item analysis conducted separately on the different ethnic groups showed that Items 1, 3 and 6 did not load significantly on either of the extracted factors. When the content of these items was reviewed, it became apparent that these items did not fit with either of the indicated factors. Items 1, 3 and 6 were subsequently omitted from further factor analysis. Careful reformulation or possible replacement of these factors is advised for the further refinement of the TSI. Overall though, the results of the factor analysis proved to be meaningful, as the two extracted factors are theoretically interpretable, explain a sufficient amount of variance and yielded satisfactory communalities. Reliability indices for both factors in the total participant group and the two subgroups were satisfactory, and together with the mean inter-item correlations indicated adequate internal consistency of the TSI.

Criterion-related validity was determined by correlating the TSI total score and the two extracted factors with psychological and physiological measures that have a well-established association with stress. The TSI and its two extracted factors displayed sound criterion-related validity by correlating significantly, and in expected directions with measures of psychological well-being and symptoms of mental illness within the total group. However, in the African group, correlations between the TSI total score and that of its subconstructs and the MHC-SF proved not to be of any significance. This lack of association was also evident when the TSI was correlated with physiological measures of stress. The low and variable correlations that were found within the African group could possibly be explained by the restricted range of stress data found within this subgroup. From the descriptive statistics for the study population, it is evident that the African group as a whole experienced "much" to "extreme" stress, with mean values on the TSI that were also substantially higher than the levels of stress reported by the Caucasian group. This lack of spread within the stress data might have had a negative influence on the visibility of the correlations between the measured constructs, possibly contributing to the low and variable correlations that had been observed. This possible explanation is substantiated by the fact that limited but visible correlations with physiological data were observed in the total group, where the combined results of the Caucasian and African groups resulted in a larger spread within the data. It could thus be hypothesised that, within a more heterogeneous study population, which would possibly have shown a less restricted range in stress data, larger correlations between the TSI and physiological measures of stress might have been observed.

Another possible explanation for the lack of significant correlations between TSI results and physiological measures of stress, is that the blood pressure measures were taken in a 24-hour time period of which the majority of time was spent outside of the teaching/school context. Measures of blood glucose and Gamma glutamyl transferase (γ-GT) were taken at the Metabolic Unit Research Facility, which is also removed from the teaching context that the TSI and its items are focused on. Any number of factors, many of which are not directly associated with the teachers' experiences at the schools where they are employed, could therefore have impacted on these measures, and especially the blood pressure and blood glucose levels that were reported. The cross-sectional design of the current study may therefore have had an impact on the correlations, or the lack thereof, shown with self-reported stress in the work context as measured with the TSI. How to distinguish between normal daily living circumstances and the working environment influencing health unfortunately remains arbitrary. In spite of this, 24-hour ambulatory blood pressure monitoring during a normal working day, remains the gold standard for determining hypertensive status (Piepoli et al., 2016). Prospective findings confirmed chronic mean hypertensive 66.7% prevalence rates in the African educators (Hamer, Von Känel, Reimann, Malan, Schutte, Huisman & Malan, 2015), which aligns well with the current cross-sectional value of 66% in African educators.

Despite the above results, suggesting a degree of reliability and validity of the TSI in the current study population, the question of whether the TSI is truly culture-sensitive and applicable in the broader South African context, requires further research attention. Descriptive statistics in this study clearly indicate significant differences between African and Caucasian South Africans on indices of psychological and physiological health. It is known that the effects of stress on individuals and their functioning are multiple on both psychological and physiological levels. A possible shortcoming of the current study is, however, that it did not consider the possible mediating effect of the coping mechanisms used by teachers from different cultural backgrounds. In the absence of effective coping strategies, individuals may turn to negative coping behaviour, such as the use of alcohol (Olivier & Venter, 2003). This could not only contribute to stress, but could also have a negative influence on an individual's physical health and psychological well-being, which is a factor that future studies should consider.

Conclusion

This study yielded a number of promising results regarding the validity of the TSI in a South African context. The two-factor model showed good

construct validity in comparison to the five factors initially identified by Boyle et al. (1995), and indices of internal consistency indicated that reliable conclusions could be drawn from the data. The factors extracted during the analysis suggest that teacher stress in this cohort is primarily a direct function of generally poor circumstances regarding the teaching situation, including workload, poor resources and poor colleague relationships, together with learner-related stressors, such as student misbehaviour. The results also showed that the TSI generally displayed expected associations with measures of psychological well-being and mental illness within this multicultural sample of South African adults, attesting to its concurrent validity. However, users should remain cautious when using the TSI as direct predictor of psychological and physical stress until its validity and reliability have been ascertained within a more heterogeneous study population, which is more representative of the diverse South African context. It is also recommended that future studies endeavour to measure prospective physiological indicators of stress as experienced within the teaching context, as it might produce different, or more significant correlations with teachers' self-reported stress. Should results, however, be replicated, stress management programmes aimed at enhancing teacher well-being would do well to take the present findings into account, as these could have important implications for public policy with regard to the management of teacher stress and mental health care.

In conclusion, the TSI has proved to be a useful, brief self-report questionnaire for the assessment of occupational stress within this cohort of South African teachers. However, further psychometric evaluation is necessary before the TSI can be considered to be a valid instrument in the broad South African context.

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Notes

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ii.

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