

Construct Validation of Anxiety Measures Using Multitrait-Multimethod Matrix

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Abstract

This study sought to establish the construct validity for an instrument for measuring anxiety. The researchers used a four-point questionnaire and a seven-point Osgood semantic differential scale on depression to ascertain the convergent validity while two instruments measuring aggression were employed to establish the divergent trait with anxiety using multitrait-multimethod matrix. The face validity was carried out by experts in Educational Measurement and Evaluation. Cronbach Alpha reliability estimates for internal consistency of the items yielded 0.76, 0.98 for anxiety measures; 0.74, 0.85 for depression measures and 0.63, 0.79 for aggression measures respectively. The PPMC coefficient was used to test the hypotheses. Samples of thirty Senior Secondary III students of University of Nigeria Demonstration Secondary School were purposively selected for the study. The results demonstrated moderate convergence ($r = 0.20, 0.49, 0.39$ for measures of anxiety, depression and aggression respectively) between two different methods of the same trait. Measures assessing anxiety and depression could be distinguished from measures assessing aggression. In conclusion the rejection of the first hypothesis and the retention of the second and third hypotheses based on the correlation confirm the convergent and divergent validities of the instruments; therefore, the instruments for measuring anxiety were deemed valid and reliable.

Keywords: Multitrait-multimethod Matrix, Anxiety, Depression, Aggression, Anxiety Measures, Construct Validity

Introduction

A construct is a psychological trait, attribute or characteristic that is not directly observable. Constructs are assessed in psychology in order to furnish data that could explain some covert behaviour. Examples of psychological constructs include anxiety, depression, aggression, honesty, aptitude, interest, extraversion, introversion, self-control, friendliness, impulsivity etc. These psychological constructs are useful in explaining differences in behaviour among people. Assessment of these constructs requires the use of sound instruments, instruments with unquestionable psychometric properties—if the results obtained from such assessments are to be interpreted and upheld as a true reflection of the construct in question. This brings to bear the need for construct validation.

Construct validation is essentially employed in various studies to confirm various hypotheses regarding the internal structure of the construct and its relationship with other variables. Instruments like questionnaires, interview schedules, rating scales, checklists, semantic differential scales, and projective techniques are used in measuring constructs. To ensure that these instruments are functioning, the construct validity is estimated to establish whether or not the instrument is measuring what it purports to measure.

The purpose of the study is to validate measures of anxiety using multitrait-multimethod matrix. Specifically, the study intends to achieve the following:

- i. Find out the extent of relationship between anxiety and depression;
- ii. Find out the extent of relationship between anxiety and aggression;
- iii. Find out the extent of relationship between depression and aggression;
- iv. Validate an effective measure for anxiety.

Statement of Hypotheses

To achieve the purpose of the study, three hypotheses were formulated to provide guide for the study.

1. There is no significant relationship between measures of anxiety and depression.
2. There is no significant relationship between measures of anxiety and aggression.
3. There is no significant relationship between measures of depression and aggression.

Review of Related Literature

Anxiety

In defining anxiety for psychological assessment, it is always important to recognise that it is not the same thing as fear, which is usually experienced when faced with something that is realistically threatening. Anxiety must also not be mistaken for the normal reaction that is exuded when faced with a perceived stressor. Anxiety in general psychology may refer to any generalised subjectively unpleasant feelings of dread over something that is unlikely to occur (Bouras, 2007; Davidson, 2008; and Öhman, 2000). It is usually an overreaction to a situation that is only subjectively seen to be menacing and is often accompanied by nervous behaviour, somatic complaints and rumination (Seligman, Walter & Rosenham, 2001). To further bring the psychological construct “anxiety” into perspective, Sylvers, Lilienfeld, and Laprairie (2011) contrasted it with fear in four significant areas: (1) duration of emotional experience, (2) temporal focus, (3) specificity of threat and (4) motivated direction. Based on these domains, anxiety was defined as long-acting, future-focused, broadly focused towards a diffuse threat and promoting caution while approaching a potential threat. It is worthy of note that when anxiety becomes overwhelming and distressing to the sufferer, it could be classified under anxiety disorder in psychiatry.

Anxiety presents physical, emotional, cognitive and behavioural effects. The physical effects of anxiety may include heat palpitations, muscle weakness and tension, fatigue, nausea, chest pain, shortness of breath, stomach aches, or headaches. Besides these negative effects, potentially positive physical reaction to anxiety may include pupillary dilation, increased blood pressure and heart rate, sweating, increased blood flow to major muscle groups, and inhibition of immune and digestive system functions. These reactions somehow prepares the individual to

deal with the perceived threat should it occur. This is commonly referred to as the 'fight or flight response' (Iacovou, 2011). Emotional effects of anxiety may include feelings of apprehension or dread, trouble concentrating, tension, anticipating the worst, irritability, restlessness, watching and waiting for signs and occurrences of danger, feeling like your mind has gone blank, and nightmares. Other effects are obsessions about sensation, *déjà vu*, a trapped feeling in the mind and feeling like everything is scary (panicaway.com, 2012). Cognitive effects of anxiety may include thought about suspected dangers, such as fear of dying (Smith & Kendoll, 2008). Behavioural effects may include withdrawal from situations where unpleasant effect of anxiety have been experienced in the past, nail biting and increased motor tension, such as foot tapping and pacing back and forth (Barker 2003).

Generally, every individual at some point in time experiences some degree of anxiety. Oftentimes, this happens when the individual is faced with a new situation, such as a first date, or when the individual is trying to do something well, such as taking a school test. Arguably, a mild to moderate amount of anxiety in these situations is normal. Bufka and Barlow (2008) maintain that such anxiety could even be beneficial to the individual at that material time. They argue that anxiety can motivate an individual to prepare for an upcoming event and can help keep them focused on the task at hand. The researchers further opine that too little anxiety or too much anxiety, on the other hand, can cause problems. Persons who do not feel any measure of anxiety when faced with an important situation may lack alertness and focus. Moreover, those who experience an abnormally high amount of anxiety may become overwhelmed, immobilized, and unable to accomplish the task at hand. In the later case, Bufka and Barlow (2008) submit that such individuals who experience too much anxiety often suffer from one of the anxiety disorders classified in psychiatry.

Depression

Depression is another construct of interest in this work. Depression in general psychology describes the prolonged feeling of sadness usually accompanied by a general loss of energy and interest in previously interesting activities, hopelessness and an overall moodiness. In assessing depression for clinical purposes, it is worth noting that clinical depression is not just a passing "blue mood", the duration and manifestation must be taken into consideration. Common symptoms of depression generally include prolonged sadness, irritability, hopelessness and worry—in younger children; anxiety, anger, excessive sleeping, sex spree and avoidance of social interaction—in adolescents; boredom, fatigue, loss of appetite, feelings of worthlessness, suicide ideation, insomnia and loss of interest in sex—in older adults. In the case of adults, depression may go undiagnosed because symptoms are often associated with other illnesses. Generally, depression could be mild, moderate, or severe. However, depression can take several forms. In bipolar disorder, sometimes called manic-depressive illness, a person's mood swings back and forth between depression and mania. People with seasonal affective disorder typically suffer from depression only during autumn and winter, when there are fewer hours of daylight. In dysthymia, people feel depressed, have low self-esteem, and suffer poor concentration—often for a period of years—but their symptoms are milder than in major depression. Some people with dysthymia experience occasional episodes of major depression.

Generally, the term clinical depression is used to refer to any of the above forms of depression (Cohen, 2008). On the most common forms of depression, Grohol (2013) maintains that:

- Major depression combines several symptoms that interfere with the ability to work, study, sleep, eat, and enjoy activities previously considered pleasurable such as sex and social interactions. Such a disabling episode of depression may occur only once but more commonly occurs several times in a lifetime.
- Dysthymia involves long-term, chronic symptoms that do not disable, but that do not allow the sufferer to function efficiently or enjoy simple everyday activities.
- Bipolar disorder is a rare type of depression that is often characterized by dramatic and rapid mood cycles: severe highs (mania) and lows (depression). During these mood switches, the individual may exhibit any or all of the symptoms of a depressive disorder. When in the manic cycle, the individual may be hyperactive, garrulous, and full of energy. This often impairs thinking, judgment, and social behaviour in ways that cause serious problems and embarrassment.

Not everyone who is depressed or manic experience every symptom. Furthermore, while some individuals may experience a few symptoms others may experience many of the symptoms and in varying degree and duration. Still, at some point in their lifetime, everyone is susceptible to depression directly or indirectly.

Aggression

In general psychology, aggression describes any behaviour that can lead to physical and/or psychological harm to oneself, others or objects in the environment (Cherry, 2013). Aggression is usually expressed verbally, mentally or physically. These expressions also reflect the known forms of aggression: physical aggression, verbal aggression, mental aggression, and emotional aggression. Cherry (2013) maintains that aggression can serve to express anger or hostility, assert dominance, intimidate or threaten others, achieve a goal, or express possession. Furthermore, it can serve as a response to fear, a reaction to pain, or a response to competition.

According to Gould, Gould, and Jensen (2008), learned experience is an important determinant of aggressive behaviour in humans. The researchers maintain that triggers of aggression such as personal insults, status threats, and the presence of weapons are all learned sources of aggressive behaviour. Gould and colleagues are of the opinion that the psychological rewards that usually follow aggressive behaviour are the prime sustainers of aggression and also predict the recurrence of aggressive behaviour. As an example, the authors cite the situation where children learn that aggression can enable them to control resources such as toys and parental attention. Children also learn aggression by observing others behave aggressively. Children whose parents discipline with physical force tend to use more physical aggression when interacting with others, and parents who abuse their children were found to have been abused as children themselves (Gould, Gould, & Jensen, 2008).

Reliability and Validity

There are two major theoretical considerations or issues in constructing a measurement scale. These are the reliability and validity of the test. They answer the questions: "how well can the result of the test be relied upon? And to what extent does the instrument measure what it is meant to measure? A psychological and educational test is reliable to the extent that it produced similar result when the subject is repeatedly tested under the same conditions. It is the extent to which a test measures whatever it is measuring consistently. It shows the level of internal consistency of an instrument or its stability overtime (Joshua, 2005). Methods used in estimating reliability include test-retest, equivalent forms, split-half, Cronbach's alpha, Kuder-Richardson 20 and 21.

Validity is the most important property of a test. It is the extent to which an instrument actually measure what it purports to measure. Validity is also concerned with determining how well an instrument compares as a whole with or relates to anything external or internal to the instrument which accurately indicates what the test or instrument was intended to measure. The methods by which validity may be determined include content validity, criterion-related validity and construct validity (Aiken, 2000). All these procedures are used to the extent that they improve the understanding of what a test measures and provide information for making decision about people.

Construct validity is the most important aspect of validity because it provides evidence to support such as inference from a test score to the intended construct. It is the extent to which scores obtained from an instrument are indicative of an underlying theoretical construct. Messick (1989) suggested that construct validity embraces and subsumes all forms of validity evidence. According to Suen (1990), central to the process of construct validity is a sound construct theory. The theory should specify the internal structure of the construct, how construct manifests itself in other indicators, and how the construct relates to other variables. Construct validity of an instrument can be established through convergent and divergent validation. Convergent validity has to do with traits correlating strongly with instruments of other kinds designed to measure the same trait or that are thought to measure it. Divergent validity on the other hand is shown by the fact that the test correlates little or not at all with measures of other traits, whether by the same method or by other methods (Aiken, 2000) Aiken further asserts that evidence for the convergent and divergent validity of a psychometric instrument can be obtained by comparing correlations between measures of the following:

- The same construct using the same method (convergent)
- Different construct using the same method (divergent)
- The same construct using the different method (convergent)
- Different construct using the same method (divergent)

Campbell and Fiske (1959) introduced the multitrait-multimethod (MTMM) matrix as a means for construct validation and this gave impetus to the study of validity. Eid (2000) observed that MTMM approach can be applied when multiple traits are examined simultaneously and each of them is assessed by a given set of measures or measurement methods. In other words, MTMM is demonstrated when correlation between the same construct measured by the same and different methods are significantly higher than correlations between different constructs measured by the same or different methods. Correlation of scores obtained from an anxiety

measure with those obtain from a depression measure would be an example of convergent validity. For the same measure, divergent validity would be evidenced by a low and insignificant correlation with scores obtained from aggression measure, since aggression is an irrelevant variable in a measure designed to measure anxiety. Aggression is an opposite of anxiety. It is expected that an anxious person is not likely to be aggressive rather the person may become depressed. Anxiety would be more positively correlated to depression and depression negatively correlated to aggression. The use of these three constructs provides evidence of convergent and divergent validity. Conceptually, one would expect the correlation for reliability of two maximally similar measures of the same construct to be higher than the correlation between two maximally dissimilar measures of two different constructs (Aiken 2000).

Duckworth & Kern (2011) conducted a study using 33564 participants to meta-analytically examine evidence of convergent validity using measures of self-control. Results of the study demonstrated moderate convergence of $r = 0.27, 0.34, 0.33$ and 0.35 . In addition, correlations within and across types of self-control measures were strongest for informant-report questionnaire and weakest for executive function tasks. However they concluded that multidimensional construct is best assessed using multiple methods.

Raykov (2010) in his study aimed at outlining method for interval estimation of convergent and discriminant validity coefficients, as well as examining their population relationship illustrated on a data measuring guilt by self-report measures. Two diametric or opposite constructs, hostility guilt and morality conscience were measured by three methods: true-false, forced-choice and incomplete sentence tests (scales). The results showed that evaluating the population discriminant validity coefficient of the true-false tests for hostility guilt and morality conscience traits yielded a correlation estimate of .45. Alternatively, the convergent validity coefficient for the true-false and incomplete sentence measures of hostility guilt construct gave correlation estimate of .85. He further compared the convergent and discriminant coefficients in the studied population and saw that the former is markedly higher in population than the latter. In respect to consistence with theoretical expectations, the author concluded that convergent validity coefficients reflect relationships between different measures of the same traits whereas discriminant validity coefficients reflect considerably weaker relationships between different indicators of different traits.

Methodology

Subjects: The subjects comprised of thirty (30) senior secondary school students of University of Nigeria Demonstration Secondary School, Aba Campus. The ages of the subjects ranged from 15 to 18. The instruments numbering thirty (30) were administered to the subjects and collected on the spot.

Instruments: The instruments used were questionnaire and inventory. The questionnaire was constructed using a scale format in which subjects were asked to indicate the extent of their agreement to certain statements based on a four-point scale. The anxiety questionnaire was on four-point scale. For the Semantic differential scale, subjects were asked to indicate on seven point scale, how much the symptoms or statements listed have bothered them and how much they describe them. Each instrument was made up of ten (10) items. The items for anxiety and depression were adapted from Beck (1993) while that of aggression questionnaire were adopted from Buss and Perry (1992).

Scoring of Instruments: The items on a questionnaire for the three variables were scored on a 4-point scale ranging from strong agreement, to strong disagreement. For the Osgood (semantic differential scale) the rating was done on a 7-points scale. Scoring was reversed for all negatively worded items and negative polar adjectives.

Validation of Instruments: Inter-correlations between scales of similar traits were calculated to determine the validity of the scales with respect to convergence and divergence. Cronbach Alpha reliability was calculated for each scale and the reliabilities of different instruments are as shown on Table 1.

Table 1: Cronbach Alpha Reliability Coefficient for Measures of Anxiety, Depression and Aggression

Instrument	Trait	r
Questionnaire	Anxiety	0.85
	Depression	0.74
	Aggression	0.63
Semantic Differential	Anxiety	0.98
	Depression	0.76
	Aggression	0.79

Table 2: Correlation among six measures of three constructs resulting from two measurement methods

N=30

Measure	Likert Scale			Osgood Scale		
	AQ	DQ	AGQ	AS	DS	AGS
Questionnaire						
Anxiety	AQ	(0.76)				
Depression	DQ	0.49	(0.74)			
Aggression	AGQ	-0.45	-0.08	(0.63)		
Semantic						
Anxiety	AS	0.20	0.06	0.23		(0.98)
Depression	DS	0.33	0.49	-0.25	0.27	(0.85)
Aggression	AGS	-0.29	0.41	0.39	-0.22	-0.41
						(0.79)

Test of Hypotheses

The three hypotheses earlier stated were tested based on the correlations between the three traits measured with the same and different methods as shown on the matrix in Table 2.

Hypothesis One: There is no significant relationship between measures of anxiety and depression.

From the matrix in Table 2, it was observed that the relationship between anxiety and depression by two methods represented by AQ, AS and DQ, DS respectively are

$$r_{AQ/DQ} = 0.49, r_{AQ/DS} = 0.33, r_{AS/DQ} = 0.06, r_{AS/DS} = 0.02$$

The above relationship between anxiety and depression are significant, positive and greater than zero. The null hypothesis is therefore rejected on the basis of this result. This result confirms the view of Minirth and Meier (1988) that anxiety and depression are similar traits. Suen (1990), Raykov (2010) and Duckworth & Kern (2011) affirm a significant relationship between measures of similar constructs.

Hypothesis Two: There is no significant relationship between measures of anxiety and aggression

Aggression measures are represented by AGQ and AGS in the matrix, Table 2, the following relationship exist between anxiety and aggression:

$$r_{AQ/AGQ} = -0.25, r_{AQ/AGS} = -0.41, r_{AG/AGI} = -0.22$$

The relationships are low, negative and non-significant. The null hypothesis is therefore upheld. This result indicates that anxiety and aggression are diametric traits. An anxious individual is usually nervous, fearful and unsteady unlike an aggressive person who is fearless, harsh and easily gets into arguments (Anderson & Dill, 2000; Smith & Kendoll, 2008).

Hypothesis Three: There is no significant relationship between measures of depression and aggression.

From the matrix in Table 2, it was observed that:

$$r_{DQ/AGQ} = -0.08, r_{DQ/AGS} = -0.20, r_{DS/AGQ} = -0.45, r_{DS/AGS} = -0.29$$

The null hypothesis is rejected and the alternate hypothesis upheld. The low, negative and non-significant result was expected because measures of maximally dissimilar constructs do not have high correlation (Aiken, 2000; Raykov, 2010; and Suen, 1990). Overall, the rejection of the first hypothesis and retention of the second and third hypotheses based on the correlation as shown in the matrix confirms the convergent and divergent validities of the instruments. The instruments therefore are valid and reliable measures of anxiety.

Discussion of Results

The anxiety (A), depression (D) and aggression (AG) measures using two methods questionnaire (Q) and semantic differential scale (S) showed a convergent validity of 0.20, 0.49 and 0.39 respectively. These results establish the assumption of Campbell and Fiske (1959) and findings of Raykov (2010) that correlations among measurement of the same traits by different methods should be highly significant. The next assumption that convergent validity should be higher than correlation between measurements of different traits by different methods was established for one.

$$\begin{aligned} r_{AQ/AS} &> r_{AS/DQ}; \quad r_{AS/AGQ} \\ 0.20 &> 0.06; \quad 0.23 \end{aligned}$$

The case of non-establishment of the assumption for different measures of anxiety and aggression may be as a result of the number of items for the measures and the sample size being too small and may not have covered an adequate area of the universe intended or due to the random responses on the part of the respondents.

The convergent validity should be higher than the correlations between measurements of different traits by the same method. This was established for all cases.

$$r_{AQ/AS} > r_{AS/DS} > r_{AS/AGS}$$

$$0.27 > 0.20 > -0.22$$

This finding is consistent with those of Raykov (2010).

The pattern of correlation between measurements of different traits by same method should be similar from method to method. Table 3 shows similarities in the correlation pattern. The validity of the two instruments had been established since the correlation pattern is consistent with the Campbell and Fiske (1959) method. The instrument therefore is useful for measuring anxiety.

Table 3: Summary of Relationships between Traits using PPMC

Traits	Methods	r's
Anxiety and Depression	AQ & DQ	0.49
	AQ & DS	0.33
	AS & DQ	0.06
	AS & DS	0.27
Anxiety and Depression	AQ & AGQ	-0.25
	AQ & AGS	-0.41
	AS & AGQ	0.23*
	AS & AGS	-0.22
Depression and Aggression	DQ & AGQ	-0.08
	DQ & AGS	-0.20
	DS & AGQ	-0.45
	DS & AGS	-0.29

*Assumption not established.

Conclusion

It was observed that the different measures of anxiety correlated highly, measure of similar construct; depression also gave a positive relationship. In contrast, measures of aggression gave low and negative relationship. These observations confirm the assumption that correlation coefficient of two maximally similar measures of the same construct should be higher than correlation between two maximally dissimilar measures of two different constructs. Given the results of this study as presented supra, multitrait-multimethod matrix is adequate for establishing convergent and divergent validity of measures. Finally this paper will provide psychologist and the measurement community with added impetus to adopt the multitrait-multimethod matrix method for construct validation of measures.

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