Exploring the Factor Analytic Structure of the Multidimensional Anxiety Scale for Children (MASC) in a School-Based Sample of South African Adolescents

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TABLE OF CONTENTS

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LETTER OF CONSENT

Permission Statement to Submit Article for Degree Purposes

I, the co-author, Q. M. Temane hereby declare that the input and effort of Johannes Schickerling in the writing this article, is of sufficient scope to be a reflection of his own efforts. I hereby grant permission that he may submit this article for examination purposes in partial fulfillment of the requirements for the degree *Magister* Artium in Clinical Psychology.

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Q. M. Temane

INTENDED JOURNAL AND GUIDELINES FOR AUTHORS

Intended Journal: Psychological Reports.

The manuscript as well as the reference list has been styled according to the below mentioned Journal's specifications. (Manuscript submission guidelines to follow)

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Summary

Despite the importance of anxiety measuring tools, there is no published data on the factor analytic structure of the Multidimensional Anxiety Scale for Children (MASC) in South African adolescents. The present study was an attempt to examine the factor structure of the MASC in South African adolescents, the factor structure equivalence for boys and girls and the correlation between MASC scores and scores on the Child Trauma Questionnaire (CTQ), Child PTSD Checklist Score, and the Beck Depression Inventory (BDI) to establish whether the MASC distinguishes between anxiety and other constructs.

Available literature indicates that the MASC is invariant across gender and age and it shows excellent internal reliability and test-retest reliability (March Parker, Sullivan,Stallings & Conners, 1997). The MASC appears to measure separate dimensions of anxiety, which in turn makes it ideally suited to discriminate patterns of anxiety in children with anxiety disorders (Rynn et al., 2005). The MASC also correlates well with other measures of anxiety (Revised Children's Manifest Anxiety Scale [RCMAS] and Screen of Child Anxiety Related Emotional Disorders [SCARED]), less so with measures of depression (Children's Depression Inventory [CDI]) and not at all with measures of disruptive behaviour (March et al., 1997; Muris, Merckelbach, Ollendick & King, 2002). Several studies across the world have confirmed the four-factor structure of the MASC and found its subscales to be reliable in several studies across the world (Ólason, Sighvatsson & Smari, 2004; Rynn et al., 2005).

A sample of 1078 grade 10 adolescents was selected to participate in this study. The adolescents were from nine different schools, representative of the socio-economic status and ethnic diversity of the region in the Cape Town metropole (South Africa). Principal Components Confirmatory Factor Analysis was conducted on MASC scores using a varimax rotation. Item bias analysis were used to determine gender equivalence and Pearson's correlation statistics were used to explore the correlation of MASC scores to CTQ, BDI, and Child PTSD Checklist scores.

The results of the study confirm the MASC four-factor structure and its subscales were found to be reliable. The MASC performed the best out of four scales measuring anxiety or depression. Analysis showed that the four-factor structure applies equally well for males and

females. Younger adolescents scored higher than older adolescents on the MASC total scale and no differences on the MASC total scale were found when comparisons of race were made. Item bias analysis showed no statistically or practically significant eta-squared (η^2) value, indicating no gender bias. In general, results in this sample show that the characteristics of the MASC are similar to the original factor structure found by March et al. (1997). The MASC appears to measure separate dimensions of anxiety, which in turn should make it ideally suited to discriminate patterns of anxiety in subgroups of children with anxiety disorders. It can be concluded that the MASC shows to be a valid and reliable measure of anxiety for South African adolescents. It can be recommended that the MASC is a clinically useful and reliable self-report scale for assessing anxiety in children and adolescents.

Keywords: Factor Analytic structure, Item bias analysis, Multidimensional Anxiety Scale for Children (MASC), school-based sample, South African adolescents

Opsomming

Ten spyte die belangrikheid van meetinstrumente vir angs, is daar geen gepubliseerde data oor die faktor-analitiese faktor struktuur van die Multidimensional Anxiety Scale for Children (MASC) vir Suid-Afrikaanse adolessente nie. Die huidige studie het gepoog om die faktor struktuur van die MASC te ontleed vir Suid-Afrikaanse adolessente, die gelykheid van die faktorstruktuur tussen seuns en dogters te bestudeer en om die korrelasie tussen MASC tellings en die tellings van die Child Trauma Questionnaire (CTQ), Child PTSD Checklist Score, en die Beck Depression Inventory (BDI) te bestudeer.

Beskikbare literatuur dui aan dat die MASC onveranderlik is ten opsigte van geslag en ouderdom, en toon uitstekende interne betroubaarheid en toets-hertoets betroubaarheid (March et al., 1997). Dit wil voorkom asof die MASC verskillende dimensies van angs meet, wat dit baie gepas maak om te onderskei tussen patrone van angs in kinders met angsversteurings (Rynn et al., 2005). Die MASC korreleer ook goed met ander angs skale (Revised Children's Manifest Anxiety Scale [RCMAS] en Screen of Child Anxiety Related Emotional Disorders [SCARED]), minder met depressie skale (Children's Depression Inventory [CDI]) en geensins met instrumente wat gedragsprobleme meet nie (March et al., 1997; Muris et al., 2002). Veelvoudige internasionale studies het die MASC vier-faktor struktuur bevestig en die subskale betroubaar gevind (Ólason, Sighvatsson & Smari, 2004; Rynn et al., 2005).

'n Steekproef van 1078 graad 10 adolessente was geselekteer om vrywillig aan die studie deel te neem. Die adolessente uit nege verskillende skole van die Kaapstadse metropool (Suid-Afrika) was verteenwoordigend van die area se etniese diversiteit en sosio-ekonomiese status. Hoofkomponent Grondslag Bevestigende Faktor-Analise met varimax rotasie was gebruik vir die ontleding van MASC tellings. Itemsydigheidsanalise is gebruik om geslagsgelykheid te bepaal en Pearson se korrelasie statistiek is gebruik om die korrelasie tussen die MASC tellings en CTQ, BDI en die Child PTSD Checklist tellings te bepaal.

Die resultate van die studie bevestig die MASC vier-faktor struktuur en bevind die subskale betroubaar. Die MASC was die beste bepaler van angs vanuit 4 skale wat angs en of depressie meet. Analise het getoon dat die vier-faktor struktuur ewe toepaslik is vir beide geslagte. Ten

opsigte van die MASC se 'totaal skaal' het jonger adolessente hoër tellings behaal, terwyl geen rasse verskille aangedui was nie. Itemsydigheidsanalise het geen betekenisvolle eta-kwadraat waarde gevind nie, wat dui op geen geslagsydigheid nie. In die algemeen stem die MASC resultate in die studie ooreen met die oorspronklike faktor struktuur bevind deur March et al. (1997). Dit wil voorkom asof die MASC verskillende dimensies van angs meet, wat dit gepas maak om te diskrimineer tussen patrone van angs in subgroepe van kinders met angsversteurings. Die gevolgtrekking is dat die MASC 'n betroubare, geldige meetinstrument van angs vir Suid-Afrikaanse adolessente is. Dit word aanbeveel dat die MASC 'n kliniese bruikbare en betroubare self-verslag skaal is vir die assessering van angs in kinders en adolessente.

Trefwoorde: Faktor-Analitiese Struktuur, Itemsydigheidsanalise, Multidimensional Anxiety Scale for Children (MASC), Skool gebaseerde steekproef, Suid-Afrikaanse adolessente

Manuscript

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ABSTRACT

The goals of this study were threefold: to examine the factor structure of the Multidimensional Anxiety Scale for Children (MASC) in South African adolescents, the factor structure equivalence for boys and girls and the correlation between MASC scores and scores on the Child Trauma Questionnaire (CTQ), Child PTSD Checklist Score, and the Beck Depression Inventory (BDI) to establish whether the MASC distinguishes between anxiety and other constructs. A purposive sample of 1078 adolescents from nine different schools was included for participation in the study. The MASC four-factor structure was confirmed and its subscales were found to be reliable. The four-factor structure applies equally well for males and females. The MASC performed the best out of four scales measuring anxiety, depression and other constructs. In general results in this study show that the characteristics of the MASC are similar to the original factor structure established by March et al. (1997). It was concluded that the MASC is a clinically useful measure (i) to discriminate between anxious and depressed paediatric patients (ii) discriminate between patterns of anxiety in subgroups of children with anxiety disorders (iii) proves measurement- and congeneric equivalence and (iv) proves to be a valid and reliable measure of anxiety for South African adolescents.

Keywords: Factor Analytic Structure; Item bias analysis; Multidimensional Anxiety Scale for Children (MASC); School-Based Sample; South African; Adolescents

Anxiety assessment tools are essential for several reasons; first, children and adolescents undergo a developmentally sanctioned progression in anxiety symptoms; second, their environments are different to that of adults such that the presentation of anxiety may also differ; and third, age, gender and race norms are important considerations when differentiating normal from pathological anxiety in youth (March et al., 1997). In a survey of 200 studies of adolescent anxiety published between 1994 and 2001, Brooks, Krulewicz and Kutcher (2003) identified more than 70 different diagnostic and symptom measurement instruments that had been used. Across these studies, self-report measures of anxiety discriminated poorly between anxiety and depression in adolescents and scale items were not diagnostically keyed to specific anxiety disorders. However, in recent years a variety of self-report anxiety measures, such as the Screen of Child Anxiety Related Emotional Disorders [SCARED], Spence's Children's Anxiety Scale [SCAS] and the Multidimensional Anxiety Scale for Children [MASC] (Kaufman, Birmaher, Brent, 1997; March et al., 1997) have demonstrated utility in discriminating between children and adolescents with mood and anxiety disorders. They also have diagnostic validity for specific anxiety disorders as classified in the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) (APA, 2000).

One such measure, the MASC was developed to assess a wide spectrum of common anxiety symptoms in youth across elementary, junior and senior higher school age range (March et al., 1997; Ólason et al., 2004). The MASC consists of 39 items distributed across four major factors, with three of these factors split into subscales: (i) physical symptoms (tense/restless and somatic/automatic) (ii) social anxiety (humiliation/rejection and public performance), (iii) harm avoidance (perfectionism and anxious coping), and (iv) separation anxiety. The MASC appears to measure separate dimensions of anxiety, even at a sub-factor level, which in turn makes it ideally suited to discriminate patterns of anxiety in subgroups of children with anxiety disorders (Rynn et al., 2005). The MASC is also invariant across gender, age and shows excellent internal reliability and test-retest reliability (March et al., 1997). Reliability in psychometric terms has several meanings.

Internal reliability is defined as consistency between items within a group of items comprising a discrete factor, and has been shown to be excellent for the MASC. Test-retest reliability, which represents consistency in a set of scores by the same rater or set of raters over time, has

also been demonstrated to be good to excellent at 3 weeks and 3 months (March & Sullivan, 1999).

The MASC correlates well with other measures of anxiety (Revised Children's Manifest Anxiety Scale [RCMAS], Screen of Child Anxiety Related Emotional Disorders [SCARED]), less so with measures of depression (Children's Depression Inventory [CDI]) and not at all with measures of disruptive behaviour (March et al., 1997; Muris, Merckelbach, Ollendick & King, 2002). For example, in a school based survey of 9th grade youths where three dimensional scales (CES-D, RCMAS and MASC) were administered to detect anxiety and depressive disorders in 632 youths from three sites (Dierker et al., 2001). MASC scores were found to correlate most strongly with individual anxiety disorders, especially in females, and discriminated well between anxiety and depression on the CES-D. The RCMAS was least successful in discriminating between anxiety and depression (Dierker et al., 2001).

Similarly, the MASC four-factor structure was also confirmed and its subscales found to be reliable in a sample of 193 children and adolescents with a diagnosis of major depressive or anxiety disorder (Rynn et al., 2005).The scale correlated well with other measures of anxiety and less so with measures of depression. The subscales and two MASC items differentiated between anxious and depressed patients, and the authors concluded that the MASC was clinically useful in discriminating between these two groups of patients in their study (Rynn et al., 2005). In a confirmatory factor analysis of the Icelandic version of the MASC undertaken in 625 children aged between 10 and 15 years, the four-factor structure of the scale was replicated (Ólason et al., 2004). As with the original version (March et al. 1997), the four-factor structure of the Icelandic version applied equally well to males and females and across different age groups, with similar reliabilities and similar mean scores for the MASC and its subscales. Convergent and divergent validity with the RCMAS and the CDI were also similar.

In order to study the MASC's convergent validity, 405 Swedish adolescents were asked to rate their anxiety symptoms on the MASC, depressive symptoms on the Children's Depression Inventory (CDI), their attitude to their body on the Body Esteem Scale for Adolescents and Adults (BESAA) and filled in demographical data on themselves (Invarsson, 2006). The MASC showed adequate internal consistency both for the whole scale and for subscales. The scale showed convergent validity through a moderate correlation with the CDI and the BESAA. The Swedish concluded that the MASC appears to be a reliable and valid

scale both on the global and on the subscale level (Ivarsson, Svalander, Litlere & Nevonen, 2005). Another study done on Swedish adolescents with regards to weight concerns, body image, depression and anxiety found that girls had higher scores on the CDI and on the MASC (except one subscale) than boys. On the MASC subscale level, adolescents from intact families scored significantly higher than those from separated families on Separation Anxiety and a tendency for adolescents with illness or handicap to score higher on the Physical symptoms subscale than those who had not (Invarsson et al., 2005).

The aforementioned studies suggest that the MASC has robustness as a multi-domain self-report measure of anxiety, and is a valid and reliable tool when used in different cultural contexts. To date, there is no published data on the factor analytic structure of the MASC in South African adolescents. Thus, the aims of the present study were three-fold: (i) to examine the factor structure of the MASC in a South African adolescent school sample using a Principal Components Analysis with varimax rotation. (ii) to examine whether the factor structure of the MASC is equivalent for boys and girls in the sample (iii) to examine the correlation between MASC total and subscale scores and total scores on the Child Trauma Questionnaire (CTQ), Child PTSD Checklist Score, and the Beck Depression Inventory to establish whether the MASC distinguishes between anxiety and other constructs.

METHODS

Design

This study forms part of a larger study conducted in 2000 on adolescents from nine different schools in the Cape Town metropole (South Africa) (Seedat, Nyamai, Ngenja, Vythilingum & Stein, 2004). The aim of the study was to review adolescents' level of anxiety, trauma, post traumatic stress and depression. A posteriori cross-sectional survey was implemented for this study. Usually cross-sectional surveys are used to collect quantitative information once-off about items in a population (Bland & Peacock, 2000).

Participants

One thousand and seventy eight grade 10 adolescents, comprising 412 boys and 558 girls (missing data on gender in 108 participants), participated in the study. Adolescents from nine different schools in the Cape Town metropole of South Africa were included. Schools were selected to be reflective of the socioeconomic status (SES) and ethnic diversity of the region. The mean age in the sample was 15.8 years (standard deviation (SD) = 1.1). In respect of

ethnicity, the majority were either of coloured/mixed race (38.8%) or white (30%), black (18.5 %) Asian (1.8%) and Other (2.1%). More than half the children reported their parents' marital status as married or living together (59.6%).

Measures

For the purpose of the present study, the following measures were employed:

The Multidimensional Anxiety Scale for Children [MASC] (March et al, 1997; March et al., 1999) is a 39 item scale with items rated on a four-point Likert scale ranging from 0 = "Never applies to me" to 3= "Often applies to me". The self-rated measure taps anxiety in four domains: physical symptoms (12 items, with subscales tense/restless and somatic/automatic); social anxiety (9 items, with subscales humiliation/rejection and public performance); harm avoidance (9 items, with subscales perfectionism and anxious coping) and separation anxiety (9 items, no subscales). The total anxiety score, an Anxiety Disorders Index (derived from items found to best discriminate between those with anxiety disorders and those without this diagnosis) and an Inconsistency Index (composed of a summary score of the differences between highly related items and the short form of the MASC (10 items)) can be derived. Reliability and validity data for the MASC have been published (March et al., 1997; March et al., 1999). The scale was normed on over 2,500 children and adolescents in the United States and has excellent overall test/retest reliability, established factorial validity, strong sensitivity and specificity (overall classification rate of 88% for the Anxiety Disorder Index) and good convergent validity (March et al., 1997). Internal reliability of the scale and its subscales are reported contextually under the results section.

The **Demographics questionnaire**. An anonymous self-report questionnaire to obtain demographic information on age, gender, ethnicity, composition of the home, parental marital status, parental occupation, family income and substance use.

The **Beck Depression Inventory [BDI]** (Beck& Steer, 1987) is a 21-item scale which measures the presence and degree of depressive symptomatology in adolescents and adults. Each of the 21-items of the BDI attempts to assess a specific symptom, with higher total scores indicating more severe depressive symptoms. The BDI takes approximately 10 minutes to complete, although clients require a fifth – sixth grade reading age to adequately understand the questions (Groth-Marnat, 1990). The scale demonstrates high internal

consistency, with alpha coefficients of .86 and .81 for psychiatric and non-psychiatric populations, respectively (Beck et al., 1987).

The **Child PTSD Checklist** (Amaya-Jackson, McCarthy, Cherney, & Newman, 1995) is a 28-item structured interview, was administered in self-report format for this survey. It rates DSM-IV (APA, 2000) characterised PTSD symptoms in the past month on a 4-point Likert scale with 0 corresponding to "not at all" and 3 to "all of the time". Higher scores are indicative of more severe PTSD symptoms. Analyses with the Child PTSD Checklist revealed strong internal consistency and good test–retest reliability. Support for convergent validity also was indicated, as PCL scores were found to correlate highly with scores derived from well-established measures of PTSD (Amaya-Jackson et al., 2005).

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The **Childhood Trauma Questionnaire [CTQ]** (Bernstein & Fink, 1998) is a 28-item self-report inventory that provides brief, reliable, and valid screening for histories of abuse and neglect. It inquires about five types of maltreatment - emotional, physical, and sexual abuse, and emotional and physical neglect. Also included is a 3 item Minimization/Denial scale for detecting false-negative trauma reports. The CTQ does not assess other traumatic events that may occur during childhood, such as the death of a parent or a major illness. The items are written at a sixth grade reading level and it can be administered to individuals 12 years of age and older.

Procedure

After having obtained the approval of the institutional review board at the University of Stellenbosch (Cape Town) and the Western Cape Department of Education, consent was requested and obtained from the relevant school authorities, teachers and parents. All grade ten adolescents who were present at school participated. For more detailed information on study methodology, see Seedat et al., (2004). The anonymous self-report questionnaire consisted of a demographic questionnaire, the Multidimensional Anxiety Scale for Children (MASC) (March, 1997); the Childhood Trauma Questionnaire (CTQ) (Bernstein et al., 1998); the Beck Depression Inventory (BDI) (Beck et al., 1987), the Trauma Checklist (from the K-SADS-PL) (Kaufman et al., 1997); the Life Events Questionnaire (Masten et al., 1994), and the Child PTSD Checklist (Amaya-Jackson et al., 1995).

Ethical consideration

The approval of the institutional review board at the University of Stellenbosch (Cape Town) and the Western Cape Department of Education were obtained. Ethics Approval number: 2000/C026 (PI: S Seedat). Consent from the relevant school authorities, teachers and parents were obtained. All participants were informed as to the duration and content of the research project. The main outcomes of the study were communicated to the children, their teachers, and parents. The questionnaires were completed by the children themselves.

Data Analysis

Data were analysed using both SPSS (ver. 13.0) and Statistica (ver. 7.0) software packages. First, descriptive statistics (mean and standard deviations) were determined for scores on each of the measures used to realise the aims of the study.

Second, to examine for gender differences in MASC total and subscale scores, student's t-tests were calculated (cf. Kim & O'Mahony, 1998). A t-test is any statistical hypothesis test in which the test statistic has a Student's t distribution if the null hypothesis is true. Among the most frequently used t-tests are: A test of the null hypothesis that the means of two normally distributed populations are equal. Given two data sets, each characterized by its mean, standard deviation and number of data points, we can use some kind of t-test to determine whether the means are distinct, provided that the underlying distributions can be assumed to be normal. All such tests are usually called Student's t tests. Significance of the t-test is assumed when $P < 0.05$ (Kim & O'Mahony, 1998).

Third, Pearson's correlation statistics were used to explore the correlation of MASC scores to CTQ, BDI, and Child PTSD Checklist scores. Pearson's correlation coefficient measures the strength of the linear relationship between two variables (Lohninger, 1999). The coefficient ranges between -1.0 and +1.0 with a linear relationship between x and y suggesting continuous random variables and suggesting x and y must be independent of each other. Where -1.0 is a perfect negative (inverse) correlation, 0.0 is no correlation, and 1.0 is a perfect positive correlation (Lohninger, 1999).

One-way and two-way analyses of variance were conducted for MASC total scale and subscale scores with race and gender/age, respectively, as the independent variables. One-way analysis of variance allows for the comparison of several groups of observations, all of which are independent but possibly with a different mean for each group. A test of great importance is whether or not all the means are equal. Significance is assumed at level 0.05 (cf. Gravetter & Wallnau, 2000). Race was categorized as Asian, black, coloured/mixed race, white and other, while age was categorized as 12-15 years and 16-19 years.

Fifth, interval consistency of the MASC was assessed with Cronbach's alpha, a numerical coefficient of reliability (or consistency). Cronbach's alpha is an index of internal consistency or reliability associated with the variation accounted for by the true score of the "underlying construct" (Hatcher, 1994). Nunnaly (1978) has indicated 0.7 to be an acceptable reliability coefficient but lower thresholds are sometimes used in the literature. According to some authors the use of any cut-off value (including 0.7) is short-sighted due to inadequate criterion reliability the true correlations involving a predictor and an unreliable outcome variable will be seriously underestimated (Schmitt, 1996).

Sixth, item-level analysis (item bias analysis) was performed by using the analysis of variance (ANOVA) procedure for the MASC. According to Van de Vijver and Leung (1997), it can be assumed that an item is unbiased if persons from different language or gender groups, with an equal standing on the theoretical construct underlying the instrument, have the same expected score on the item. Although several statistical techniques are available for analysing item bias, analysis of variance has the advantage of computational implicity, robustness, and the possibility of studying both uniform and non-uniform bias (Mellenbergh, 1982). Practical significance for item bias was determined on the basis of eta-squared (η^2) (Kline, 2005). Researchers have been inclined to test the practical significance of measurements (see Cohen, 1988).

Finally, a Principal Components Confirmatory Factor Analysis was conducted on MASC scores using a varimax rotation. The statistical method of Principal Components Analysis transforms a set of data from a space of observables to components of a space of orthonormal eigenvectors which we can try to assign to physical traits, or a combination of physical traits (Lorenzo-Seva, 2003). The main idea is to reduce the dimensionality of the data to a smaller set of coordinates that will describe most of the information in the original set. The same four

factors could be identified by extracting four factors from all respondents, the male respondents and the female respondents respectively. These four factors explained respectively 39.6 % of the variation in all variables for of all respondents, 41.8% for males and 36.9% for females. Loadings above 0.39 were used to identify the simple structure from the Varimax rotated factor loadings.

RESULTS

Reliability of the MASC and its subscales

Means and standard deviations for all of the subscales are presented in Table 1. Cronbach's alphas were used as a measure of internal consistency and were computed for all subscales and for the total scale (see Table 1). Nunally (1978) has suggested that the Cronbach's alpha be higher than 0.7, however lower thresholds are sometimes used in the literature (Schmitt, 1996).

Harm Avoidance and Separation Anxiety subscales and the MASC-10 scale had internal consistencies below 0.7, suggesting relatively weak internal reliability. Rynn et al. (2005) also found that the MASC-10 scale as well as ADI had weak internal consistency, while March et al (1997) found all scales to have good internal consistency.

[Insert Table 1 here]

Correlation of MASC with other measures

As shown in Table 2, the MASC total score showed significant correlation with BDI, Child PTSD Checklist and CTQ scores. In addition, almost all MASC subscales were significantly correlated with Child Trauma Questionnaire (CTQ), Child PTSD Checklist, and Beck Depression Inventory scores. Harm Avoidance was not significantly correlated with the CTQ and the BDI. This is in accordance with what Rynn et al. (2005) found, namely that Harm Avoidance did not show any correlation to the BDI and other depression measures. The MASC scale had the highest correlation with the Child PTSD Checklist and the lowest with the CTQ. The findings here concur with previous work (e.g. March et al, 1997; Rynn et al., 2005) showing a more significant correlation of the MASC to measures of anxiety rather than to a measure of depression. The Child PTSD Checklist and BDI had the highest correlation with each other

[Insert Table 2 here]

MASC: Gender, age and race

The descriptive statistics based on the MASC scores are presented in Tables 3 and 4. The means and standard deviations for the MASC (total, four scales and subscales), the Anxiety Disorder Index and the Inconsistency Index for the whole sample, based on gender and age are presented. Girls scored significantly higher than boys on all scales and subscales. Significant differences were obtained for gender and age as indicated in Table 3.

[Insert Table 3 here]

For the MASC total scale and social anxiety (performance) scale, younger adolescents scored higher than older adolescents (Table 4).

[Insert Table 4 here]

In respect of race, there were no differences on the MASC total scale and most subscales, with the exception of separation/panic where black adolescents scored higher than white and mixed-race adolescents (Table 5). In two-way analyses of variance, there were no significant interactions between age and sex for MASC total scale and main subscale scores.

[Insert Table 5 here]

Item bias analysis for gender

Item-level analysis (item bias analysis) was performed using the analysis of variance (ANOVA) procedure for the MASC (see Van de Vijver et al., 1997). Although most studies show invariance across gender it would be important to see whether this includes congeneric equivalence. Firstly a score level was determined using percentiles for each field (e.g. Social anxiety). Two-way ANOVA followed with gender and score level as the two factors. Two effects were tested for significance in the subsequent variance analysis, namely the main effects of gender and the interaction effects of gender and score level. If both the main effect of gender and the interaction of gender and score level are found to be non-significant, the item is taken as unbiased.

Table 6 shows the results obtained of the analysis of variance (ANOVA) for each individual item of the 39-item MASC. According to Table 4, no statistically or practically significant

eta-squared (η^2) value was obtained for any item of the MASC, indicating that none of the items showed bias.

[Insert Table 6 here]

MASC principal component factor analytic findings

A principal component factor analysis (using varimax rotation) extracting the four factor solution was performed. These factors are Physical symptoms, Social anxiety, Separation anxiety and Harm avoidance (Table 7), concurring with other studies done (March et al., 1997). There were twelve, nine, nine and eight items spread over the four factors. The four factors accounted for 39.55% of the total variance. According to Kaiser's criterion 8 factors should be retained, explaining 51.5% of the variance (Kaiser, 1958). In contrast to the reported factor structure, these smaller factors explained little additional variance and contained items that tended to load across multiple factors. The analysis also showed that the four-factor structure applies equally well for males and females since essentially the same four factors (Physical symptoms, Social anxiety, Separation anxiety and Harm avoidance) could be identified for males and females. The factor analysis for the males and the females were done similarly again choosing 0.39 as the loading to distinguish between high and low loadings. Clark & Watson (1995) have suggested that inter-item correlation be between 0.15 and 0.5, as is the case with all four factors. Each of these items contributes to the reliability, if any one item should be taken away, the reliability would decrease.

[Insert Table 7 here]

DISCUSSION

Internal reliability for the MASC fell in the excellent range according to the suggestions of Nunnally (1978). The Cronbach alpha for each of the MASC subscales were: Physical Symptoms 0.83, Harm Avoidance 0.67, Social Anxiety 0.85 and Separation Anxiety 0.60. Item-total correlations for individual MASC items show a negligible reduction in alpha reliability with serial removal at the factor level. Thus the individual items share factor-level variance, but also contribute unique variance to the specified constructs. This concurs with what was found in previous studies where internal reliability and test-retest reliability was found to be excellent (March et al., 1997; Ólason et al., 2004; Rynn et al., 2005). The MASC also showed adequate internal consistency both for the whole scale and subscales (Invarsson, 2006).

In the correlation between MASC total and subscale scores and total scores on the Child Trauma Questionnaire (CTQ), Child PTSD Checklist, and the Beck Depression Inventory a higher correlation was found with the Child PTSD Checklist. The lowest correlation was found with the Child Trauma Questionnaire (CTQ). The Harm Avoidance scale was not significantly correlated with the CTQ and the Beck Inventory. Dierker et al (2001) confirmed these findings but concluded that the MASC performed the best out of three scales measuring anxiety or depression. These findings are in accordance with other findings in the literature (March et al., 1997, Rynn et al., 2005 and Dierker et al, 2001). These findings imply that the MASC is a valid and reliable measure of anxiety for South-African adolescents.

Analysis showed that the four-factor structure applies equally well for males and females. The means and standard deviation for most of the scales were similar to what was found by March et al. (1997) and Ólason et al. (2004) namely that girls scored significantly higher than boys on all scales and subscales. Younger adolescents scored higher than older adolescents on the MASC total and social anxiety (performance scale). There were no differences on the MASC total scale and most subscales when comparisons of race were made, with the exception of separation/panic where black adolescents scored higher than white and mixed-race adolescents. In general the results in this sample show that the characteristics of the MASC are similar to the original factor structure found by March et al. (1997). Item bias analysis showed no statistically or practically significant eta-squared (η^2) value was obtained for any item of the MASC, indicating that none of the items showed bias. This implies that the MASC contains measurement equivalence (measure relates to the underlying construct in the same way across both samples) and congeneric equivalence (equivalence between gender). If congeneric equivalence is not present the difference is so dramatic that we do not have comparable constructs, and comparative analysis should be stopped (Everett & Borgatti, 1994).

Principal Components Confirmatory factor analysis confirmed that the four factor solution for the 39 MASC items was equivalent for males and females. Literature suggests that anxiety is more common in females than males (Ivarsson, 2006). The factor structure of the MASC is unique among extant scales in its subdivision of the main factors into sub factors that nevertheless explain a meaningful portion of the variance. The MASC appears to measure separate dimensions of anxiety, which in turn should make it ideally suited to discriminate patterns of anxiety in subgroups of children with anxiety disorders.

Overall the aims of this research were to explore the factor analytic structure of the Multidimensional Anxiety Scale for Children (MASC) in a school-based sample of South African adolescents. The MASC performed the best out of four scales measuring anxiety, depression and other constructs, reliability fell into the excellent range. In general results in this sample show that the characteristics of the MASC are similar to the original factor structure found by March et al. (1997). The four factor solution for the 39 MASC items was equivalent for males and females and analysis showed no statistically or practically significance in gender bias. This shows the MASC's measurement- and congeneric, as opposed to pangeneric, equivalence. The MASC appears to measure separate dimensions of anxiety, which in turn should make it ideally suited to discriminate patterns of anxiety in subgroups of children with anxiety disorders. It can be included that the MASC shows to be a valid and reliable measure of anxiety for South African adolescents. It can be recommended that the MASC is a clinically useful measure of anxiety for South African youth.

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Table 1: Internal Consistency of the MASC and its subscales

MASC	Number of Items	Mean (SD)	Cronbach alpha
MASC-Total Scale	39	79.2 ± 17.6	.89
MASC Subscales			
Physical Symptoms	12	48.4 ± 6.9	.83
Harm Avoidance	9	22.5 ± 4.9	.67
Social Anxiety	9	19.9 ± 6.7	.85
Separation Anxiety	8	15.2 ± 3.9	.60
Anxiety Disorder Index	10	19.9± 5.4	.70
MASC-10	10	29.1 ± 5.4	.69

MASC: Multidimensional Anxiety Scale for Children

Table 2: Correlation of MASC total and main subscale scores with total scores on the CTQ, BDI and Child PTSD Checklist

	Physical Symptoms	Harm Avoidance	Social Anxiety	Separation/ Panic	MASC total score	CTQ total score	Child PTSD Checklist total score	BDI total score
Physical Symptoms	1.00							
Harm Avoidance	.399**	1.00						
Social Anxiety	.505**	.331**	1.00					
Separation/ Panic	.502**	.408**	.406**	1.00				
MASC total score	.816**	.641**	.777**	.699**	1.00			
CTQ total score	.291**	-0.08	.253**	.096**	.214**	1.00		
Child PTSD Checklist total score	.553**	.186**	.358**	.300**	.466**	.445**	1.00	
BDI total score	.490**	.041	.414**	.240**	428**	.306**	.583**	1.00

CTQ: Child Trauma Questionnaire BDI: Beck Depression Inventory MASC: Multidimensional Anxiety Scale for Children

**. Correlation is significant at the 0.01 level (2 tailed).

Table 3: MASC scores by gender

MASC scores	Total (mean ± SD)	Boys (mean ± SD)	Girls (mean ± SD)	t	df
Anxiety Disorders Index**	19.9 ± 5.4	18.2 ± 4.9	21.2 ± 5.3	-7.8	749
Physical Symptoms (total)**	22.2 ± 6.9	19.9 ± 6.0	23.9 ± 7.1	-8.0	734
Physical Symptoms: Tense symptoms**	10.7 ± 3.9	9.6 ± 3.4	11.6 ± 3.9	-7.4	768
Physical Symptoms: Somatic symptoms**	11.6 ± 3.6	10.5 ± 3.2	12.3 ± 3.7	-7.2	761
Harm Avoidance (total)**	22.5 ± 4.9	21.3 ± 5.2	23.4 ± 4.6	-5.6	738
Harm Avoidance: Perfectionism*	8.2 ± 2.2	7.9 ± 2.3	8.4 ± 2.0	-3.0	782
Harm Avoidance: Anxious Coping **	13.9 ± 3.6	13.1 ± 3.6	14.6 ± 3.5	-5.9	758
Social Anxiety**	19.9 ± 6.7	17.7 ± 6.4	21.3 ± 6.6	-7.3	742
Social Anxiety: Humiliation Fears**	11.2 ± 4.4	9.8 ± 4.0	12.0 ± 4.4	-6.8	767
Social Anxiety: Performance Anxiety**	8.7 ± 3.0	7.8 ± 2.9	9.2 ± 2.9	-6.5	778
Separation/Panic**	15.0 ± 4.4	13.7 ± 3.9	15.9 ± 4.4	-7.3	751
MASC Total score**	78.6 ± 17.6	71.9 ± 16.7	83.6 ± 16.6	-8.6	616
Inconsistency index**	6.4 ± 2.9	5.7 ± 2.7	6.9 ± 2.7	-5.7	704

Significant gender differences: ** p value <0.001, * p value <0.01

Table 4: MASC scores by age

MASC scores	12-15 years (mean ± SD)	16-19 years (mean ± SD)	t	df
Anxiety Disorders Index	20.1 ± 5.5	19.7 ± 5.2	1.0	628
Physical Symptoms (total)	22.4 ± 7.3	21.9 ± 6.5	0.8	616
Physical Symptoms: Tense symptoms	10.8 ± 4.1	10.5 ± 3.6	1.2	646
Physical Symptoms: Somatic symptoms	11.7 ± 3.8	11.6 ± 3.6	0.2	642
Harm Avoidance (total)	22.6 ± 4.8	22.4 ± 5.1	0.5	616
Harm Avoidance: Perfectionism	8.2 ± 2.1	8.1 ± 2.3	0.7	660
Harm Avoidance: Anxious Coping	14.1 ± 3.4	13.9 ± 3.7	0.8	637
Social Anxiety	20.1 ± 6.5	19.1 ± 6.7	1.9	629
Social Anxiety: Humiliation Fears	11.3 ± 4.2	10.8 ± 4.3	1.5	656
Social Anxiety: Performance Anxiety*	8.9 ± 2.9	8.3 ± 3.0	2.7	657
Separation/Panic	15.4 ± 4.7	14.8 ± 4.4	1.5	632
MASC Total score*	80.3 ± 18.3	76.9 ± 16.9	2.2	512
Inconsistency index	6.3 ± 2.9	6.5 ± 2.9	-0.9	589

* mean difference is significant at level $p < 0.05$

Table 5: Differences in MASC scores by race (One-way ANOVA)

	White (mean±SD)	Mixed Race (mean±SD)	Black (mean±SD)	Asian (mean±SD)	Other (mean±SD)
MASC total score	77.3 ± 16.7	78.6 ± 71.5	83.1 ± 19.1	76.5 ± 21.6	80.6 ± 18.0
Physical Symptoms	21.9 ± 7.1	21.9 ± 6.6	23.8 ± 7.2	22.8 ± 9.4	23.8 ± 6.5
Harm Avoidance	22.3 ± 4.6	22.4 ± 5.0	23.6 ± 5.2	20.3 ± 4.9	21.4 ± 6.1
Social Anxiety	20.2 ± 7.0	19.7 ± 6.4	19.9 ± 6.9	19.8 ± 7.1	18.6 ± 7.1
Separation/ Panic**	13.5 ± 3.5	15.4 ± 4.6	16.7 ± 4.7	13.9 ± 3.6	15.1 ± 3.4

** mean difference is significant at level 0.05

Separation/Panic scale: blacks > whites, mixed race > whites, no significant difference between blacks and mixed-race adolescents

Table 6 Item bias analysis of the MASC

Item	Gender	Interaction of gender and score level
1	0.003	0.007
2	0.000	0.014
3	0.000	0.005
4	0.001	0.011
5	0.006	0.010
6	0.004	0.007
7	0.000	0.019
8	0.000	0.007
9	0.000	0.011
10	0.000	0.012
11	0.002	0.017
12	0.004	0.009
13	0.001	0.009
14	0.003	0.003
15	0.000	0.005
16	0.000	0.001
17	0.008	0.022
18	0.003	0.008
19	0.007	0.011
20	0.000	0.006
21	0.001	0.012
22	0.000	0.007
23	0.000	0.002
24	0.001	0.012
25	0.003	0.006
26	0.007	0.018
27	0.001	0.004
28	0.003	0.003
29	0.001	0.016
30	0.000	0.007
31	0.003	0.021
32	0.011	0.012
33	0.000	0.010
34	0.006	0.003
35	0.000	0.008
36	0.001	0.009
37	0.005	0.009
38	0.002	0.010
39	0.000	0.022

$\eta^2 > 0.06$ — Practically significant (medium effect) (Cohen, 1988)

Table 7. Factor Analytic Findings: Principal Components Analysis

MASC Item	Physical symptoms	Social anxiety	Separation anxiety	Harm avoidance	Communalities
MASC 1	0.542	-	-	-	0.429
MASC 5	0.518	-	-	-	0.278
MASC 8	0.6079	-	-	-	0.433
MASC 12	0.550	-	-	-	0.345
MASC 15	0.625	-	-	-	0.445
MASC 18	0.570	-	-	-	0.366
MASC 24	0.681	-	-	-	0.484
MASC 27	0.646	-	-	-	0.496
MASC 31	0.609	-	-	-	0.452
MASC 35	0.600	-	-	-	0.387
MASC 38	0.560	-	-	-	0.362
MASC 2	-	0.552	-	-	0.348
MASC 6	-	0.563	-	-	0.337
MASC 9	-	0.556	-	-	0.362
MASC 11	-	0.508	-	-	0.357
MASC 13	-	0.680	-	-	0.472
MASC 25	-	0.485	-	-	0.311
MASC 28	-	0.573	-	-	0.387
MASC 32	-	0.397	-	-	0.245
MASC 3	-	-	0.765	-	0.606
MASC 10	-	-	0.785	-	0.647
MASC 14	0.305	-	0.533	-	0.433
MASC 16	-	-	0.725	-	0.589
MASC 21	-	-	0.479	-	0.297
MASC 22	-	-	0.735	-	0.584
MASC 29	-	-	0.694	-	0.541
MASC 33	-	0.322	0.437	-	0.303
MASC 37	-	-	0.484	-	0.297
MASC 39	-	-	0.593	-	0.398
MASC 4	-	-	-	0.546	0.387
MASC 7	-	-	-	0.592	0.370
MASC 17	-	-	-	0.555	0.352
MASC 19	-	-	-	0.435	0.215
MASC 23	-	-	-	0.413	0.220
MASC 26	-	-	-	0.500	0.274
MASC 30	-	-	-	0.555	0.398
MASC 34	-	-	-	0.442	0.318
Eigenvalue	8.20	2.84	2.66	1.73	
Cumulative %	21.02	28.3	35.11	39.55	

MASC: Multidimensional Anxiety Scale for Children

Only loadings of 0.3 or larger were retained