Factorial validation and reliability analysis of the brain fag syndrome scale

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Abstract

Background: Brain fag is an indigenous psychopathology or culture-bound syndrome formally documented in Nigeria in the 1960's by Raymond Prince.

Objective: The need for a factorial examination of the scale to ensure factorial validity and also to examine the reliability of this screening scale.

Methods: Two hundred thirty four (234) participants with ages between 11 – 20 years with a mean age of 14.20 and a Standard Deviation of 2.14 of which 114 were from a private secondary school and 120 from a public secondary school were randomly selected and administered the Brain Fag Syndrome Scale [BFSS]. The data was subjected to factor analysis using Principal Component Analysis with Oblim Rotation.

Results: Two valid factors emerged with items 1-3 and items 4, 5 & 7 loading on them respectively, making the BFSS a two-dimensional (multidimensional) scale which measures 2 aspects of brain fag [labeled burning sensation and crawling sensation respectively]. The reliability analysis yielded a Cronbach Alpha coefficient of 0.521, and a standardized item alpha of 0.528 estimated its internal consistency. Also, the BFSS was correlated with other tests to establish its concurrent validity [convergent and divergent].

Conclusion: BFSS is a valid and reliable two-dimensional instrument to assess brain fag syndrome.

Key words: Culture-bound syndrome, Validation, Brain Fag, Students

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Introduction

Brain Fag Syndrome (BFS) has emerged as one of the recurring culture bound syndromes or indigenous psychopathologies in literatures of student's psychopathological response to reading in Africa[2, 3,4,5,6]. The syndrome was first described by Prince as a psychiatric illness associated with study among African students in 1960, the phrase "brain fag" being the name by which the students themselves called the condition, which they believed was due to brain fatigue[7]. BFS is a tetrad of somatic complaints; cognitive impairments; sleep related complaints; and other somatic impairments. The somatic complaints consist of pains and burning sensations around the head and neck; the cognitive impairments consist of inability to grasp the meaning of written and sometimes spoken words, and inability to concentrate as well as inability to concentrate and poor retention; sleep related complaints consisting of fatigue and sleepiness in spite of adequate rest; and other somatic impairments such as blurring, eye pain and excessive tearing.

BFS affects 6 to 54 adolescents out of 100[6]. The aetiology of psychiatric morbidity associated with education in Africa was explored by Guinness in 1992 and he demonstrated five independent factors associated with BFS: (a) the financial implications of education which represented the change from subsistence to cash economy; (b) fear of envy and bewitchment which represented the intense cultural response to education; (c) parenting in the pre-school years which was the independent family variable; (d) academic ability; (e) attributes of the school. While current family adversity in terms of unstable parental union, paternal use of alcohol, polygamy and sib-ship size operated by interactive

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or additive effect, age of starting school and birth rank had a marginal effect. But gender and social status had no effect. The brain fag syndrome can be related to the complex social changes during rapid social transition where education is a major agent of change. The social and economic implications of this illness have not been explored conclusively possibly due to disagreements about the diagnostic validity of this illness.

BFS was defined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) as a culture bound syndrome in 1994, just like Koro syndrome and other culture related syndromes[8]. In DSM-IV it was "translated" as an idiom of distress that resembles certain forms of anxiety, depressive and somatoform disorders. Particularly, the cluster of symptoms has been called somatisation in classical descriptions in the West and BFS might therefore be seen as a somatisation reaction to study.[7] However, the question arises whether such interpretations provide a valid description of the subject's distress and most importantly, whether the new category of culture bound syndrome or categories of anxiety, depression or somatisation have any personal validity or meaning for the subject. On the whole, nevertheless, majority of the cases turned out to defeat classification into standard nosologies and the theme remains the same -signs and symptoms associated with studying.[6]

The lack of consistent findings concerning the etiology, patho-physiology and risk factors for BFS reflects lack of standardized reproducible diagnostic criteria for BFS. Different studies have used different instruments to assess brain fag and fewer studies only followed the description by Prince[6, 9, 10, 11, 12]. Sixty percent of reviewed studies reported rates of the brain fag symptoms rather than brain fag syndrome[6]. And to some extent, the inconsistent and often conflicting results from studies of BFS reflect referral bias.

The diagnosis of BFS rests not only on the presence of symptoms but also on the association between (a) the unpleasant sensations around the head/neck and (b) study difficulty. These two factors (a and b) are necessary for determining the caseness of BFS and represent the construct of the syndrome. The use of a validated instrument to obtain standardized measures of the major symptom domains of BFS is necessary but we are aware of no published studies that have validated the Brain Fag Syndrome scale (BFSS), the standardized clinically empirical instrument, designed by Prince and Morakinyo, to characterize persons with BFS. The objective of the present study was to validate the BFSS based on Prince/DSM-IV description of BFS.

Objectives

The BFSS was developed by Prince[3] and Morakinyo[1]. When the BFSS was developed, scant information and few theories were available on how BFS symptoms developed. There were also limitations in terms of extensive cross-cultural researches exploring possible different aspects of this mental illness. The BFSS was predominantly used to assess the manifestation of brain fag symptoms in student population. However, since its initial development about forty eight years ago and its modification about twenty years ago, it has not been subjected to empirical validity, factorial or reliability analysis. This study attempts to:

1. Factorially validate the BFSS
2. Determine the factor structure of the BFSS
3. Establish the empirical reliability and validity of the BFSS

Methods

Settings and participants

The participants for this study were students in JSS 3 and SS3 from one public and private secondary school in Ota, Ogun State. Approval for the research protocol by the Ethics and Research Committee of Covenant University was obtained. The participants were informed about the aim and objectives of the study and were assured of total confidentiality. They were also told that it was not an examination. After, written informed consent was obtained from them, they were administered three questionnaires namely: the Brain Fag Syndrome Scale (BFSS), the State Trait Anxiety Inventory (STAI – Y1 & Y2) and the Index of Peer Relations (IPR).

The participants were randomly administered the questionnaires in an odd and even manner with the odd numbered students receiving the questionnaires and the even numbered students not receiving any. A total of 250 questionnaires were administered but 234 were correctly responded to and used for this study (participation rate = 93.6%).

Measures

Brain Fag Syndrome Scale (BFSS)

BFSS is a screening scale developed by Prince and refined by Morakinyo. It screens for and diagnoses brain-fag syndrome using three response options of 0, 1, 2, corresponding to never, sometimes and often.

The score ranges from 1 – 14 and higher scores represent a manifestation of the syndrome. When the respondent has a score of 6 and above, the respondent is considered to manifest brain-fag. For a diagnosis to be reached, the score of 6 and above must have items 4 and 5 represented with either a 1 or 2. The scale has been found to have face validity[6, 10, 24].

State Trait Anxiety Inventory (STAI – Y1 & Y2)

State Trait Anxiety Inventory (STAI – Y1 & Y2) was developed by Spielbeger[13]. The STAI – Y1 is a 20 item inventory which measures anxiety. Specifically, this subscale of STAI measures state anxiety which is situation -specific anxiety idiosyncratically manifested by an individual. This measure the transient state an individual is at a particular time. The STAI – Y1 has 10 direct and reverse scoring items. Omoluabi[14] validated it in Nigeria. He got a mean score of 33.59 and a test retest reliability of 0.61. When a respondent scores higher than the norm, it indicates state anxiety while lower scores indicate high state anxiety. STAI- Y2 is the second subscale of the STAI. It measures trait anxiety which is an individual's propensity or proclivity to being anxious. STAI – Y2 has both direct (11) and reverse (9) score items. The mean score of the Nigerian sample is 34.54 and a test retest coefficient is 0.86. The interpretation of the STAI Y2 is the same as the Y1 subscale.

Index of Peer Relations (IPR)

The IPR is a questionnaire that measures the problems faced in interpersonal relationship with peers. It is a 25 - item inventory which aims at assessing the problems of interpersonal relationship an individual faces with peers in a social, school, home or other social situations. It was developed by Hudson, Nuris, Daley and Newstone [15]. The IPR has both direct scoring (13) and reverse scoring (12) items. The IPR was validated in Nigeria by Anumba[16]. Anumba obtained a mean score of 29.13 for males and 26.83 for females and a divergent correlation coefficient of 0.62 by correlating it with Hare self Esteem Scale [17]. In the IPR, a score higher than the norm indicates a poor peer relation while scores lower than the norm shows a good level of peer relations.

Statistical analysis

All results are reported as means ± standard deviations (SD). Construct validation of BFSS is complex because there are no definitive measures for the underlying construct. Hence, we conducted a series of scale validation procedures. Internal consistency (the degree to which the items of a scale measure the same construct) of the 7 BFSS items was measured using Cronbach's alpha.

To assess the structure of the BFSS, a factor analysis was conducted using Principal Components Analysis with varimax rotation.

Convergent validity is the degree of correlation between a new scale and previously validated measures of the same construct. This was assessed using two-tailed Pearson correlations between the BFSS total score and scores on State Trait Anxiety Inventory (STAI – Y1 & Y2). In addition, peer relationship would not be expected to be impaired in BFS. Therefore, we assess the BFSS discriminant validity using correlations with IPR.

All statistical analyses were conducted using SPSS, Version 15 [18]. The level of significance was set at conventional 5%.

Results

A total of 234 secondary school students (91 males, 143 females) ranging in age from 11 to 20 years (14.20 ± 2.14, mean ± s.d.) completed the questionnaires. One hundred and twenty were from a public secondary school, 60 from Junior Secondary (JSS3) and 60 from Senior Secondary (SS3) while one hundred and fourteen (114) were from a private secondary school, 60 from Junior Secondary (JSS3) and 53 from Senior Secondary (SS3) (Table 1).

Factorial Validation

To determine the dimensions of BFSS, factor analysis was carried out in four stages. These stages are: the analysis of data in terms of their compatibility with factor analysis, obtaining the factors, factor rotation and naming factors. In order to test whether the data of BFSS lends itself for factor analysis, first, the Bartlett's test of Sphericity and Kaiser-Meyer-Olkin (KMO) sample sufficiency tests were conducted. The 7 items on the BFSS showed a good correlation with each other, showing that the data gathered was appropriate for factor analysis. The analysis showed a value of 0.646 on the Kaiser - Meyer- Olkin measure of sampling adequacy. As the KMO value was above 0.50, even above 0.60, it shows that the sample of 234 participants was enough to carry out a factor analysis.

The data also showed a significant value (χ^2 (21) = 118.164, $p < .001$) on the Bartlett's test of

Sphericity. The significance of this value supported the assumption that there is high correlation among items in the correlation matrix, thus, the data was accepted convenient for factor analysis. All tests carried out referred to the result that the data was appropriate for factor analysis. The communalities on the BFSS data were well above 0.30.

To determine the factorial structure of BFSS, exploratory factor analysis and the widely used technique of principal component analysis were used. As a result of the analysis conducted with this technique, factors with the value of one and above, two factorial structures of the BFSS were arrived at. The two factors explained 44% of the total variance. These factors respectively, explained 27.511% and 16.769% of the variance.

The factor loadings of the items in those factors were analyzed with the principal component technique. When the analysis results in Table 1 are examined, it can be seen that factor communality varies between .307 and .609, and that the communalities of some items (6, 5 and 1) are low. However, since these items met the item selection criteria, they were retained. It was however found that item 6 loaded negatively on factor 1. This interesting loading made the authors review the criteria for the caseness of brain-fag to include item 6. It had been pointed out earlier in this study that caseness depended on the scoring of 6 and above and on the participant having items 4 and 5 represented in the score. With a negative loading of item 6 which states: "I am satisfied with my general efficiency in studying and with retention (assimilation) of what I study," the authors decided t include this criteria in the selection of caseness for BFSS. Hence, noting that in addition to the score of above 6, having items 4 and 5 represented, the respondent must have a response of 'often' or 'sometimes' on item 6 for caseness of brain - fag syndrome to be established.

From table 1, it can also be seen that factor one (burning sensation) has 3 items (1, 2, and 3) and factor two (crawling sensation) has 3 items (4, 5, and 7) significantly and unambiguously loaded on them. These labels were decided on in line with Prince's[19] examination of the brain-fag syndrome and the burning and crawling sensation components where he noted that "these symptoms occur or are exacerbated while reading or occasionally, while listening to lectures". Prince also pointed out the prevalence of these symptoms in school aged students in reaction to intellectual activities.

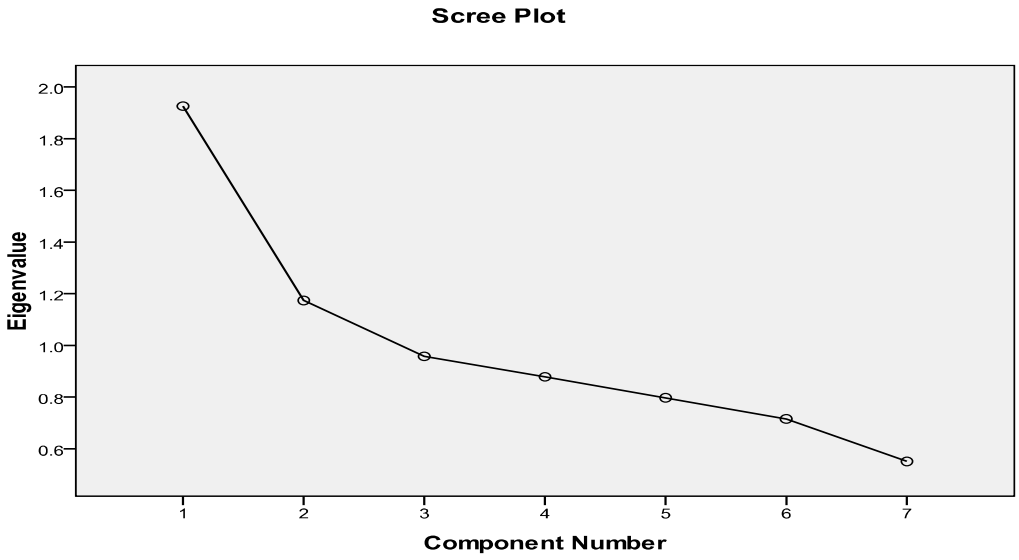
Table 1: Factor loadings and communalities on the BFSS with direct oblim rotation

Item number	Item on BFSS	Factor 1 Burning Sensation	Factor 2 Crawling Sensation	Communalities
7	I suffer unpleasant sensations in my body related to study		.755	.590
6	I am satisfied with my general efficiency in studying and with retention (assimilation) of what I study	-.577		.325
5	These unpleasant sensation (burning, crawling, heat, cold) make it difficult for me to study or assimilate what I read	.726	.307	
4	I experience brain burning, crawling heat or cold or other unpleasant sensations in my head, while studying		.558	.609
3	I find it difficult to concentrate when studying	.607		.406
2	When I read, I feel that the words don't make sense	.732		.524
1	I get period of complete exhaustion and fatigue	.540		.340

Extraction Method: Principal Component Analysis

In order to further graphically determine the number of factors related to the construct, the scree graphic based on eigen values was examined[20, 21]. At the end of the scree graphic (see graph 1 below) carried out for the BFSS, a rapid drop was observed in graphic curve's bevel after the first factor. After the second factor, the acceleration tapered down, turning into a horizontal state and declining.

Figure 1: Screen plot of the factorial validation of the BFSS



Discussion

Reliability and validity

Cronbach Coefficient Alpha of the BFSS yielded a reliability coefficient of 0.521 with a standardized item alpha of 0.528 estimated internal consistencies. In addition, attempt was made to establish the intrinsic validity of the BFSS following Guilford's [22] conceptualization of the intrinsic validity being the square root of the reliability coefficient of a measure, in this case, 0.722. The BFSS has been shown to have construct validity as a result of the result of the above and empirical factor analysis and the analysis of internal consistency above[23].

Construct validity of the BFSS

Convergent Validity

Convergent validity of the BFSS was established using the State Trait Anxiety Inventory (STAI) Y1 & Y2. The BFSS construct has an underlying anxiety as basis of its manifestation. Hence, in order to empirically establish this, the STAI was used. The analysis of the BFSS and the STAI – Y1 yielded a significant two-tailed correlation coefficient of 0.280, $p<.0001$ level of significance while a correlation of the BFSS and the STAI – Y2 also yielded a significant correlation coefficient of 2.86, $p = 0.0001$.

Discriminant Validity

Discriminant validity of the BFSS was established using the Index of Peer Relations (IPR). There is no relationship between brain-fag and peer relations, their constructs differ. In order to establish the discriminant validity of the BFSS, the IPR was used. The analysis yielded a non significant correlation coefficient of 0.075. This simply means that there is no relationship between scores on the IPR and scores on the BFSS. They measure different constructs.

Conclusion

This study has established the reliability and validity of the BFSS. It is important to note that the BFSS was developed by Prince [3], forty eight years ago and was modified by Morakinyo [1] twenty years ago. It however has not been empirically validated or found reliable except on a prima facie basis. Although the brain-fag syndrome is represented in the DSM-IV [8], no empirical instrument exists to measure it. This study therefore, has empirically validated the BFSS which manifests also among undergraduate Nigerian students [24] and has also established the reliability of the brain fag syndrome scale as a robust measuring instrument for brain-fag manifestation in students.

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