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12-Item Depression, Anxiety, And Stress Scales (Dass-12): Associations With Self-Report Measures, A Semi-Strcutured Interview, And Behavioral Tasks

Eu Gene Chin
University of Mississippi

12-ITEM DEPRESSION, ANXIETY, AND STRESS SCALES (DASS-12): ASSOCIATIONS WITH SELF-REPORT MEASURES, A SEMI-STRCUTURED INTERVIEW, AND BEHAVIORAL TASKS

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EU GENE CHIN

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ABSTRACT

To date, only one study has examined the psychometric properties of the 12-item Depression, Anxiety, and Stress Scales (DASS). Moreover, all psychometric studies conducted with the DASS-21 have focused narrowly on associations with semi-structured interviews and other relevant self-report measures. In order to address these limitations, I proposed to diversify the ways in which we examine the DASS instrument (for both the 12- and 21-item versions). First, I examined the extent to which the DASS instrument is able to predict responses to behavioral tasks and whether the DASS was able to produce hypothesized convergent and divergent relationships with relevant self-report measures. Second, I examined how well the DASS predicted diagnoses gleaned from semi-structured interviews. Third, I estimated the reliability of the DASS with Raykov's reliability estimates and Cronbach's alpha values. Results across these analyses suggest that the DASS-12 and DASS-21 possess acceptable psychometric properties when measuring general psychological distress. However, both instruments lacked compelling evidence for being able to account for symptoms of anxiety, depression and stress after factoring in general psychological distress. Recommendations such as revising DASS-items, generating new items, or simply using the total score are discussed in the context of a broader taxonomy of anxiety and mood disorders.

DEDICATION

I dedicate this dissertation to God, who gave me the intellect, desire, and determination to learn all things that are fearfully and wonderfully made. I also dedicate this dissertation to my wife, who was by my side through easy and hard times – my constant supporter regardless of the circumstances. I also dedicate this dissertation to my parents, who sacrificed their time, finances, and energy investing in my life for the past 20+ years. Lastly, I dedicate this dissertation to countless colleagues, advisors, and friends met along the way that have shaped my journey and supported me throughout this invaluable time spent at the University of Mississippi.

LIST OF ABBREVIATIONS AND SYMBOLS

APA	American Psychological Association
ADIS-IV	Anxiety Disorders Interview Schedule for the 4th edition of the Diagnostic Statistical Manual
ANOVA	One-Way Analyses of Variance
AUC	Area Under the Curve
BIS/BAS	Behavioral Inhibition and Behavioral Activation Scales
BAS	Behavioral Activation System
BSI	Brief Symptom Inventory
DASS-12	12-item Depression, Anxiety, and Stress Scales
DASS-21	21-item Depression, Anxiety, and Stress Scales
DASS-42	42-item Depression, Anxiety, and Stress Scales
DSM-IV	Diagnostic and Statistical Manual-4th Edition
DSQ	Diagnostic Symptom Questionnaire
BDI	Beck Depression Inventory
BDI-II	Beck Depression Inventory-2nd Edition
BAI	Beck Anxiety Inventory
CFA	Confirmatory Factor Analysis
GAD	Generalized Anxiety Disorder
GHQ	General Health Questionnaire
HADS	Hospital Anxiety and Depression Scale

ICD-10	10th edition of the International Classification of Disease
LISREL	Linear Structural Relations
MDD	Major Depressive Disorder
MINI	Mini International Neuropsychiatric Interview
NA	Negative Affect
NPV	Negative Predictive Power
NOS	Not Otherwise Specified
PANAS	Positive and Negative Affect Scale
PA	Positive Affect
PD	Panic Disorder
PPV	Positive Predictive Power
PSWQ	Penn State Worry Questionnaire
Q-Q Plot	Normal Probability Plot
ROC	Receiver Operating Curve
sAD	Personal Disturbance Scale
SCID-IV	Structured Clinical Interview for DSM-IV
SPSS	Statistical Package for Social Sciences
STAI	State Trait Anxiety Inventory
SWLS	Satisfaction with Life Scale

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INTRODUCTION

Lovibond and Lovibond (1995) developed the Depression, Anxiety, and Stress Scales to maximize the ability to discriminate between anxiety and depressive symptoms without significantly compromising the breadth of symptoms assessed. The original instrument consisted of 42-items generated via iterative empirical methods and current theoretical models of anxiety and depression at that time. The instrument was the first of its kind that measured depression (i.e., depression subscale), physical arousal (i.e., anxiety subscale), and generalized anxiety (i.e., stress subscale) symptoms in an integrated manner. The DASS-42 demonstrated good internal consistency, temporal stability, and better separation of anxiety and depressive symptoms compared to other relevant measures (Brown, Chorpita, Korotitsch, & Barlow, 1997; Lovibond & Lovibond, 1995)

Subsequently, Antony, Bieling, Cox, Enns and Swinson (1998) conducted a psychometric analysis of the 21- and 42-item DASS (DASS-21 and DASS-42 respectively) to determine whether an abbreviated version of the measure would yield comparable psychometric properties. Results suggested that the DASS-21 was preferable to the DASS-42 because it yielded a more stable factor structure (i.e., less cross-loadings between factors and higher mean loadings on hypothesized factors) and was a more efficient assessment tool since it contained less items compared to the DASS-42. Since then, the DASS-21 has been used frequently in a variety of treatment outcome studies – for instance, it has been used with inpatient psychiatric patients (Ng et al., 2007), inpatient and outpatient depressed individuals (Page, Hooke, & Morrison, 2007),

patients with brain tumors or traumatic brain-injury (Ownsworth, Little, Turner, Hawkes, & Shum, 2008), and war-veterans (Allen et al., 2011). This is likely due to the instrument having good psychometric properties, its ease of administration, and the fact that it is freely available.

The literature review that follows provide a more detailed account of psychometric studies conducted with the DASS-21 and a recently reduced 12-item DASS. Specifically, the literature review includes convergent and divergent validity with other self-report questionnaires, associations with semi-structured and unstructured interviews, and recent factor structure results of the DASS instrument. The literature review will then conclude in a description of the current study that is aimed to (1) replicate known psychometric properties of the DASS-21 with the 12-item DASS and (2) provide a more thorough examination (methodologically and statistically) of the recently proposed 12-item DASS. In order to achieve the aforementioned goals, I proposed to examine how anxiety, depression, stress, (i.e., subscale scores) and generalized psychological distress (i.e., total score) would associate with other self-report measures, a semi-structured interview, and a variety of behavioral validation tasks.

Convergent and divergent validity with other self-report questionnaires

A scale's ability to measure a specific latent variable is an issue of validity (DeVellis, 2003). Convergent and divergent validity, in particular, are important domains that reveal whether or not a scale is able to predict the hypothesized relationships to measures of other constructs. Two theoretically similar constructs should demonstrate higher correlations with each other (i.e., convergent validity) compared with two theoretically *dissimilar* constructs (i.e., divergent validity). There is no cutoff that defines adequate discriminant and convergent validity

(DeVellis, 2003). Rather, researchers have greater confidence in a scale's validity to the extent that the scale is able to reproduce the convergent-divergent pattern of correlations.

Antony et al. (1998) calculated correlations between the DASS-21 subscales, Beck Depression Inventory (Beck, Rush, Shaw, & Emery, 1979), Beck Anxiety Inventory (Beck & Steer, 1990), and State Trait Anxiety Inventory (Spielberger, 1983) with an outpatient clinical sample. Compared with all possible correlation combinations between the DASS-21 and the three aforementioned self-report measures, the DASS-21 depression subscale produced the highest correlation with the BDI (r = .79) and the DASS-21 anxiety subscale produced the highest correlation with the BAI (r = .85). The DASS-21 stress subscale, on the other hand, produced correlations that were comparable in strength with all three instruments (r = .69 with BDI; r = .70 with BAI; r = .68 with STAI-T). The authors replicated this pattern of correlations with the original 42-item DASS. In summary, Antony et al. (1998) deduced that these results provide evidence to believe that the DASS-21 functions in a similar manner with the DASS-42.

Henry and Crawford (2005) administered the DASS-21 with a non-clinical sample and calculated correlations between the DASS-21 subscales, Positive and Negative Affect Scale (Watson, Clark, & Tellegen, 1988), Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), and the Personal Disturbance Scale (sAD; Bedford & Foulds, 1978). The correlation between the PANAS Positive Affect (PA) scale and DASS-21 depression scale was significantly higher than the correlations between PANAS-PA and the other two DASS-21 subscales. The correlation between the PANAS Negative Affect (NA) and DASS-21 stress scale was significantly higher than the correlation of PANAS-NA with the other two DASS-21 scales. The DASS-21 also replicated convergent and discriminant validity results found with the DASS-

42, sAD and HADS. Thus, Henry and Crawford (2005) concluded that the DASS-21 performs similarly to the DASS-42.

Norton (2007) examined the DASS-21 in relation to the PANAS, BDI, and BAI with a diverse sample of African American, Caucasian, Hispanic, and Asian undergraduate students. Norton calculated partial eta-squared statistics ($\eta\rho^2$) to estimate the unique proportion of DASS-21 variance accounted by each predictor (i.e., PANAS, BDI, and BAI). The BDI had a stronger significant association with the DASS-21 depression subscale ($\eta\rho^2 = .203$) than the BAI or any of the PANAS subscales. The BAI had a stronger association with the DASS-21 anxiety subscale ($\eta\rho^2 = .205$) than the BDI or any of the PANAS subscales. Contrary to their hypothesis, however, the DASS-21 stress subscale showed weaker relationships (compared to the aforementioned associations) with the PANAS-NA ($\eta\rho^2 = .083$), BDI ($\eta\rho^2 = .099$), and the BAI ($\eta\rho^2 = .052$). Since the DASS stress scales lacked evidence for divergent validity, the authors speculated that the stress construct overlaps with both anxiety and depression.

Based on Lovibond and Lovibond's (1995) assertion that the DASS-42 stress subscale measures a construct that is independent of the anxiety and depression subscales, Szabo (2010a) conducted a study to investigate whether the DASS stress subscale would produce a specific association with worrying (a hallmark feature of Generalized Anxiety Disorder; GAD) in a sample of undergraduate students. Total scores on the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990), relative frequency of worry, and uncontrollability of worry were each entered as dependent variables in three separate regression analyses. In each analysis, the DASS depression subscale was entered at the first step, followed by the DASS anxiety subscale, and the DASS stress subscale as the last step. In all three regressions, the DASS stress subscale explained a significant amount of variance that was not explained by the

depression and anxiety subscales. In conclusion, Szabo (2010a) suggested that the DASS-42 stress subscale is useful for assessing the emotional experience associated with self-reported worrying.

Associations with semi-structured and unstructured interviews

Mental health professionals often assign diagnoses after conducting an interview with patients. Clinicians in applied settings typically conduct these interviews in an unstructured manner, while researchers more often employ semi-structured interviews. Structured methods are well researched and tend to produce more reliable results compared to unstructured interviews (Dawes, Faust, & Meehl, 1989). The issue of criterion validity with the DASS relates to the extent to which the DASS empirically associates with results gleaned from interviews (both structured and unstructured). Put another way, the validity and clinical utility of the DASS (or any measure for that matter) relates to how it can predict actual diagnoses. The following subsection will focus on DASS studies conducted with semi-structured and unstructured interviews.

Antony et al. (1998) administered the Structured Clinical Interview for DSM-IV (SCID-IV; First, Spitzer, Gibbon, & Williams, 1996) to compare DASS-21 scores across diagnostic groups. Based on a series of one-way analyses of variance (ANOVAs) and Duncan's multiple-range tests, Antony et al. (1998) reported that patients diagnosed with Major Depressive Disorder (MDD) tended to score highest on the DASS-21 depression and stress subscales. On the other hand, patients diagnosed with Panic Disorder (PD) scored highest on the anxiety subscale. In addition, the non-clinical comparison group produced lower scores on all three-DASS-21

subscales compared to those in the clinical group. The authors deduced that the DASS-21 does a good job of measuring depression and panic symptoms in clinical and non-clinical groups.

Ng et al. (2007), on the other hand, examined DASS-21 scores across the 10th edition of the International Classification of Disease (ICD-10; World Health Organization, 1993) diagnoses assigned by psychiatrists. The authors calculated the average score of the DASS-42 for each subscale and compared scores according to each diagnostic category. Ng et al. (2007) reported significant differences in DASS-42 subscale scores across diagnostic groups at admission, but not at discharge. This pattern of results was replicated for each DASS-21 subscale. In addition, patients in the personality disorder group had the highest DASS-21 average scores at admission and discharge. In addition, all diagnostic groups demonstrated 45-55% of improvements in DASS-21 subscale scores. These improvements generally corresponded with one self-report measure (14-item Mental Health Questionnaire; Ware & Sherboune, 1992) and two clinician-rated scales (Health of the Nation Outcome Scales; Wing, Curtis, & Beevor, 1996; Clinical Global Impressions; Guy, 1976). These findings support the notion that the DASS-21 detects symptom severity differences between diagnostic groups at admission and is sensitive to changes in symptom severity.

Gloster et al. (2008) analyzed data from SCID interviews and self-report questionnaires with a group of clinical patients seeking treatment to manage worry. Based on the SCID, the authors used a subsample of patients assigned to four diagnostic groups: GAD, Mood Disorder (i.e., MDD, dysthymia, or depressive disorder NOS), comorbid GAD and Mood Disorder, and no diagnosis. Based on receiver operating curve (ROC) analyses, Gloster et al. (2008) reported that the DASS-21 stress scale predicts the diagnostic presence of GAD as well as the PSWQ and PANAS NA subscale. In addition, the DASS-21 depression scale performs equally well as the

BDI-II in predicting the diagnostic presence of mood disorders. Gloster et al. (2008) concluded that the DASS-21 is a viable alternative screening instrument that can be used to measure GAD and mood symptoms because it is easy to administer and yields additional information via its three integrated scales.

Mitchell, Burns, and Dorstyn (2008) examined the performance of the DASS-21 as a screening tool in comparison with the Brief Symptom Inventory (BSI; Derogatis & Spencer, 1982) and the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998). The authors calculated correlations between the DASS-21 and BSI as well as sensitivity and specificity values for the DASS-21, BSI, and MINI. The DASS-21 and BSI demonstrated good convergent validity, but poor discriminant validity with each other. Using traditional cut-off scores, the DASS-21 and BSI demonstrated good sensitivity for depression (57% agreement for both measures) and anxiety (86% agreement for both measures). The BSI, however, demonstrated better specificity for depression (82% for BSI; 76% for DASS-21) and anxiety (88% for BSI; 64% for DASS-21). Given that screening tools prioritize the importance of minimizing the risk of producing false negative results (i.e., maximizing sensitivity) over the risk of false positive results (i.e., maximizing specificity), Mitchell, Burns, and Dorstyn (2008) concluded that the DASS-21 serves as a promising alternative screening tool for assessing depression and anxiety symptoms for patients with spinal cord injury.

Factor structure

Factor analysis allows us to (1) empirically determine how many latent constructs underlie a scale and (2) determine the fit of a theoretical model on the observed covariation of items with each other. This analytic tool is important for developing the DASS instrument since

the DASS allows multiple latent variables to serve as causes of variation in its set of items. Once a researcher ascertains the latent structure, one would estimate the proportion of true score variance to total observed variance for each latent structure (i.e., reliability). Results from studies conducted to date are limited because they use Cronbach's (1951) coefficient alpha, a reliability index that assumes indicators of a given factor have equal factor loadings with differing measurement error – a condition that is typically not true in datasets (Raykov 2001b; 2004). Even though Cronbach's (1951) coefficient alpha remains the most typical method for evaluating reliability, we no longer have to make this assumption because computer programs (e.g., LISREL; Joreskog & Sorbom, 2006) can calculate more precise reliability estimations; thus, it it important that psychological researchers update their reliability analytical approach. The following subsection will describe a series of previous factor analytic and reliability investigations conducted with the DASS.

Anthony et al. (1998) conducted an exploratory factor analysis with two DASS versions (DASS-42 and DASS-21) based on an outpatient clinical sample treated for anxiety and mood disorders. They used principal components extraction and, based on eigenvalues and a scree test, determined the optimal factor solution for the 42-item and 21-item DASS. Both measures displayed similar factor structures with each other. The DASS-21, however, produced lower intercorrelations between factors, less cross-loading items, and higher mean loadings compared to the DASS-42. In terms of reliability, the 42-item DASS produced the following Cronbach (1951) coefficient alpha values: .97 for depression, .92 for anxiety, and .95 for stress. Similarly, the 21-item DASS produced the following values: .94 for depression, .87 for anxiety, and .91 for stress. Overall, Anthony et al. (1998) suggested that the DASS-21 is a better instrument because

it has a more cohesive factor structure compared to the DASS-42 and has similar reliability performance with the DASS-42.

Clara, Cox, and Enns (2001) tested seven possible DASS models via confirmatory factor analysis (CFA) in an outpatient adult sample referred for mood disorders: (1) two variants of the 42-item three factor DASS model, (2) two variants of the 21-item three factor DASS model, and (3) three variants of the 15-item DASS model. Results suggested that Lovibond and Lovibond's (1995) DASS-21 three-factor structure met the minimum criteria of four good fit indices and explained more model variance compared to the alternative DASS-21 model. In addition, Lovibond and Lovibond's (1995) DASS-21 model showed better fit over the 42-item DASS models. Cronbach's (1951) coefficient alpha values for each subscale were as follows: .81 for anxiety, .92 for depression, and .88 for stress. In conclusion, Clara et al. (2001) suggested that Lovibond & Lovibond's (1995) DASS-21 model provided the best fit over all the aforementioned factor structure models.

Based on a non-clinical adult sample, Henry and Crawford (2005) tested a series of CFA models: (1) Lovibond and Lovibond's (1995) model, (2) Lovibond and Lovibond's (1995) model imposed on the remaining 21 items obtained from DASS-42, (3) a confirmatory bifactor model, and (4) the tripartite model (Clark and Watson, 1991). Results based on pre-specified fit indices suggested that the confirmatory bifactor model, which splits the variance between a common "distress" dimension and more specific subscales, provided the best fit compared to other models. Cronbach's (1951) coefficient alpha values were .88 for depression, .82 for anxiety, .90 for stress, and .93 for the total score. These reliability and factor analysis results support the conclusion that the bifactor model provides the best fit for the DASS-21 instrument.

Similarly, Szabo (2010b) found evidence for a general psychological distress factor in youth ages 11-15. The author examined a series of one-, two-, and three-factor models in addition to a confirmatory bifactor model. The majority of pre-specified fit indices suggested that the bifactor model provided a better fit over the next best fitting model (i.e., the original model proposed by Lovibond & Lovibond, 1995) in a young adolescent sample. Cronbach (1951) coefficient alpha values were .87 for depression, .79 for anxiety, and .83 for stress (no reliability estimates for the total score). In conclusion, Szabo (2010b) suggested that the DASS-21 measures three affective states and a general dimension of psychological distress in children, similar to how the DASS-21 performs in adult and older adolescent populations.

In order to improve on the bifactor model of the DASS, Chin, Ebesutani, Buchanan, & Young (2015) conducted an exploratory bifactor analysis, a type of analysis that allows researchers to examine how items perform without constraint for where items "should" load on to sub-factors (c.f., Reise, Moore, & Haviland, 2010). Results based on a non-clinical college sample strongly suggested the presence of a general factor, which accounted for 80% of variability in responses. Findings from this phase of study were then used to derive a twelve-item version of the DASS, which only comprised items that loaded sufficiently on the general factor and maintained specificity for their hypothesized subscales (i.e., bifactor structure). A multigroup confirmatory factor analysis (MGCFA) suggested that the condensed instrument was invariant across ethnicity, but not across gender. The authors concluded these preliminary results support the idea that a 12-item DASS has the potential to function like the 21-item DASS.

Current Study

There is a need to examine the psychometric properties of the DASS-12 because, to date, only one study has attempted to do so (i.e., Chin et al., 2015). Furthermore, all DASS

psychometric studies conducted to date have only utilized self-reports, clinician ratings, or clinical interviews (i.e., methods that rely predominantly on memory and verbal report). Thus, given the limited scope of previous studies in terms of establishing convergent and discriminant validity, I included a broader array of instruments in order to advance the psychometric study of the 12-item DASS. In view of these limitations, several traits were measured via several methods to see whether (1) different methods would produce convergent results when measuring the same trait and/or (2) similar methods would produce divergent results when measuring different traits. In addition, previous studies have only estimated the DASS reliability with Cronbach's (1951) coefficient alpha. Even though this reliability index is widely used, it can underestimate or overestimate scale reliability, depending on underlying measurement parameters (Raykov, 2001a, Zimmerman, 1972). A CFA-based method of estimating scale reliability (Raykov, 2001a; 2004) makes less assumptions about underlying measurement parameters compared to Cronbach's coefficient (1951) alpha; thus, Raykov's Reliability values were calculated to estimate the reliability values of the DASS total scale and subscale scores.

Broadly speaking, my goal was to examine whether known psychometric properties of the DASS-21 would be replicated (and possibly improved) with the 12-item DASS and to provide a more thorough methodological and statistical approach to examine the psychometric properties of the DASS-12 and DASS-21. This dissertation is composed of a series of studies. In the first study, I conducted multiple correlational analyses between DASS instruments and other self-report measures and hierarchical regressions between DASS instruments and indices from behavioral tasks. In the second study, I conducted ROC analyses to examine the extent to which the DASS instruments are able to predict diagnostic categories gleaned from a semi-structured interview. In the third study, I examined Raykov's reliability and Cronbach's alpha estimates for

the DASS instruments to determine whether Cronbach's alpha would consistently overestimate reliability of the DASS-12 and DASS-21 subscales.

GENERAL METHOD

The following three studies represent a series of studies conducted with two college student samples in Mississippi. Data analyses for the second (Study 2: Comparison with a semi-structured interview) and third (Study 3: Reliability of bifactor structure) studies were conducted based on archival data. The first Study (Study 1: Validity with other self-report measures and behavior tasks) constituted a new wave of data collection. Each study recruited participants by announcing an opportunity to earn experimental credit. For Study 1, the research assistant informed the participant that he/she would have the opportunity to earn extra experimental credit above what they would originally earn via attendance. A detailed rationale for this specific procedure is in the next subsection. To increase ease of readability, I will only refer to the DASS-12 in the rest of the methods section; however, all analyses conducted with the DASS-12 were replicated with the DASS-21.

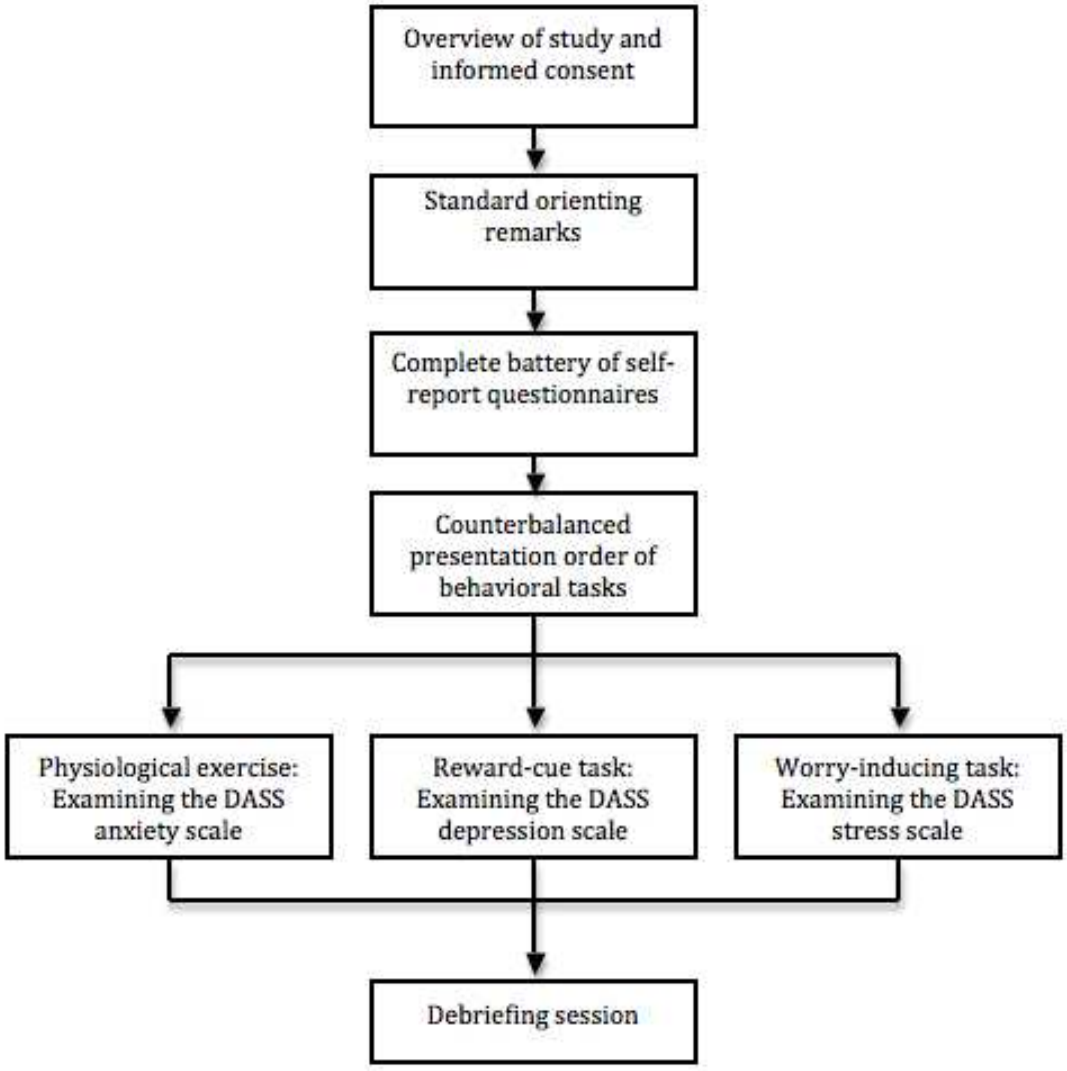
STUDY 1: VALIDITY WITH OTHER SELF-REPORT MEASURES AND BEHAVIOR TASKS

Method

During the appointed study time, the research assistant provided a brief overview of the study (see Figure 1 for overview of procedures) and asked that the participant provide informed consent. The research assistant then provided a standard set of orienting remarks in which the project is portrayed as part of a larger study that examines pattern recognition. Specifically, the research assistant informed the subject that the ability to recognize patterns is related to intelligence, intuition, and predisposition to emotional states. The goal of the project was to purportedly examine how these variables affect the intuitive process. The research assistant also reminded the participant that he/she would have the opportunity to earn extra credit if he/she performed sufficiently well in two behavior tasks (i.e., reward- and worry-cue task). This set of orienting remarks was modeled according to how Carver & White (1994) instructed their participants in their Behavioral Inhibition and Behavioral Activation Scales (BIS/BAS) validation study.

After giving the above-mentioned set of orienting remarks, the research assistant explained that the participant would need to complete a battery of self-report measures (reviewed in detail in the materials section below) to control for the effects of transient emotional states. Specifically, the participant completed the 21-item Depression, Anxiety, and Stress Scales

Figure 1. Overview of procedures for Study 1: Validity with other self-report measures and behavior tasks



(DASS-21; Lovibond & Lovibond, 1995), Positive and Negative Affect Scales (PANAS; Watson, Clark, and Tellegen, 1988), Beck Anxiety Inventory (BAI; Beck & Steer, 1990), Beck Depression Inventory-II (BDI-II; Beck, Brown, & Steer, 1996), Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990), General Health Questionnaire (GHQ; Goldberg, 1978), and Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985).

Procedure for behavioral tasks

After completing the self-report instruments mentioned above, the research assistant led the student into the laboratory room and gave an overview for the next part of the study. The participant then engaged in behavioral tasks described below, with presentation order counter-balanced across participants. Each task was designed to elicit responses theoretically related to anxiety, depression, and stress. During various times in each task, the research assistant explained that the participant would fill out a self-report scale to continue to control for the effects of transient emotional states during these behavioral tasks.

Physiological exercise: Examining the DASS anxiety subscale

Anxiety was operationalized as a construct that is primarily focused on somatic symptoms because past studies (i.e., Anthony et al., 1998; Norton 2007) have found a strong association between the Beck Anxiety Inventory (Beck & Steer, 1990) and the DASS anxiety subscale. In order to engage the somatic component of anxiety, an interoceptive exercise that entailed breathing through a narrow straw for two minutes was implemented. This task was selected among several common in literature examining PD (i.e., somatic symptoms of anxiety) because Antony, Ledley, Liss, and Swinson (2006) reported that it (1) produced the greatest number of panic-related symptoms; (2) was the only exercise that produced a mean intensity of physical symptoms greater than 2 on a 0 – 8 Likert-type scale of subjective units of distress; (3) was rated highest for being similar to naturally occurring panic attacks; and (4) had the highest percentage of participants who experienced at least moderate levels of fear ($\geq$ 4 on a 0 – 8 Likert-type scale) compared to twelve other physiological exercises.

Assessing the Dependent Measure

The research assistant collected heart rate recordings before and after the participant engaged in the breathe-through-straw exercise. In order to obtain baseline heart rate recordings, the participant sat in the room alone for 5 minutes while connected to a heart rate monitor (I-330-C2+; J&J Engineering, 2004). Heart rate recordings were recorded every 100 milliseconds and the average of these recordings were used as the baseline heart rate recording. The research assistant then came back into the room and instructed the participant how he/she should engage in the breathe-through-straw exercise. During engagement in the interoceptive exercise for two minutes (or as long as the the participant was willing/able to persist), the research assistant collected another set of heart rate recordings to use as the post-heart rate recording. The difference between the mean baseline heart recording and the post-heart rate recording served as my physiological arousal dependent measure. Thus, the change score was the relevant metric of examination in the regression analyses that follow.

In order to assess individuals self-perceptions of fear intensity encountered on the basis of this task, the participant responded to an item taken from the Diagnostic Symptom Questionnaire (DSQ; Sanderson, Rapee, & Barlow, 1989). Similar to previous studies employing somatic activation tasks (cited above), this item required the participant to rate subjective fear on a 0 (no fear) to 8 (intense fear) scale. Although the DSQ comprises other questions as well (e.g., rate similarity of these feelings to their naturally occurring panic attacks, if any), I only analyzed this specific question for the purposes of the present study (akin to the method used by Antony et al. (2006).

Reward-cue task: Examining the DASS depression subscale

Depression was conceptualized as a mood disorder that is influenced by one's tendency to respond to reward cues (i.e., a temperamental trait called positive affect). This term is derived from the tripartite theory of anxiety and depression (Clark & Watson, 1991), which posits that a lack of positive affect is centrally relevant to the development of depressive symptoms. Concurrently, other research groups present similar findings, albeit via different research traditions. Carver and White (1994), for instance, hypothesized that deficits in the behavioral activation system (BAS) predicted depressive symptoms. From an evolutionary perspective, the BAS is theorized to be part of a neurological system that regulates behavior aimed toward signals of reward and escape from punishment. Thus, a faulty or suppressed function in this system could promote anhedonia and avoidance, which could in turn contribute to depressive symptoms (similar to the tripartite conceptualization of PA). Thus, this study created a scenario that engaged the positive affect trait or behavioral activation system. In order to do this, the research assistant presented a reward stimulus and recorded self-rated mood ratings before and after the participant engaged in a reward-cue task. These procedures were modeled directly after Carver and White's (1994) Behavioral Activation Scale validation study. The rest of this subsection describes the procedures in detail.

The research assistant reminded the participant that he/she had the opportunity to earn an extra experimental point by earning sufficient points in the reward- and worry-cue tasks. The research assistant then explained instructions on how each participant should work on a pattern recognition task and demonstrated it with one sample item. Each item consisted of 6 numbers and alphabetical characters presented on each page. Ostensibly, the first five characters represented a sequence but the 6th character may or may not be part of the overall sequence. The

participant's task, then, was to determine whether or not the 6th character was part of the overall sequence by selecting yes or no on a response choice sheet. The research assistant then explained that he/she had 8 seconds to make this decision for each item and explicitly instructed the participant to use his/her intuition (instead of logic) to make their decision. The characters in each item were only designed to look like a genuine sequence but, in reality, did not represent an actual sequence. The research assistant then explained that good performers would get seven out of ten items correct. A good performance on each block wins the participant one "game point" and the participant gets six trials to potentially earn up to six "game points" in total (one extra experimental credit requires an accumulation of 10 "game points" in the reward- and worry-cue tasks). After making sure the participant understood the instructions, the research assistant administered the task with the participant.

Assessing the Dependent Measure

Before and after the participant completed the reward-cue activity, the participant rated how much he/she agreed with the statement "I feel very happy on a 1 (strongly disagree) to 6 (strongly agree) Likert-type scale (Carver & White, 1994). The difference between these two ratings constituted the dependent measure for this task. I embedded this item among distractor items that measured other affect qualities so the participant will not focus too much on the affect (i.e., happiness) that is being measured (c.f., Carver & White, 1994). The use of a single item as my dependent variable is also supported by studies that report robust performance for single-item rating scales versus longer questionnaires (Burisch, 1984a, 1984b). Collectively, I named the compilation of these self-report items the 'affect-rating scale' (refer to Appendix A), which was the title visible when the research assistant explained procedures to participants.

Reward Cue Manipulation

After completing ten items (constituting one block), every participant submitted their response choice sheet to the research assistant. The research assistant then graded their choices and provided written positive feedback at the end of the first block regardless of how the participant performed. The feedback page displayed descriptive results of their "good performance" (70% correct responses) and the total number of points accumulated to that point. To simulate authenticity, feedback given for the second block was not as successful. Consequently, the participant received a feedback that displayed his/her "under-par performance" (50% correct responses). The participant, however, "won" the third (70%), fourth (70%), fifth (80%), and sixth (70% blocks). It was predicted that the feedback of good performance at the sixth block would serve as a reward cue and would alter the participants' happiness ratings. Once the participant completed the task, the research assistant then reminded the participant that it was time to fill out another 'affect-rating scale' to control for transient emotional states. The completion of the affect-rating scale marked the end of the reward-cue task.

Worry-inducing task: Examining the DASS stress subscale

I conceptualized stress as the emotional experience associated with worrying, which is concordant with prior theoretical discussions contained in the DASS literature. For example, Szabo (2010a) reported that (1) the DASS-42 stress subscale predicted a significant increase in the amount of variance of the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) on top of what was already explained by the DASS-42 anxiety and depression subscales and (2) DASS-42 stress items tended to have strong associations with the

total PSWQ score while only one DASS-42 anxiety item displayed a strong association with the total PSWQ score. Moreover, Gloster et al. (2008) reported that the DASS-21 stress scale predicted the presence of GAD (a disorder characterized by worrying) as well as the PSWQ and Negative Affect subscale (Watson et al., 1988). Therefore, I intended to create a situation whereby participants engaged in worry. In other words, I wanted to get to them to anticipate an aversive event that is about to occur (detailed procedures appear below).

Assessing the Dependent Measure

Before engaging in the worry-inducing task, the participant filled out an 'affect-rating scale' that consisted of one item embedded among distractor items. The item I was interested in was the participant's endorsement for the item "I worry too much about the future" on a 1 (strongly disagree) to 6 (strongly agree) Likert-type scale. After engaging in the worry-inducing task (i.e., after spending 10 minutes preparing a speech), the research assistant then came back into the room and requested the participant complete another affect-rating scale before he/she delivered his/her speech. The difference between both ratings constituted the dependent measure for this task.

Worry Cue Manipulation

The research assistant explained to the participant that he/she had 10 minutes to prepare a speech on "how psychology is relevant to everyday life". The research assistant then told the participant that it was necessary for his/her speech to be at least 3 minutes, but that it was preferable for him/her to speak for 10 minutes. His/her performance was recorded on video and was purportedly going to be evaluated by a panel of graduate students and faculty members. The participant was informed that this panel of judges would determine the number of points he/she

deserves based on the quality of their speech (total number of points that could be earned in the worry-cue task is 5 points). The research assistant then left the room to give the participant 10 minutes to prepare a speech. After 10 minutes, the research assistant came back into the room and asked that he/she complete another 'affect-rating scale' while the research assistant set up the video camera. Once the participant completed the 'affect-rating scale', he/she then delivered the speech. The end of the speech concluded the worry-cue manipulation task.

Debriefing Procedures

After completion of behavioral tasks, the research assistant immediately debriefed the participant and informed him/her that everyone earns the extra experimental credit regardless of his/her performance. The research assistant also explained that the cover story was necessary to temporarily conceal the actual goals of this study in order to obviate the effects of "demand characteristics" (Elms, 2009), which is the disruption of normal behavior patterns when participant are explicitly aware that their behavior is under scrutiny. This debriefing session is a common safeguard against any potential adverse effects caused by deception used in research studies (APA, 2002; refer to Appendix B for a thorough description and rationale for using these deceptive elements).

Materials

The 12-item Depression, Anxiety, and Stress Scales (DASS-12; Chin et al., 2015) comprises a subset of items from the 21-item DASS, a self-report instrument originally designed to assess anxiety, depression, and stress (Lovibond & Lovibond, 1995) and recently suggested to measure a common "distress" dimension as well (Henry & Crawford, 2005; Szabo, 2010b). Chin et al. (2015) conducted an exploratory bifactor analysis to examine to which items variance

could be attributed to a common dimension and individual subscales. The results suggested that only 12 items tapped a common factor as well as their respective subdomains. Although relatively less is known about the psychometric properties of the DASS-12, initial examinations indicated comparability to the DASS-21 (which, as reviewed in the introduction, is strongly supported).

The Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item self-report that comprises two subscales that measure positive (PA) and negative affect (NA). Respondents indicated the extent to which each item described his/her experience in the past week on a 1 (very slightly to not at all) to 5 (extremely) Likert-type scale. Each subscale contains 10-items, and the total score for each subscale was obtained by adding the raw score for each respective item. This instrument has good psychometric properties and has been widely used in clinical, psychopathological, and personality research. For instance, Watson et al. (1988) reported very good (DeVellis, 2003) Cronbach's (1951) coefficient alphas: .88 for PA and .87 for NA. Moreover, Watson et al. (1988) reported patterns of correlation in theoretically consistent directions with the Hopkins Symptom Checklist, Beck Depression Inventory, and the State Anxiety Scale of the State Trait Anxiety Inventory. Thus, there is support for the postulation that the PANAS instrument differentially predicts anxiety and depressive symptoms through assessment of the relevant, superordinate aspects of tripartite theory.

The Beck Anxiety Inventory (BAI; Beck & Steer, 1990) is a 21-item self-report measure that describes subjective, somatic and panic-related anxiety symptoms. Participants endorsed each item on a Likert-type scale ranging from 0 (not at all) to 3 (severely). The raw score of each item was then added to get a total score. Beck, Epstein, Brown, and Steer (1988) reported that the BAI has excellent psychometric properties, including a high Cronbach's (1951) coefficient

alpha value (.92). A one-way analysis of variance (ANOVA) demonstrated that participants who were categorized as anxious scored significantly higher on the BAI compared to depressed and healthy control groups. In addition, the BAI produced the hypothesized pattern of correlations with the Revised Hamilton Rating Scales for Anxiety and Depression, as well as the Cognition Checklist for Anxiety and Depression.

The Beck Depression Inventory-II (BDI-II; Beck, Brown, & Steer, 1996) is a 21-item self-report measure of depressive symptoms. Similar to the BAI, participants rated each item on a Likert-type scale ranging from 0 (not at all) to 3 (severely), and raw scores were summed to produce a total score (between 0 – 63). Beck, Steer, Ball, and Ranieri (1996) reported that the BDI-II produced a .91 Cronbach's (1951) coefficient alpha value, as well as a higher positive correlation with the revised Hamilton Rating Scale for Depression than the Hamilton Rating Scale for Anxiety.

The Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzer, & Borkovec, 1990) is a 16-item self-report instrument that measures the self-perceived uncontrollability and excessiveness of worrying. Respondents endorsed the extent to which each item described them on a Likert-type scale that ranged from 1 (not at all typical) to 5 (very typical). Hazlett-Stevens, Ullman, and Craske (2004) reported a high internal consistency value of .94 for this measure. In terms of validity, Brown, Antony, and Barlow (1992) reported that the instrument differentiated participants with GAD from participants diagnosed with other anxiety disorders. In addition, the worry subscale of the Reaction to Tests measure was the only subscale that predicted PSWQ results compared to other subscales (i.e., perfectionism, general time urgency, nervous energy) on the Reaction to Tests measure (Meyer et al., 1990).

The 12-item General Health Questionnaire (GHQ: Goldberg, 1978) is a 12-item self-report questionnaire that was designed to measure general psychological distress (Goldberg, 1978). Questions typically began with the phrase, "Have you recently…" followed by a specific symptom such as "…been getting pains in your head?" Possible responses included: (1) not at all, (2) no more than usual, (3) rather more than usual, and (4) much more than usual. The total score was obtained by summing the raw score of each item. Split-half reliability has been reported as .83 for the GHQ-12 (Goldberg, 1972), with a more recent international study also demonstrating a wider array of strong psychometric properties (Goldberg et al., 1997). Specifically, the average area under the Receive Operator Characteristic Curve (ROC; Zweig & Campbell, 1993) value was .88, which indicated that any randomly selected distressed individual had an 88% chance that his/her GHQ score would be significantly elevated compared to a randomly selected non-distressed individual.

The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) is a widely used, 5-item, self-report instrument that measures the cognitive aspect of subjective wellbeing. Respondents endorsed each item on a 7-point Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree), and the total score was obtained by summing the raw score of each item. The SWLS has demonstrated good internal consistency in previous studies, where it produced a .87 Cronbach's (1951) coefficient alpha value when administered with a group of undergraduate students (Diener et al., 1985). In terms of convergent validity, Diener et al. (1985) reported that the SWLS had moderately strong correlations with 10 other subjective-well being scales. Similarly, its divergent validity was also supported, in that the SWLS had no correlation with the Marlowe-Crowne Social Desirability Scale (Diener et al., 1985). This

suggests the SWLS does not elicit a social desirability response set. Moreover, the SWLS correlated negatively (r = -.41) with a symptom checklist similar to the Hopkins inventory.

Data Analysis

Convergent and discriminant validity with other self-report measures

Multiple bivariate and partial correlation coefficients were calculated between theoretically convergent and divergent self-report measures. Specifically, the following relationships were hypothesized: (1) total DASS-12 score would have a positive correlation with the GHQ and negative correlation with the SWLS; (2) DASS-12 anxiety subscale would have a positive partial correlation with the BAI after controlling for the PSWQ, and a smaller positive correlation with the BDI; (3) DASS-12 depression subscale would have a positive correlation with the BDI, a negative correlation with the PANAS-PA subscale, and smaller positive correlations with the BAI and PSWQ; and (4) DASS-12 stress subscale would have a positive, partial correlation with the PSWQ after controlling for the BAI, and a smaller positive correlation with the BDI. An a priori sample size calculation (two tailed test, α = .05, power = .80, and effect size = .50) with GPower (Erdfleder, Faul, & Buchner, 1996) suggested that a sample size of 47 participants was needed to examine whether the resultant r values were statistically different from zero. Multiple tests were controlled for with Bonferroni-Holms correction (Holm, 1979), a more powerful, sequentially rejective version of the simple Bonferroni correction. First, all p-values were sorted in order of smallest to largest. Next, if the 1st p-value was greater than or equal to α (Type-1 error = .05) divided by the total number of tests (k), the procedure was stopped and none of the remaining p-values were considered significant. Otherwise, the 1st p-value was declared significant and the second p-value was

compared to α (Type-1 error = .05) divided by (k-1). If the 2nd p-value was greater than or equal to α /(k-1), the procedure was stopped and no further p-values were significant. Otherwise, the steps described above were repeated for the remaining p-values.[1]

DASS subscales as a predictor of fear intensity, physiological arousal, happiness, and worry.

I computed four hierarchical regression analyses in order to determine whether each DASS subscale significantly predicted its respective outcome variable over and above variance that could already be explained by the other two DASS subscales. Similar to the correlational analyses described in the preceding section, I corrected for multiple comparisons using Bonferroni-Holm's (Holm, 1979) correction procedure. An a priori sample size calculation (f^2 = .15, α = .0125, power = .80) with G*Power suggested that a minimum sample size of 105 participants was needed to examine whether the amount of variance in the dependent variable (i.e., fear intensity, physiological arousal, happiness, or worry) could be significantly attributed to a DASS subscale over and above the other DASS subscales.

In order to examine the DASS anxiety subscale, I computed two separate hierarchical regressions predicting 1) self-reported fear intensity and 2) heart rate change score from the DASS instrument. In both regression models, the depression and stress subscales were entered simultaneously in the first step, and the anxiety subscale represented the second step in the process. A similar hierarchical regression was computed to determine the unique predictive ability of the DASS depression subscale of self-reported happiness ratings change scores. Anxiety and stress were simultaneously entered as covariates in this equation, with depression

[1] Overall results were not affected by Bonferonni-Holm's correction. Thus, instead of delineating every step of the Bonferonni-Holm's correction (e.g., arranging p-values in from smallest to largest), actual p-values are presented in the results section (unless p-values are less than .001) to ease readability.

entered in the second and final step. In like fashion, the stress subscale was used to predict the change in self-reported worry ratings before and after engaging in the worry-inducing task, with depression and anxiety subscales entered as covariates.

Results

Participants

Four participants did not consent to have their data be used for research purposes after disclosure of the study's deception component. Thus, data from these participants were removed from analyses. The remaining data set comprised a diverse sample of 139 college students in Mississippi (61.2% female; mean age = 19.66 years; range 18 – 36; average number of close friends = 6.27; See Table 1 for further demographic information).

Bivariate and Partial Correlations

Total DASS scores with GHQ and SWLS

Total score of the DASS-21 positively correlated with the GHQ total ($r = .68$, $p < .001$). Similarly, the total score of the DASS-12 positively correlated with GHQ total ($r = .72$, $p < .001$). Similar magnitudes and directions of correlations were observed in the negative direction when examining the relationship between the SWLS total and DASS-21 ($r = -.54$, $p < .001$) and DASS-12 ($r = -.58$, $p < .001$).

DASS anxiety subscales with the BDI-II and BAI

The DASS-21 anxiety subscale positively correlated with the BAI after controlling for PSWQ ($r = .67$, $p < .001$). This partial correlation was noted to be significantly larger ($Z = 2.13$, $p = .0167$) than the correlation between the DASS-21 anxiety subscale and the BDI-II (r = .60,

Table 1

Sample Demographic Information for the Study 1

Demographic	*n*	%
Gender		
Female	85	61.2
Male	50	36.0
Missing	4	2.9
Race/Ethnicity		
African American	25	18.0
Caucasian	98	70.5
Hispanic/Latino	4	2.9
Other	12	8.6
Missing	0	0
Martial Status		
Single	90	64.7
In a dating relationship	46	33.1
Married	1	0.7
Divorced	2	1.4

p < .001). The same analyses on the DASS-12 anxiety subscale yielded similar results, with a positive correlation with the BAI ($r = .71$, $p < .001$) that was significantly larger ($Z = 4.07$, $p < .001$) than the BDI-II ($r = .58$, $p < .001$).

DASS depression subscales with BDI, PANAS-PA, BAI, and PSWQ

As expected and seen in previous research, the DASS-21 depression subscale positively correlated with the BDI-II ($r = .70$, $p < .001$). This correlation was significantly larger ($Z = 3.65$, $p < .001$) than the correlations between the DASS-21 depression subscale and the BAI ($r = .58$, $p <.001$), and between the DASS-21 depression subscale and the PSWQ ($r = .46$, $p < .001$; $Z = 3.56$, $p < .001$). In addition, the DASS-21 depression subscale negatively correlated with the PANAS-PA subscale ($r = -.46$, $p < .001$).

The DASS-12 depression subscale also demonstrated similar correlations with the aforementioned self-report measures, with the correlation with the BDI-II (r = .67, p <.001) noted as significantly larger (Z = 2.88, p = .002) than the DASS-12 depression subscale and the BAI (r = .56, p <.001) and the correlation between the DASS-12 depression subscale and the PSWQ (r = 0.41, p < .001; Z = 3.59, p < .001). In addition, the DASS-12 depression subscale also negatively correlated with the PANAS-PA subscale (r = -.44, p < .001).

DASS stress subscales with the PSWQ and BDI-II

The DASS-21 stress subscale positively correlated with the PSWQ after controlling for BAI (r = .31, p = .001). Contrary to hypotheses, the DASS-21 stress subscale was significantly smaller (Z = -4.18, p < .001) than the correlation between the DASS-21 stress subscale and the BDI-II (r = .64, p < .001). Similarly, the DASS-12 stress subscale positively correlated with the PSWQ after controlling for BAI (r = .29, p = .001), which was also noted as significantly smaller (Z = -3.47, p < .001) than the correlation between the DASS-12 stress subscale and the BDI-II (r = .57, p < .001).

Testing assumptions of hierarchical multiple regressions

Prior to conducting all hierarchical regression models, all relevant assumptions of these statistical analyses were tested. Specifically, standardized (i.e., Z-scores), cook's distance, and jackknife residual values were examined for multivariate or univariate outliers, residual plots (residual versus predicted) and normal probability plots (Q-Q plot) were inspected to examine if data patterns met Gaussian Error assumptions, and Condition Index and Variance Proportion values were examined to determine if multicollinearity assumptions were met.

Results from these examinations consistently indicated that all relevant assumptions were met for all regression models – except for the regression model involving the prediction of heart rate from DASS anxiety subscales. Specifically, standardized (i.e., Z-scores), cook's distance, and jackknife residual values suggested that heart rate recordings for two participants were both univariate *(Z* score > 3 standard deviations) and multivariate outliers (Leverage > 2*k*/*n*). Further inspection of heart rate raw scores for both participants suggested that scores contained a number of errors due to poor signal quality. Heart rate data for these participants were thus removed from the dataset. Inspection of residual plots (residual versus predicted) and normal probability plots (Q-Q plot) suggested that data in both regression models (constructed after removal of these two participants) met Gaussian Error assumptions. The Condition Index and Variance Proportion values for the heart rate regression models suggested that multicollinearity assumptions were met as well.

Predicting fear ratings from DASS anxiety subscales

A two stage hierarchical multiple regression was thus conducted with fear rating as the dependent variable. The DASS-21 depression and stress subscales were entered at stage one of the regression model to control for depression and stress symptoms. The DASS-21 anxiety subscale was entered at stage two. The overall regression model was significant ($F = 7.06$, $p < .001$; see Table 2, Appendix C for more details), and the three DASS-21 subscales accounted for 14.7% of the variance in fear ratings. Closer inspection of the R^2 change associated with adding the DASS-21 anxiety subscale at stage two, however, suggested that the DASS-21 anxiety subscale only explained 1.7% of the variation in fear ratings above and beyond the other subscales, and that this change in R^2 was not significant ($F(1, 123) = 2.469$, $p = 0.119$).

This same two stage, hierarchical multiple regression model was also tested with the DASS-12 subscales. The DASS-12 depression and stress subscales were entered at stage one of the regression model to control for depression and stress symptoms, with the DASS-12 anxiety subscale entered at stage two. The overall regression model was significant ($F = 5.55$, $p = .001$) and accounted for 11.7% of the variance in fear ratings. Analogous to the same examination using the 21-item version, the R^2 change associated with the anxiety subscale at stage two explained minimal variance and was not significant ($R^2 = 0.3\%$; $F(1, 126) = 0.45$, $p = .51$).

Predicting heart rate from DASS anxiety subscales

Analyses followed the same patterns as above, with DASS depression and stress subscales entered at stage one and anxiety at stage two. The dependent measure in these regressions was heart rate change score (i.e., difference between pre- and post-stressor interoceptive task). The overall regression model for the 21-item version was not significant ($F = .81$, $p = .49$; see Table 3, Appendix D for more details), and accounted for very limited total variance (2.1%). The same pattern of results was notable for the 12-item version, with the overall model being non-significant ($F = .91$, $p = .44$) and accounting for limited variance (2.3%).

Predicting happiness ratings from DASS depression subscales

These analyses were also similar to those examining the anxiety subscales (above), only with anxiety and stress entered at stage one, depression entered at stage two, and happiness ratings as the dependent outcome. The overall regression model was not significant for the 21-item version ($F = 2.10$, $p = .10$; see Table 4, Appendix E for more details), although it accounted for more variance than the anxiety subscale and heart rate association (4.6%). Conversely, results for the 12-item version indicated that the overall model was significant in predicting happiness

change score ($F = 3.20$, $p = .025$), accounting for 6.7% of total variance. The R^2 change associated with adding the DASS-12 depression subscale at stage two, however, suggested that the DASS-12 depression subscale explains less than 0.1% of the variation in happiness ratings, which was not significant ($F(1, 134) = 0.006$, $p = .94$).

Predicting worry ratings from DASS stress subscales

Analyses followed the same patterns as above, with DASS depression and anxiety subscales entered at stage one and stress at stage two. The dependent measure in these regressions was worry ratings (i.e., difference between pre- and post-worry inducing task). The overall regression model for the 21-item version was not significant ($F = 0.89$, $p = 0.45$; see Table 5, Appendix F for more details), and accounted for very limited total variance (2.1%). The same pattern of results was notable for the 12-item version, with the overall model being non-significant ($F = 0.47$, $p = 0.71$) and accounting for limited variance (1.1%).

Results Summary for Study 1

Overall, convergent and divergent correlations with other self-report measures suggested that the DASS-12 total score, anxiety subscale, and depression subscale functioned equivalently in comparison to the DASS-21 self-report measure. It is also interesting to note that, contrary to hypotheses, both DASS instruments produced smaller correlations with the PSWQ compared with the BDI-II. Associations with indices obtained from behavioral tasks, however, paint a globally less optimistic picture for both versions of the measure. Although the overall model was significant in several cases, the ability of subscales to predict theoretically relevant constructs was limited.

STUDY 2: COMPARISON WITH A SEMI-STRUCTURED INTERVIEW

Method

During the appointed study time, the research assistant brought the participant into the study room, provided an overview of the study, and obtained informed consent. Students completed a battery of measures, including the DASS-21, which was used as the basis to analyze both the 21- and 12-item DASS in the current study. The research assistant then administered the Anxiety Disorders Interview Schedule for the 4th edition of the Diagnostic Statistical Manual (ADIS-IV; Brown, Di Nardo, & Brown, 2004). After the research assistant completed the administration, the participant was debriefed and awarded experimental credit.

Materials

The ADIS-IV (Brown, Di Nardo, & Brown, 2004) is a semi-structured interview designed to assess current episodes of anxiety disorders and discriminate between different anxiety disorders. This interview also enables the administrator to assess other highly comorbid disorders such as mood, somatoform, and substance use. Brown, Di Nardo, Lehman, and Campbell (2001) reported good to excellent reliability for all DSM-IV diagnoses (≥ .60 kappa coeffcients; Fleiss, Nee, and Landis, 1979). In terms of validity, Brown, Chorpita, and Barlow (1998) compared four different models and reported that a five-factor model consistent with DSM-IV typology (i.e., depression, PD with agoraphobia, social phobia, obsessive-compulsive disorder, and GAD) provided the best fit the data. Moreover, in this previous examination,

identified symptoms of each disorder loaded significantly on their expected latent factor without any cross-loading on other disorders.

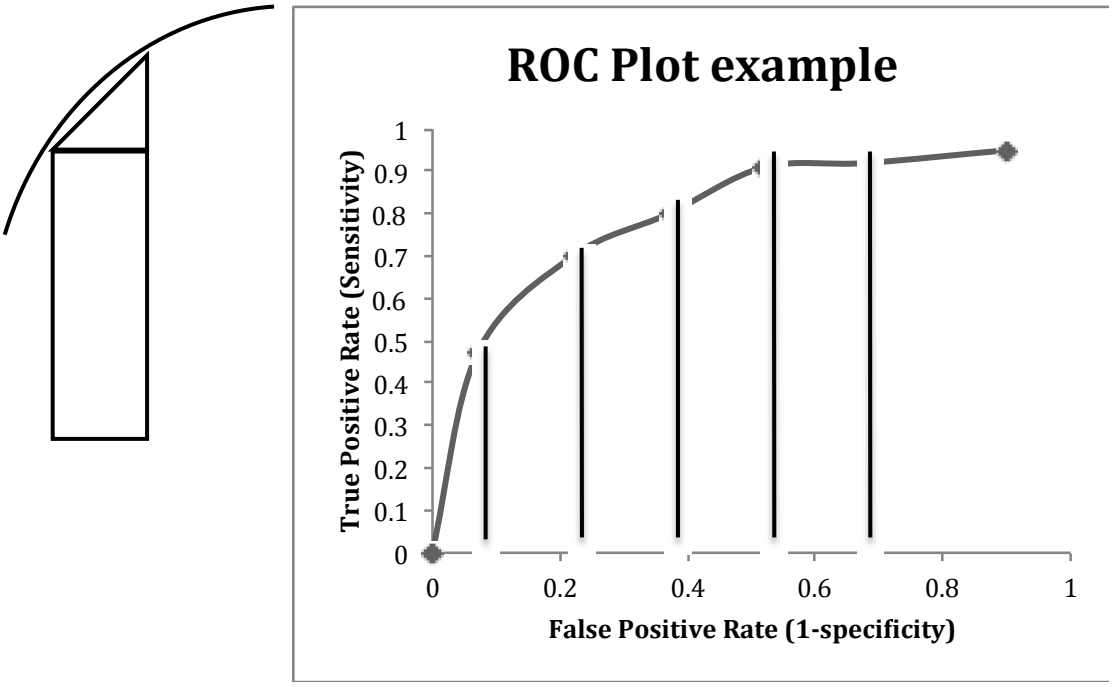
Data Analysis

Originally developed in the 1950's to discriminate radio signals from noise, the ROC plot is now considered one of the most important tools in clinical medicine (Zweig & Campbell, 1993). Receive Operating Characteristic Curve plots (ROC; Metz, 1978), sensitivity, specificity, area under the curve (AUC), positive predictive power (PPV), and negative predictive power (NPV) were examined for the 21- and 12-item version DASS using various ADIS-IV diagnoses as criterion validity. Phrased differently, this study examined the degree to which DASS scores could accurately categorize individuals on discrete outcomes (i.e., diagnosis of a mental disorder). For the ease of reading, I will only refer to the 12-item DASS for the rest of ROC data analysis description even though all analyses were replicated with the 21-item DASS.

The ROC procedure involves calculation of four different types of fractions: (1) fraction of participants correctly identified by DASS-12 as having a disorder relative to all participants who have a disorder, (i.e., true positives), (2) fraction of participant correctly identified by DASS-12 as *not* having a disorder relative to all participants who do not have a disorder (i.e., true negatives), (3) fraction of participants incorrectly identified by DASS-12 as having a disorder relative to all participants who do not have a disorder (i.e., false positives), and (4) fraction of participants incorrectly identified as *not* having a disorder relative to all participants who do have a disorder (false negatives). The first two fractions are conventionally termed 'sensitivity' and 'specificity'.

A ROC plot also enabled exploration of changes in sensitivity and specificity under variable conditions of the threshold position for cut-off on the DASS-12. In Figure 2, the x-axis represents the spectrum of false positives, (0.0 – 1.0) and the y-axis represents the corresponding

Figure 2. Trapezoid approximation under ROC curve (left). A series of trapezoids constructed under the ROC plot (right). Cumulative area covered by series of trapezoids will serve as estimate for area under the curve.



spectrum of true positives (0.0 – 1.0). Once a ROC plot was generated, the area under the curve was calculated using non-parametric methods. This entailed constructing a series of trapezoids under the ROC plot (see Figure 2 for illustration) to estimate AUC, which was conducted using the Statistical Package for Social Sciences (IBM SPSS Statistics For Windows, Version 22.0).

The AUC value represents the probability that that DASS-12 score is higher for an individual with a diagnosable disorder when a pair of healthy and unhealthy individuals is randomly selected (Faraggi & Reiser, 2002). For example, an AUC of 0.80 implies that there is

an 80% chance that a randomly selected diseased individual will receive a higher score on the 12-item DASS compared to a randomly selected healthy person. A general criteria for classifying AUC values are as follows: .90 – 1 = excellent; .80 - .90 = good; .70 - .80 = fair; .60 - .70 = poor; .50 - .60 = fail (Hanley & McNeil, 1982). To determine optimal cut-off points for the 12-item DASS, Youden's Index (Youden, 1950) was calculated for every cut-off value (i.e., sensitivity + specificity - 1). Youden's Index is a commonly used method of identifying optimal cut-off scores when sensitivity and specificity are equally weighted. It ranges from 0 to 1, with values close to 1 indicating better performance (i.e., no false positives or false negatives). A cut-off value is identified as the optimal cut-off value based on its ability to produce the highest Youden's Index score.

Lastly, PPVs and NPVs were calculated. PPVs indicate the probability that a given condition is present when the 12-item DASS is above the set threshold and NPVs give the probability that the condition is not present when the 12-item DASS is below the set threshold. For instance, a PPV value of 60% suggests 60% of those predicted to have a diagnosable disorder according to the DASS-12 actually have a diagnosable disorder. Similarly, an NPV value of 60% suggests that 60% of those predicted to not have a diagnosable disorder according to the DASS-21 actually have no diagnosable disorder. PPV was calculated as a ratio of true positives to the total number of individuals categorized as positives by the 12-item DASS (i.e., regardless of whether they were true or false positives). NPV was calculated similarly, but with consideration of true negatives and all negatives as categorized by the DASS-12.

Results

ROC analyses for DASS anxiety subscales

Participants included a diverse sample of 293 college students in Mississippi (71.0% female; mean age = 19.97 years; range 18 – 53; see Table 6 for further demographic information). Participants with any missing data were excluded listwise from the analysis, which resulted in three participants (1.0%) being removed from this analysis.

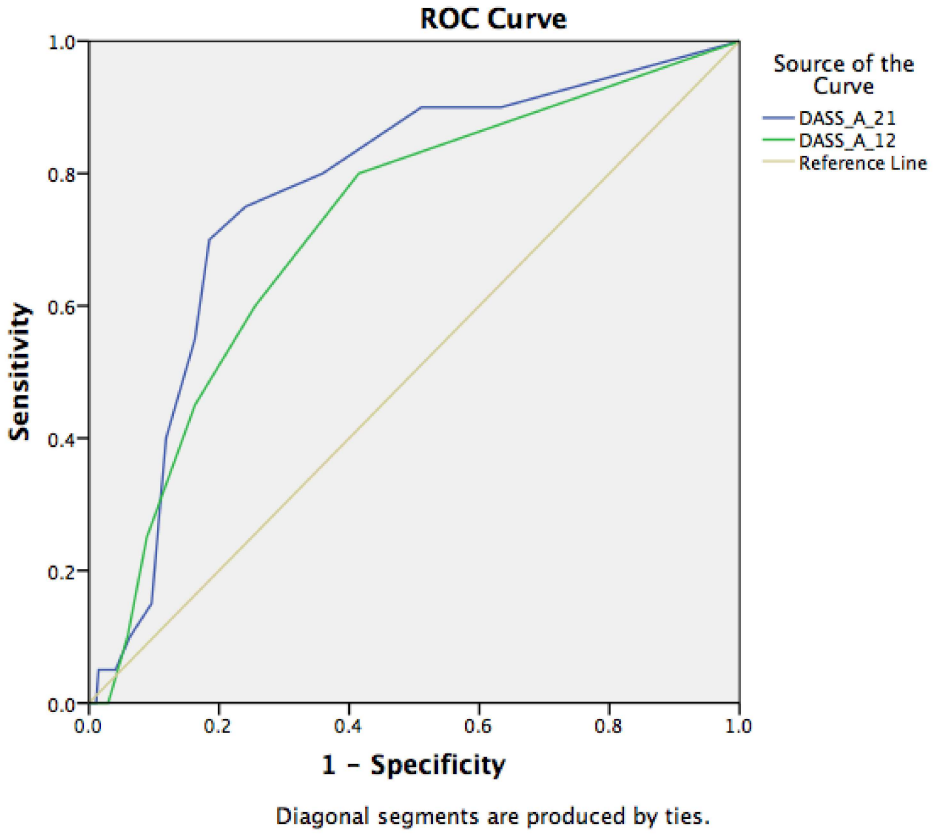
Table 6

Sample Demographic Information for the Study 2 & 3

Demographic	*n*	%
Gender		
Female	83	28.3
Male	208	71.0
Missing	2	0.6
Race/Ethnicity		
Caucasian	190	64.8
African American	83	28.3
Asian	6	2.0
Asian or Pacific Islander	2	0.7
Multiracial	9	3.1
Missing	3	1.0
Marital Status		
Never Married	278	94.9
Not Married, but Living with Partner	5	1.7
Divorced/Annulled	1	0.3
Widowed	2	0.7
Married	5	1.7
Missing	2	0.7

The DASS-12 anxiety subscale produced a "fair" AUC value of .72 (*SE* = .058; 95% *CI* = .61 - .83; see Figure 3 for ROC Curve). Based on base rates of PD in the general US

Figure 3. Receive Operating Curve (ROC) for the anxiety subscales of the DASS-12 and DASS-21 in predicting the presence of Panic Disorder



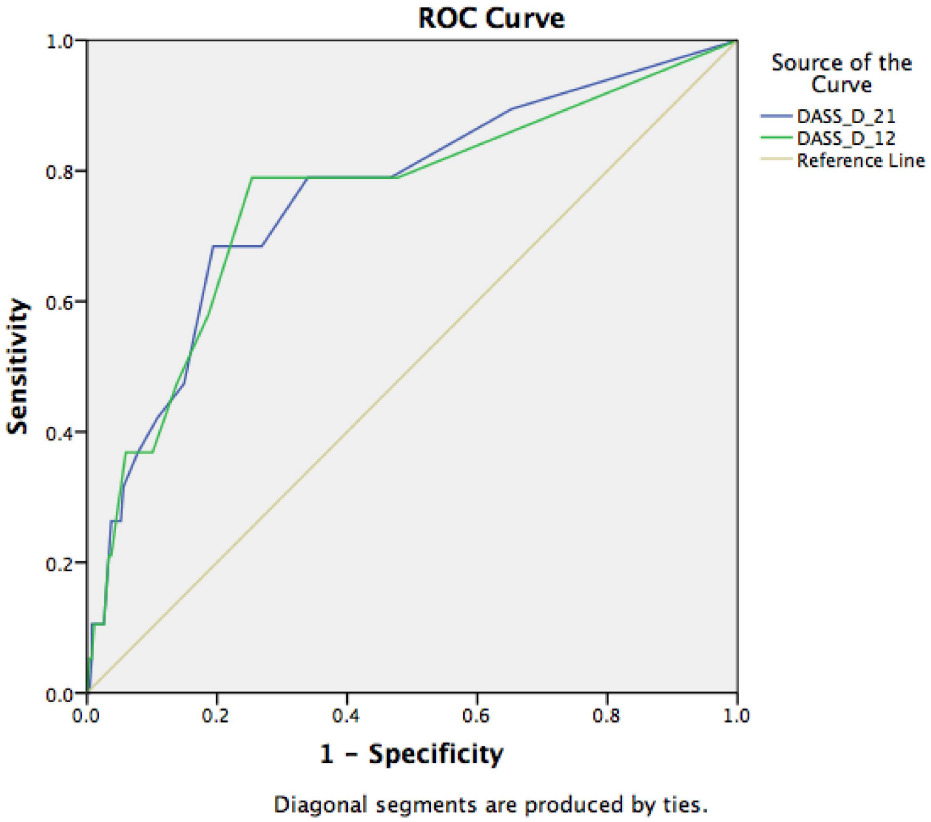
population (2.7% 12 months prevalence rate; Kessler, Chiu, Demler, Merikangas, & Walters, 2005), sensitivity, specificity, PPV, and NPV values were calculated for various cut-off scores are (see Table 7, Appendix G, for summary). Examination of these values suggested that 1 point or more on the DASS-A-12 subscale was the optimal screening cut-off score for PD (sensitivity = .80, specificity = .59; PPV = 5.1%; NPV = 99.1%; Youden's Index = .39). The DASS-21 anxiety subscale also produced a "fair" AUC value of .77 (*SE* = .053; 95% *CI* = .66 - .87. Sensitivity, specificity, PPV, and NPV for various cut-off scores are also presented in Table 7.

Examination of these values suggested that 5 points or more on the DASS-A-21 was the optimal screening cut-off score for screening PD (sensitivity = .70, specificity = .82; PPV = 9.5%; NPV = 99.0%; Youden's Index = .52). Taken together, these results indicated that the DASS-21 appears to possess better psychometric properties than the DASS-12 anxiety subscale when screening for PD.

ROC analyses for DASS depression subscales

Participants that had any missing data were excluded listwise from the analysis; resulting in six participants (2.2%) being excluded from this analysis. The DASS-12 depression subscale produced a "fair" AUC value of .76 (*SE* = .065; 95%*CI* = .63 - .88; See Figure 4 for ROC Curve diagram). With consideration of the base rate of MDD in the general US population (6.9% 12

Figure 4. Receive Operating Curve (ROC) for the depression subscales of the DASS-12 and DASS-21 in predicting the presence of Major Depressive Disorder



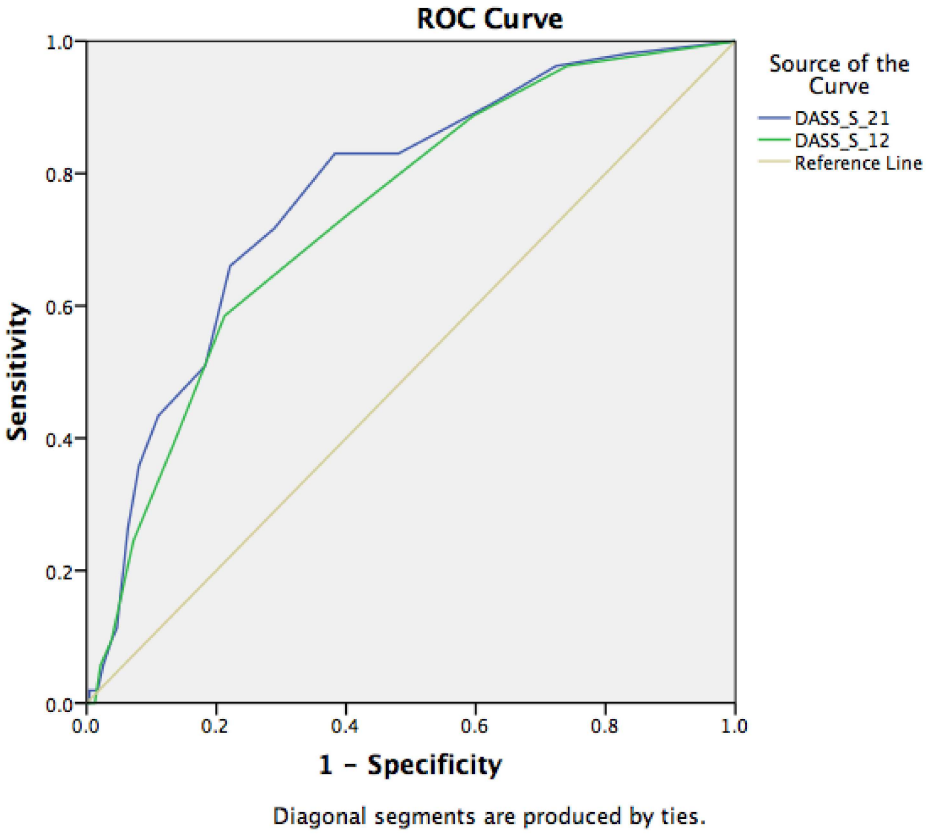
months prevalence rate; Substance Abuse and Mental Health Service Administration, 2013), sensitivity, specificity, PPV, and NPV values were calculated for various cut-off scores (see Table 8, Appendix H, for summary). Examination of these values suggested that 3 points or more on the DASS-D-12 would be the optimal screening cut-off score for screening MDD (sensitivity = .79, specificity = .75; PPV = 18.7%; NPV = 98.0%; Youden's Index = .54). Similarly, the DASS-21 depression subscale produced a "fair" AUC value of .76 (*SE* = .061; 95% *CI* = .64 - .88. Sensitivity, specificity, PPVs, and NPVs for various cut-off scores are also presented in Table 8. Examination of these values suggested that 5 points or more on the DASS-D-21 would be the optimal screening cut-off score for screening MDD (sensitivity = .68, specificity = .81; PPV = 20.7%; NPV = 97.2%; Youden's Index = .49). Taken together, these results indicated that the DASS-12 and DASS-21 depression subscales appear to possess comparable psychometric properties when screening for MDD.

ROC analyses for DASS stress subscales

Participants that had any missing data were excluded listwise from the analysis, which resulted in five participants (1.7%) being excluded from this analysis. The DASS-12 stress subscale produced a "fair" AUC value of .74 (*SE* = .036; 95% *CI* = .67 - .81; See Figure 5 for ROC Curve diagram). Based on base rates of GAD in the general US population (3.1% 12 months prevalence rate; Kessler & Wang, 2008), sensitivity, specificity, PPV, and NPV values were calculated for various cut-off scores (see Table 9, Appendix I, for summary). Examination of these values suggested that 4 points or more on the DASS-S-12 would be the optimal screening cut-off score for screening GAD (sensitivity = .59, specificity = .79; PPV = 8.1%; NPV = 98.3%; Youden's Index = .37). The DASS-21 stress subscale also produced a "fair" AUC value of .77 (*SE* = .035; 95% *CI* = .70 - .84). Sensitivity, specificity, PPV, and NPV values for

the DASS-21 are also presented in Table 9. Examination of these values suggested that 5 points or more on the DASS-S-12 would be the optimal screening cut-off score for screening GAD (sensitivity = .83 specificity = .62; PPV = 6.5%; NPV = 99.1%; Youden's Index = .45). Taken together, these results indicated the DASS-12 and DASS-21 stress subscales appear to possess comparable psychometric properties when screening for GAD.

Figure 5. Receive Operating Curve (ROC) for the stress subscales of the DASS-12 and DASS-21 in predicting the presence of Generalized Anxiety Disorder



STUDY 3: RELIABILITY OF BIFACTOR STRUCTURE

Method

This study utilized the same methods as Study 2. See Method section for Study 2 for more details.

Data Analysis

As mentioned previously, even though Cronbach's (1951) coefficient alpha is a widely used estimator for scale reliability, it can underestimate or overestimate scale reliability, depending on underlying measurement parameters (Raykov, 2001a, Zimmerman, 1972). If the scale, for instance, is unidimensional and contains no correlated measurement errors, Cronbach's (1951) coefficient alpha will underestimate scale reliability unless tau equivalence holds (i.e., items that load on to a single latent construct do not have equal factor loadings). On the other hand, given the bifactor (i.e., multidimensional) nature of constructs measured by the DASS instrument, Cronbach's (1951) coefficient alpha may overestimate the reliability of the subscales because coefficient alpha does not distinguish between variance caused by general distress and variance caused by factors other than general distress (i.e., depression, anxiety, and stress). Since a CFA-based method of estimating scale reliability (Raykov, 2001b; 2004) does not assume tau equivalence and can account for the bifactor nature of constructs measured by the DASS, this was the method employed to calculate reliability of the DASS total scale and subscales scores.

Put more simply, Raykov's (2001b; 2004) CFA-based reliability estimation method is based on Lord and Norvick's (1968) classic formula for scale reliability estimation:

$$\rho_Y = VAR(\mathrm{T}) / Var(\mathrm{Y})$$

in which ρ_Y represents the scale reliability coefficient, VAR(T) is the true score variance, and Var(Y) is the sum of the true score variance and error variance of the instrument. If an instrument is assumed to be a congeneric measurement model (i.e., items do not cross-load across factor loadings) with no correlated measurement errors, Lord and Norvick's (1968) classic formula is expressed into:

$$\rho = (\underline{\Sigma}\lambda_i)^2 / [(\underline{\Sigma}\lambda_i)^2 + \underline{\Sigma}\theta_{ii}]$$

where $(\underline{\Sigma}\lambda_i)^2$ represents the squared sum of unstandardized factor loadings and $\underline{\Sigma}\theta_{ii}$ is the sum of unstandardized measurement error variances. This equation forms the basis of a potentially more accurate calculation of the reliability of the DASS total scale, depression subscale, anxiety subscale, and stress subscale.

Based on the above-mentioned framework, I intended to estimate scale reliability values for the 21- and 12-item DASS total scale and subscales via computation with Mplus (Muthén & Muthén, 2007), providing 95% confidence intervals for these reliability estimates. Standard interpretation of these results follows published guidelines by DeVellis (2003): below .60, unacceptable; between .60 and .65, undesirable; between .65 and .70, minimally acceptable; between .70 and .80, respectable; between .80 and .90, very good; above .90, consider shortening the scale. Cronbach's (1951) coefficient alpha values were also calculated to directly examine differences in reliability estimates.

Results

Attempts to calculate Raykov's reliability values for the depression, anxiety, stress, and general distress scales for the DASS-12 were not successful due to computational issues. Specifically, the 12th item of the DASS-12 had a negative residual variance (i.e., -22.158) when measuring stress, which indicated a Heywood case (Dillon, Kumar, & Mulani, 1987) and prevented accurate computation. Given the small ratio of items (i.e., 12-items) to constructs being measured (i.e., 4 constructs), it is likely that the Heywood Case occurred due to model misspecification instead of empirical under-identification[2] or sampling fluctuation. This was confirmed via consultation with Dr. Linda Muthén, director of the Mplus development team, who provided guidance in regards to this specific issue (L. Muthen, personal communication, October 13, 2014). Removal of the stress factor from the bifactor structure of the DASS-12 enabled computation of Raykov's reliability for the anxiety, depression, and general distress scales for the DASS-12. Thus, all results that follow are given for these scores only for the DASS-12, but include the stress subscale for the DASS-21 (where no such problems were evident).

Raykov's Reliability and Cronbach's Alpha for the DASS anxiety subscales

The DASS-12 Anxiety subscale produced a Raykov reliability value of .47, 95% *CI* = -.69 - 1.64. Based on groupings suggested by DeVellis (2003), this was an unacceptable reliability value for a subscale. In contrast, Cronbach's alpha for this subscale was .64, 95% *CI* = .57 - .71, which may be considered acceptable, but was still undesirable.

[2]The number of parameters associated with DASS-12 bifactor model did not exceed the number of pieces of information in the input correlation matrix

Similar to the DASS-12 Anxiety subscale, the DASS-21 Anxiety subscale produced an unacceptable Raykov reliability value of .33, 95% *CI* = -.56 - 1.23. The Cronbach's alpha for the DASS-21 Anxiety subscale was .74, 95% *CI* = .69 - .78, which was an acceptable reliability value and higher than the DASS-21 Anxiety subscale Raykov reliability value.

Raykov's Reliability and Cronbach's Alpha for the DASS depression subscales

The DASS-12 Depression subscale produced a Raykov reliability value of .63, 95% *CI* = -.43 - 1.69. Based on groupings suggested by DeVellis (2003), this was an undesirable reliability value for a subscale. In contrast, Cronbach's alpha for this subscale was .86, 95% *CI* = .83 - .88, which was considered to be a very good reliability value.

The DASS-21 Depression subscale appeared to produce a better Raykov reliability value compared to the DASS-12 Depression subscale. Specifically, the DASS-21 Depression subscale produced a Raykov reliability value of .72, 95% *CI* = .074 -1.36, which was considered respectable. The Cronbach's alpha for the DASS-21 Depression subscale was .86, 95% *CI* = .83 - .88, which was a very good reliability value and higher than the DASS-21 Depression subscale Raykov reliability value.

Raykov's Reliability and Cronbach's Alpha for the DASS-21 stress subscale

The DASS-21 Stress subscale produced a Raykov reliability value of .51, 95% *CI* = -.30 - 1.32. Based on groupings suggested by DeVellis (2003), this was an unacceptable reliability value. In contrast, Cronbach's alpha for this subscale was .82, 95% *CI* = .79 - .85, which was considered to be a very good reliability value.

Raykov's Reliability and Cronbach's Alpha for DASS General Distress Scale

The DASS-12 General Distress Scale produced a Raykov reliability value of .87, 95% *CI* = .62 - 1.11. Based on groupings suggested by DeVellis (2003), this was a very good reliability value. Cronbach's alpha for this scale was .86, 95% *CI* = .84 - .89, which was also considered very good and similar to the Raykov reliability value noted for the same scale.

The DASS-21 General Distress Scale appeared to produce a better Raykov reliability value compared to the DASS-12 General Distress Scale. Specifically, the DASS-21 General Distress Scale produced Raykov reliability value of .91, 95% *CI* = .79 - 1.04, which was within the range where one might consider shortening the scale. The Cronbach's alpha for the DASS-21 General Distress Scale was .91, 95% *CI* = .89 - .92, which was also within the range where one might consider shortening the scale and similar to the DASS-21 General Distress Raykov reliability value (limitations to coefficient alpha notwithstanding).

DISCUSSION

The purpose of this series of studies was to examine two versions of the DASS instrument (i.e., DASS-21 and DASS-12) to determine if either version was able to measure anxiety, depression, stress, and general distress symptoms in a manner that corresponded to theoretically cogent physical or emotional changes. In order to do so, three studies were conducted: (1) the first measuring convergent, divergent, and predictive validity of the DASS-12 and DASS-21 in relation to other self-report measures and behavioral indices, (2) the second measuring predictive validity of the DASS-12 and DASS-21 for various psychopathologies, and (3) the third measuring reliability of the DASS-12 and DASS-21 via Raykov's reliability and Cronbach's alpha.

In Study 1, both DASS instruments correlated in hypothesized ways with other relevant self-report measures (i.e., BDI-II, BAI, and PSWQ). The only exception was the DASS-21 and DASS-12 stress subscales, which produced higher correlations with the BDI-II compared with the PSWQ. When predicting responses to behavioral tasks, the total scores of both DASS measures were more apt to predict responses consistent with depression (i.e., sensitivity to reward cues) and panic symptoms (i.e., response to interoceptive task). In contrast, the total scores of both instruments were not able to predict responses consistent with GAD (i.e., response to worry inducing task). Moreover, the lack of incremental predictive ability of the depression and anxiety subscales in predicting depression and panic symptoms supported the broader conclusion that DASS-21 and DASS-12 subscales had limited utility in predicting disorder

specific physical or emotional changes. Moreover, the contrasting results between associations with self-report measures and behavioral indices suggested that a large proportion of the convergent and divergent validity results for the DASS-12 and DASS-21 instruments could be explained by a common method variance (i.e., self-report measures). A manipulation check was conducted with the PSWQ (i.e., PSWQ predicting worry ratings) in order to examine whether the DASS-total and stress subscale scores (for both 12 and 21-item versions) lacked the predictive ability to predict worry or worry was not successfully elicited in the laboratory. Null results from the manipulation check suggested that laboratory procedures were not successful in eliciting worry among participants. This represented a limitation to the results gleaned from Study 1.

Nonetheless, the general lack of precision for DASS-12 and DASS-21 subscales was consistent with results gleaned from Studies 2 and 3. In Study 2, all the subscales for DASS-12 and DASS-21 were "fair" (AUC range = .70 - .80) when predicting the presence of PD, MDD, and GAD Further inspection of the 95% confidence intervals also suggested that the range of these estimates were wide, ranging from "poor" (.60 - .70) to good (.80 - .90). This reduces prospective users' confidence that the DASS-12 and DASS-21 subscales are able to correctly identify individuals who have PD, MDD, and GAD. Put in more colloquial terms, the AUC values observed were similar to flipping a fair coin to determine whether or not one has the disorder of interest based on a score that should correspond to a particular categorization (and in some cases worse).

Consistent with results noted in Studies 1 and 2, results from Study 3 suggested that subscales of both the DASS-12 and DASS-21 mostly had "unacceptable" to "undesirable" reliabilities (based on groupings suggested by DeVellis, 2003) after taking into account variance explained by a common general distress construct. The only exception to this finding was the

DASS-21 depression subscale, which produced a Raykov reliability estimate of .72, 95% *CI* = .074 - 1.36, which is considered respectable. These reliability results are in stark contrast with Cronbach's alpha reliability estimates. Cronbach's alpha values consistently overestimated the reliability of the DASS-12 and DASS-21 subscales because they did not distinguish between variance explained by general psychological distress and variances explained by more specific constructs. The only exception to this pattern of finding was the comparisons between Raykov and Cronbach's alpha values for the total scores of the DASS-12 and DASS-21. For both estimates, Raykov reliability estimates and Cronbach's alpha values were similar to each other (i.e., "very good" for the DASS-12 and "consider shortening scale" for the DASS-21). Results from studies 1,2, and 3 broadly converged on the idea that one should use the total score of the DASS-21 or DASS-12 to measure general psychological distress instead of subscales to measure symptoms specific to PD, MDD, and GAD.

Research & Clinical Implications

Results suggested that both the DASS-21 and DASS-12 have similar psychometric properties when measuring general psychological distress. However, the subscales for both instruments did not appear to possess sufficient reliability and validity in measuring anxiety, depression, or stress with precision after taking into account general psychological distress. The implications of these results are important for theoretical and practical reasons. First, the DASS-21 has been used frequently in a variety of treatment studies with diverse populations from around the world (Mellor et al., 2014) and with patients with complex presenting problems (e.g., Wood, Nicholas, Blyth, Asghari, & Gibson, 2010; Oh, Cho, Chung, Kim, & Chu, 2014). Complex algorithms for obtaining norms for the DASS-21 (Crawford et al., 2009) and determining clinical significance of treatment outcomes using the DASS-21 (Ronk, Korman,

Hooke, & Page, 2013) have been developed to guide proper clinical use of the DASS-21. Thus, given that this instrument is widely disseminated and used among clinicians and researchers, there is a need to improve the psychometric performance of this measure, particularly if the subscales are being used to predict diagnostic status.

Second, researchers have only recently begun to discover that the DASS-21 may be measuring general psychological distress, in addition to depression, anxiety, and stress (e.g., Szabo, 2010b; Osman et al., 2012; Chin et al., 2015). Given accumulating evidence that the DASS-21 lacks precision in measuring subdomains after taking into account general psychological distress, researchers should consider adding/revising items on the DASS-21 instrument according to more current theories that explain underlying mechanisms of anxiety, depression, and stress. For instance, Lovibond and Lovibond (1995) did not originally make a distinction between anxiety and stress; stress merely emerged from their empirical analyses as an additional factor that increased coverage of anxiety symptoms. Thus, items that load on to anxiety and stress specific domains could potentially be improved if researchers make a clearer distinction between autonomic and somatic arousal.

This distinction is not unique to the DASS-21. For instance, Brown, Leary, and Barlow (2001) reported converging self-report and physiological evidence that GAD is associated with a set of symptoms that distinguishes it from other anxiety disorders. Specifically, GAD has been associated with elevated muscle tension (i.e. somatic activation) and a lack of sympathetic activation (i.e. lack of autonomic arousal). Future studies could thus modify the anxiety and stress items to better reflect the distinction between somatic and autonomic arousal, thereby increasing the psychometric performance of anxiety and stress items. In regards to depression, given that Lovibond and Lovibond (1995) did not explicitly consider anhedonia as a

distinguishing aspect of depression-specific items, adding/revising items to measure anhedonia might increase the precision of depression-specific items. This is consistent with extant literature and current nosology of MDD. Specifically, researchers could revise depression items to measure deficits in the behavioral activation system, especially in one's ability to experience positive emotions (anhedonia; Carver & White, 1994), which concurrently is a key feature of MDD (American Psychiatric Association, 2013). An alternative to revising DASS items would be to generate and develop new items using more modern methods and theories of measurement development (e.g., item response theory, confirmatory factor analyses, structural equation modeling) to obviate measurement issues commonly present in older psychological assessment instruments (Haynes, Richard, & Kubany, 1995).

Third, in the current version of the DASS-12 and DASS-21, items in both instruments appear to possess similar psychometric properties when measuring general psychological distress. Thus, clinicians can consider using the total score of the DASS-12 or DASS-21 as a measure of general psychological distress. If one is simply interested in measuring this construct, the DASS-12 appears to be the more practical alternative compared to the DASS-21, especially in front-line and clinical settings where time and fiscal resources are limited. Furthermore, interest in and use of the total score (as opposed to subscale scores) is consistent with the tripartite model, which is a dimensional, emotion-approach framework for understanding anxiety and mood disorders (Clark & Watson, 1991). According to this model, anxiety and depressive disorders are two distinct disorders that share a common, superordinate temperamental trait called negative affect, with a lack of positive affect specific to depression (Chorpita & Daleiden, 2002). General psychological distress, as measured by the DASS-12 and DASS-21 total scores, may be akin to negative affect, which is one's tendency to experience negative emotions (Clark

& Watson, 1991). There is accumulating evidence across diverse child, adolescent, and adult populations that suggest anxiety and depression are highly related dimensional constructs, collectively referred to as emotional disorders (e.g., Philipp, Washington, & Raouf, & Norton, 2008). Modern treatments, such as the Unified Protocol (Ellard, Fairholme, Boisseau, Farchione, & Barlow, 2010), are designed based on converging evidence that commonalities in etiology and latent structure among anxiety and depressive disorders supercede differences among them. Consequently, clinicians and researchers could simply use the total score of the DASS-12 and DASS-21 as a proxy of negative affect instead of attempting to differentially explain symptoms specific to PD, MDD, and GAD

Limitations

These studies have limitations worth noting. First, as previously mentioned, a manipulation check with the PSWQ suggested that Study 1 was not successful in eliciting conditions sufficient for participants to engage in worry. Unsurprisingly, the DASS-12 and DASS-21 stress subscale was not able to explain a significant amount of variance in worry ratings as well. Future research with a behavior validation component for the DASS instrument should consider other methodologies that could effectively elicit the phenomenon of worry associated with GAD. For instance, researchers can consider using a methodology used by Meeten, Dash, Scarlet, & Davey (2012) to manipulate high and low intolerance of uncertainty (i.e., a construct known to influence catastrophic worry and often observed in GAD) and measure worry using the Catastrophizing Interview. Second, Study 1 did not account for the use of psychotropic medications, which could have resulted in lower power in detecting a significant effect when predicting behavioral indices. Future research aiming to replicate the behavioral validation component should control for use of psychotropic medications to increase the power

of such analyses. Third, participants utilized in this study represented a convenience sample of college students in Mississippi. This limits the generalizability of the results to other populations around the world originating from different strata of societies (Arnett, 2008). Future research should aim to sample more diverse populations, especially those originating from rural, underserved settings.

Conclusion

The DASS instrument has the potential for diverse use (e.g., screening for relevant disorders, tracking treatment outcomes) for patients seen in a variety of settings (e.g., outpatient, inpatient, community) located in diverse countries (e.g., United States, Iran, Vietnam). It has also been widely disseminated for those purposes since its original publication (Lovibond & Lovibond, 1995). Given accumulating evidence that the DASS-21 measures general psychological distress instead of depression, anxiety, and stress, researchers could revise items to increase the precision in which items measure specific subdomains or generate new items that are more in line with seminal mechanistic theories that underlie PD, MDD, and GAD. Alternatively, researchers and clinicians can also consider using the total score of the DASS-12 and DASS-21 to measure general psychological distress or negative affect, which is consistent with a dimensional, emotion-based taxonomy to anxiety and mood disorders (i.e., tripartite model). If one chooses to focus on the total score, researchers and clinicians should consider using the shorter version of the instrument (DASS-12) instead of the DASS-21. Until more research is done to refine the DASS instrument, clinicians should assign more weight in interpreting the total score instead of depression, anxiety, and stress subscale scores for the DASS-12 of DASS-21.

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LIST OF APPENDICES

APPENDIX A: AFFECT RATING SCALE

Affect-Rating Scale

Please rate how much you are experiencing the following emotions **at the present moment**

1. I am bored

1	2	3	4	5	6
Strongly disagree	*Moderately disagree*	*Mildly disagree*	*Mildly agree*	*Moderately agree*	*Strongly agree*

2. I feel very happy

1	2	3	4	5	6
Strongly disagree	*Moderately disagree*	*Mildly disagree*	*Mildly agree*	*Moderately agree*	*Strongly agree*

3. I feel exhausted

1	2	3	4	5	6
Strongly disagree	*Moderately disagree*	*Mildly disagree*	*Mildly agree*	*Moderately agree*	*Strongly agree*

4. I am very confident in myself

1	2	3	4	5	6
Strongly disagree	*Moderately disagree*	*Mildly disagree*	*Mildly agree*	*Moderately agree*	*Strongly agree*

5. I worry too much about the future

1	2	3	4	5	6
Strongly disagree	*Moderately disagree*	*Mildly disagree*	*Mildly agree*	*Moderately agree*	*Strongly agree*

6. I feel dull

1	2	3	4	5	6
Strongly disagree	*Moderately disagree*	*Mildly disagree*	*Mildly agree*	*Moderately agree*	*Strongly*

agree

7. I feel bold and adventurous

1	2	3	4	5	6
Strongly disagree	*Moderately disagree*	*Mildly disagree*	*Mildly agree*	*Moderately agree*	*Strongly agree*

8. I feel lethargic (i.e., lacking energy)

1	2	3	4	5	6
Strongly disagree	*Moderately disagree*	*Mildly disagree*	*Mildly agree*	*Moderately agree*	*Strongly agree*

APPENDIX B: RATIONALE FOR DECEPTIVE ELEMENTS

Overall, study 1 used two types of deceptive elements: (1) misleading study description and (2) false feedback. Consistent with guidelines outlined by the American Psychological Association (APA, 2002), these deceptive elements were ethical because (1) the intended benefits of this research were greater than the costs of deceptive practices and (2) effective non-deceptive alternative procedures were not feasible (APA, 2002).

In regards to first point, it was predicted that the amount of distress participants would experience in the worry-cue task would not be above and beyond the normal levels of distress participants face on a regular basis (e.g., giving a presentation in class and being assigned a grade). Carver and White (1994), furthermore, did not report that any of their participants suffered short- or long-term psychological or physical harm when they engaged in the reward-cue task. In addition, ruling out "demand effects" (Elms, 2009) enabled better interpretation of the results for psychometric development and/or proper use of the 12-item Depression, Anxiety, and Stress Scales - an instrument that is already widely used in treatment outcome studies and clinical settings as a 21-item version (Page et al., 2007; Ng et al., 2007; Ownsworth et al., 2008; Allen et al., 2011). Furthermore, in accordance to the APA ethics code (2002), debriefing session was conducted as early as was feasible (i.e., after completion of behavior tasks). In the debriefing session, research assistants provided the opportunity for participants to obtain appropriate information about the nature and results of the research and took reasonable steps to correct any misconceptions participants may have had.

Second, non-deceptive alternative procedures were not feasible because a cohesive story was needed to make the purported rationale plausible to participants. It was not possible, for instance, to provide Carver and White's (1994) orienting remarks solely for the reward-cue task (since this was the only behavioral task that was explicitly modeled based on their procedures)

because the heterogeneity of rationales provided for different behavior tasks would have increased the chance that participants will suspect the true goal of the reward-cue task. Thus, research assistants provided Carver and White's set of orienting remarks at the beginning of the study (i.e., before the participant completed the self-report measures and engaged in any of the behavior tasks) and explained the various procedures based one rationale: the assortment of behavioral tasks and battery of self-reports served the purpose of examining the intuitive process of pattern recognition as influenced by intelligence, intuition, and predisposition to emotional states.

APPENDIX C: HIERARCHICAL REGRESSION MODELS OF DASS-A-12 AND DASS-A-21 PREDICTING FEAR RATINGS

Table 2

Hierarchical Regression Models of DASS-A-12 and DASS-A-21 Predicting Fear Ratings

		DASS-21					DASS-12				
		R^2	R^2 *Change*	*B*	*SE*	*β*	R^2	R^2 *Change*	*B*	*SE*	*β*
Step 1		.13***	.13***				.11***	.11***			
	Stress			.18	.059	.33**			.81	.11	.32**
	Depression			.035	.069	.054			.024	.074	.033
Step 2		.15***	.017				.12**	.003			
	Stress			.23	.066	.41**			.37	.12	.35**
	Depression			.054	.069	.083			.036	.076	.049
	Anxiety			-.13	.081	-.17			-.089	.133	-.668

Note. DASS-A-12 = Anxiety Subscale for the Depression, Anxiety, & Stress Scales-12-item version; DASS-A-21 = Anxiety Subscale for the Depression, Anxiety, & Stress Scales-21-item version.
Statistical significance: *$p < .05$; **$p < .01$; ***$p<.001$

APPENDIX D: HIERARCHICAL REGRESSION MODELS OF DASS-A-12 AND DASS-A-21 PREDICTING HEART RATE

Table 3

Hierarchical Regression Models of DASS-A-12 and DASS-A-21 Predicting Heart Rate

	DASS-21					DASS-12				
	R^2	R^2 *Change*	*B*	*SE*	*β*	R^2	R^2 *Change*	*B*	*SE*	*β*
Step 1	.015	.015				.018	.018			
Stress			-.044	.307	-.017			.50	.56	.10
Depression			.41	.37	.13			.16	.41	.046
Step 2	.021	.006				.023	.005			
Stress			.11	.36	.042			.70	.62	.14
Depression			.46	.37	.15			.22	.42	.062
Anxiety			-.36	.43	-.11			-.54	.69	-.089

Note. DASS-A-12 = Anxiety Subscale for the Depression, Anxiety, & Stress Scales-12-item version; DASS-A-21 = Anxiety Subscale for the Depression, Anxiety, & Stress Scales-21-item version.
None of the regression equations were significant (i.e., *p*s > .05).

APPENDIX E: HIERARCHICAL REGRESSION MODELS OF DASS-D-12 AND DASS-D-21 PREDICTING HAPPINESS RATINGS

Table 4

Hierarchical Regression Models of DASS-D-12 and DASS-D-21 predicting Happiness Ratings

	DASS-21					DASS-12				
	R^2	R^2 *Change*	*B*	*SE*	*β*	R^2	R^2 *Change*	*B*	*SE*	*β*
Step 1	.043	.043				.067**	.067**			
Stress			.046	.030	.17			.11	.051	.21*
Anxiety			.018	.039	.051			.051	.062	.080
Step 2	.046	.003				.067*	.00			
Stress			.038	.033	.14			.11	.056	.21
Anxiety			.014	.040	.040			.052	.064	.082
Depression			.020	.034	.064			-.003	.037	-.008

Note. DASS-D-12 = Depression Subscale for the Depression, Anxiety, & Stress Scales-12-item version; DASS-D-21 = Depression Subscale for the Depression, Anxiety, & Stress Scales-21-item version.
Statistical significance: *$p < .05$; **$p < .01$; ***$p<.001$.

APPENDIX F: HIERARCHICAL REGRESSION MODELS OF DASS-S-12 AND DASS-S-21 PREDICTING WORRY RATINGS

Table 5

Hierarchical Regression Models of DASS-S-12 and DASS-S-21 predicting Worry Ratings

	DASS-21					DASS-12				
	R^2	R^2 *Change*	*B*	*SE*	*β*	R^2	R^2 *Change*	*B*	*SE*	*β*
Step 1	.021	.021				.010	.010			
Depression			-.056	.036	-.16			-.042	.040	-.11
Anxiety			.047	.041	.117			.061	.070	.087
Step 2	.021	.001				.011	.001			
Depression			-.060	.040	-.17			-.048	.044	-.12
Anxiety			.041	.047	.10			.053	.075	.076
Stress			.010	.039	.033			.019	.066	.033

Note. DASS-S-12 = Stress Subscale for the Depression, Anxiety, & Stress Scales-12-item version; DASS-S-21 = Stress Subscale for the Depression, Anxiety, & Stress Scales-21-item version.
None of the regression equations were significant (i.e., *p*s > .05).

APPENDIX G: SENSITIVITY, SPECIFICITY, POSITIVE PREDICTIVE VALUE (PPV), AND NEGATIVE PREDICTIVE VALUE (NPV) FOR RANGE OF CUT-OFF SCORES FOR THE DASS-A-12 AND DASS-A-21 IN PREDICTING PRESENCE OF PANIC DISORDER

Table 7

Sensitivity, Specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) for range of cut-off scores for the DASS-A-12 and DASS-A-21 in predicting presence of Panic Disorder

Instrument	Cut-off Score	Sensitivity	Specificity	PPV	NPV	Youden's Index
DASS-A-12	**0.5**	**.800**	**0.585**	**0.051**	**0.991**	**0.385**
	1.5	.600	0.744	0.061	0.985	0.344
	2.5	.450	0.837	0.071	0.982	0.287
	3.5	.250	0.911	0.072	0.978	0.161
	4.5	.100	0.941	0.045	0.974	0.041
	5.5	0.000	0.970	0.000	0.972	-0.030
DASS-A-21	0.5	.900	0.367	0.038	0.992	0.267
	1.5	.900	0.489	0.047	0.994	0.389
	2.5	.800	0.641	0.058	0.991	0.441
	3.5	.750	0.759	0.080	0.991	0.509
	4.5	**.700**	**0.815**	**0.095**	**0.990**	**0.515**
	5.5	.550	0.837	0.086	0.985	0.387
	6.5	.400	0.881	0.086	0.981	0.281
	7.5	.150	0.904	0.041	0.975	0.054
	8.5	.100	0.937	0.042	0.974	0.037
	9.5	.050	0.959	0.033	0.973	0.009
	10.5	.050	0.985	0.086	0.974	0.035
	12.0	0.000	0.989	0.000	0.973	-0.011
	13.5	0.000	0.993	0.000	0.973	-0.007
	14.5	0.000	0.996	0.000	0.973	-0.004

Note. Suggested screening cut-off score for each subscale is bolded. DASS-A-12 = Anxiety Subscale for the Depression, Anxiety, & Stress Scales-12-item version; DASS-A-21 = Anxiety Subscale for the Depression, Anxiety, & Stress Scales-21-item version

APPENDIX H: SENSITIVITY, SPECIFICITY, POSITIVE PREDICTIVE VALUE (PPV), AND NEGATIVE PREDICTIVE VALUE (NPV) FOR RANGE OF CUT-OFF SCORES FOR THE DASS-D-12 AND DASS-D-21 IN PREDICTING PRESENCE OF MAJOR DEPRESION

Table 8

Sensitivity, Specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) for range of cut-off scores for the DASS-D-12 and DASS-D-21 in predicting presence of Major Depression

Instrument	Cut-off Score	Sensitivity	Specificity	PPV	NPV	Youden'x Index
DASS-D-12	0.5	.789	0.522	0.109	0.971	0.312
	1.5	.789	0.642	0.140	0.976	0.431
	2.5	**.789**	**0.746**	**0.187**	**0.980**	**0.536**
	3.5	.579	0.813	0.187	0.963	0.392
	4.5	.474	0.862	0.203	0.957	0.336
	5.5	.368	0.899	0.213	0.951	0.268
	6.5	.368	0.940	0.314	0.953	0.309
	7.5	.316	0.948	0.309	0.949	0.264
	8.5	.211	0.963	0.295	0.943	0.173
	9.5	.211	0.966	0.317	0.943	0.177
	10.5	.105	0.974	0.230	0.936	0.079
	11.5	.105	0.989	0.411	0.937	0.094
	12.5	.053	0.993	0.343	0.934	0.045
	13.5	.053	0.996	0.511	0.934	0.049
DASS-D-21	0.5	.895	0.347	0.092	0.978	0.242
	1.5	.789	0.534	0.111	0.972	0.323
	2.5	.789	0.660	0.147	0.977	0.450
	3.5	.684	0.731	0.159	0.969	0.416
	4.5	**.684**	**0.806**	**0.207**	**0.972**	**0.490**
	5.5	.474	0.851	0.190	0.956	0.324
	6.5	.421	0.892	0.224	0.954	0.313
	7.5	.368	0.922	0.258	0.952	0.290
	8.5	.316	0.944	0.295	0.949	0.260
	9.5	.263	0.948	0.272	0.946	0.211
	10.5	.263	0.963	0.343	0.946	0.226
	11.5	.158	0.970	0.282	0.940	0.128
	12.5	.105	0.974	0.230	0.936	0.079
	13.5	.105	0.981	0.295	0.937	0.087
	14.5	.105	0.993	0.511	0.937	0.098
	15.5	.053	0.993	0.343	0.934	0.045

Note. Suggested screening cut-off score for each subscale is bolded. DASS-D-12 = Depression Subscale for the Depression, Anxiety, & Stress Scales-12-item version; DASS-D-21 = Depression Subscale for Depression, Anxiety, & Stress Scales-21-item version

APPENDIX I: SENSITIVITY, SPECIFICITY, POSITIVE PREDICTIVE VALUE (PPV), AND NEGATIVE PREDICTIVE VALUE (NPV) FOR RANGE OF CUT-OFF SCORES FOR THE DASS-S-12 AND DASS-S-21 IN PREDICTING PRESENCE OF GENERALIZED ANXIETY DISORDER

Table 9

Sensitivity, Specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) for range of cut-off scores for the DASS-S-12 and DASS-S-21 in predicting Generalized Anxiety Disorder

Instrument	Cut-off Score	Sensitivity	Specificity	PPV	NPV	Youden's Index
DASS-S-12	0.5	.962	0.260	0.040	0.995	0.222
	1.5	.887	0.404	0.045	0.991	0.291
	2.5	.736	0.600	0.056	0.986	0.336
	3.5	**.585**	**0.787**	**0.081**	**0.983**	**0.372**
	4.5	.396	0.864	0.085	0.978	0.260
	5.5	.245	0.928	0.098	0.975	0.173
	6.5	.094	0.962	0.073	0.971	0.056
	7.5	.057	0.979	0.078	0.970	0.035
DASS-S-21	0.5	.981	0.166	0.036	0.996	0.147
	1.5	.962	0.277	0.041	0.996	0.239
	2.5	.906	0.374	0.044	0.992	0.280
	3.5	.830	0.519	0.052	0.990	0.349
	4.5	**.830**	**0.617**	**0.065**	**0.991**	**0.447**
	5.5	.717	0.711	0.073	0.987	0.428
	6.5	.660	0.779	0.087	0.986	0.439
	7.5	.509	0.817	0.082	0.981	0.326
	8.5	.434	0.889	0.111	0.980	0.323
	9.5	.358	0.919	0.124	0.978	0.278
	10.5	.264	0.936	0.117	0.975	0.200
	11.5	.189	0.945	0.098	0.973	0.133
	12.5	.113	0.953	0.072	0.971	0.066
	13.5	.094	0.962	0.073	0.971	0.056
	14.5	.057	0.974	0.066	0.970	0.031
	15.5	.019	0.983	0.034	0.969	0.002
	16.5	.019	0.987	0.045	0.969	0.006
	17.5	.019	0.996	0.124	0.969	0.015

Note. Suggested screening cut-off score for each subscale is bolded. DASS-S-12 = Stress Subscale for the Depression, Anxiety, & Stress Scales-12-item version; DASS-S-21 = Stress Subscale for the Depression, Anxiety, & Stress Scales-21-item version

VITA

Eu Gene Chin

EDUCATION

University of Mississippi Medical Center/ G.V. (Sonny) Montgomery VA Medical Center
Jackson, MS (APA Accredited)
Mississippi Psychology Residency (Internship) Training Program, Clinical Psychology
Expected Internship Completion: Summer 2015

University of Mississippi
Oxford, MS (APA Accredited)
Doctor of Philosophy in Clinical Psychology Cumulative G.P.A: 3.95
Dissertation: 21-item Depression, Anxiety and Stress Scales (DASS-21): Associations with self-report measures, clinical interviews, and behavioral tasks
Graduation Date: June 2015

University of Mississippi
Oxford, MS (APA Accredited)
Master of Arts in Clinical Psychology Cumulative G.P.A: 3.92
Master's Thesis: Fit of the tripartite model with residential youth referred for externalizing problems
Graduation Date: July 2011

University of Nebraska Lincoln (UNL)
Lincoln, NE (APA Accredited)
Bachelor of Arts (Highest Distinction) in Psychology Cumulative G.P.A: 3.97
Honors Thesis: The effect of smoking during pregnancy on infant development: visual expectations at six months
Graduation Date: July 2009

AWARDS

- National Psychologist Trainee Register Credentialing Scholarship (2014)
- Graduate Student Research Award (2012)
- Honorable Mention for Outstanding Psychology Major (2009)
- National Honor Society in Psychology (2008 – 2009)
- Academic Honor Society for Transfer Students (2008 – 2009)
- Certificate of Superior Scholarship (2009)
- UNL Honors Program (2007 – 2009)
- Dean's List, College of Arts & Sciences (2007 – 2009)
- Dean's Honor Roll (2007)

- International Student Scholar's Award (2007)
- Merit Scholarship Award (2006)

CLINICAL EXPERIENCE

G.V. (Sonny) Montgomery Veteran Affairs Medical Center
Pre-doctoral Psychology Intern, July 2014 – Present
Primary Supervisor: Jeanne Gabriele, PhD, Clinical Psychologist

- Delivery of the following EBPs (in-person and via telemedicine) via the Evidence-Based Psychotherapy Team, a team that provides level of care that is a step up from primary care but step down from most intense level of mental health care services (e.g., inpatient, residential):
  - Cognitive Behavioral Therapy for depression, anxiety, insomnia, and chronic pain; Cognitive Processing Therapy for PTSD; Acceptance and Commitment Therapy for Depression
- Prolonged Exposure for PTSD and DBT skills groups in Trauma Recovery Program, specialty team that provides most intensive level of mental health care (i.e., includes a crisis care inpatient unit, a residential treatment unit, and an outpatient clinic)

University of Mississippi Psychological Services Center
Graduate Student Therapist, August 2010 – May 2014
Clinic Director: Scott Gustafson, PhD, ABPP, Clinical Psychologist

- Cognitive Behavioral Therapy for anxiety disorders with incorporation of Motivational Interviewing techniques
- Included semester-long seminar on evidence-based treatments for anxiety disorders
- Transdiagnostic treatment of emotional disorders (Unified Protocol; Barlow et al., 2010)
- Modular, Parent Management Training techniques influenced by seminal research in child psychology (Chorpita, Daleiden, & Weisz, 2005; Weisz et al., 2012)

University of Mississippi Counseling Center
Graduate Student Counselor, August 2012 – May 2014
Counseling Center Director**:** Marc Showalter, PhD, Educational Psychology

- Individual and group psychotherapy services for university faculty and students
- Co-therapist for Cultural Connections Club, weekly meeting for international students to discuss topics of interest (e.g., acculturation)
- Co-facilitated orientation sessions for newly-arrived international students and local students returning from study abroad trips
- Clinical training/peer supervision for graduate-level counseling students
- Program evaluation services based on treatment and supervision self-report measures

University of Mississippi Psychological Assessment Clinic

Psychology Trainee, August 2012 – May 2013
Supervisor: Scott Gustafson, PhD, ABPP, Clinical Psychologist

- Psychological testing for intelligence, learning difficulties, attention and concentration problems, anxiety and mood disorders, personality disorders, and developmental disorders
- Evaluation of accommodation applications at the University of Mississippi Office of Student Disability Services

Education and Research, Baddour Center
Education & Research Intern, August 2010 – July 2012
Supervisor: Shannon Hill, PhD, Counseling Psychologist

- Functional behavioral assessments, individual therapy, and group therapy for residents with intellectual and developmental disabilities

Adult Mental Health Services, Region IV
PhD Intern, August 2011 – December 2011
Supervisor: Patricia Rothwall, PhD, Clinical Psychologist

- Cognitive Behavioral Therapy to individuals with low social and economic resources at a rural community mental health center

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FELLOWSHIPS/GRANTS

Principal Investigator [**Chin, E.** (PI) & Johnson, L. R. (Faculty Mentor)]. *Psychometric properties of the 12-item General Health Questionnaire (GHQ-12) with a Malaysian sample.* (2012, University of Mississippi Graduate Student Research Award, University of Mississippi; $1000).

Principal Investigator [**Chin, E.** (PI) & Wiebe. S. (Faculty Mentor)]. *The effect of smoking during pregnancy on infant development: visual expectations*. (2008-2009, Undergraduate Creative Activities and Research Experience (UCARE) Award, University of Nebraska-Lincoln; $6,400).

PUBLICATIONS

Johnson, L. R., Bangirana, P., Kajumba, M., Kizito, S., & **Chin, E.** (2014). *Patient perspectives on depression in Uganda: Views from traditional and psychiatric clinics.* Manuscript submitted for publication.

Johnson, L. R., **Chin, E.,** Buchanan, E., Kajumba, M., Kizito, S., & Bangirana, P. (2014). *Do concepts of depression predict help-seeking in Uganda? A closer look at explanatory models among community and clinical participants.* Manuscript submitted for publication.

Ritchwood, T.D., Ebesutani, C., **Chin, E.,** & Young, J. (2014). *The Loneliness Questionnaire: measurement invariance across African American and Caucasian youth.* Manuscript submitted for publication.

Chin, E., Drescher, C. F., Trent, L., Darden, Seak, W. C., Young, J., & Johnson, L. (in press). Searching for a screener: examination of the factor structure of the General Health Questionnaire in Malaysia. *International Perspectives in Psychology: Research, Practice, Consultation.*

Chin, E., Drescher, C. F., & Johnson, L. (2013). Biography of Draguns. *In K. D. Keith (Eds.), Encyclopedia of Cross-Cultural Psychology*: Wiley-Blackwell.

Drescher, C. F., **Chin, E.,** Johnson, L. (2012). Exploring developmental assets in Ugandan youth. *International Journal of Child, Youth, and Family Studies, 4*(1), 500-520

Chin, E., & Young, J., & Ebesutani, C. (2012). Application of the tripartite model to a complicated sample of residential youth with externalizing problems. *Child Psychiatry and Human Development, 4*(33), 469-478. doi: 10.1007/s10578-012-0341-y

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MANUSCRIPTS IN PREPARATION

Kurz, S. A., Drescher, C. F., **Chin, E.,** & Johnson, L. R. (2014). *Measuring social desirability in Malaysia: Do gender and language influence factor means and item thresholds?* Manuscript in preparation.

Chin, E., Gabriele, J., Edmond, S., Baillie, L., & Patel, A. (2014). *Reach and effectiveness of evidence-based psychotherapies for veterans with post-traumatic stress disorder (PTSD)*. Manuscript in preparation.

Chin, E., Gabriele, J., Edmond, S., Baillie, L., & Patel, A. (2014). *RE-AIM evaluation: local system changes to promote the adoption and implementation of evidence-based psychotherapies as front-line treatments.* Manuscript in preparation.

AD-HOC REVIEWING

- *Assessment* (2 independent invitations)
- *Child Psychiatry & Human Development* (1 independent invitation)
- *Journal of Clinical Psychology* (1 independent invitation)
- Sattler, J. M. (2014). Bullying and Cyberbullying. In J. M. Sattler (Eds.), *Foundations of Behavioral, Social, and Clinical Assessment of Children*. La Mesa, CA: Jerome M. Sattler, Publisher, Inc.
- Sattler, J. M. (2014). Intellectual Disability. In J. M. Sattler (Eds.), *Foundations of Behavioral, Social, and Clinical Assessment of Children.* La Mesa, CA: Jerome M. Sattler, Publisher, Inc.

PAPER PRESENTATIONS

Chin, E., Wong, N., & Gabriele, J. (2015, November). *Predictors and patterns of treatment engagement for OEF/OIF/OND Veterans Receiving Cognitive Processing Therapy and Prolonged Exposure Therapy.* Paper will be presented at the 49th annual meeting of the Association for Behavioral and Cognitive Therapies, Chicago, IL.

Chin, E., Edmond, S., Baillie, L., Patel, A., & Gabriele, J. (2015, April). *Reach and effectiveness of evidence-based psychotherapies for veterans with post-traumatic stress disorder (PTSD).* Paper presented at the 36th Annual Meeting & Scientific Sessions for the Society of Behavioral Medicine. San Antonio, TX.

Edmond, S., **Chin, E.,** Baillie, L., & Patel, A., & Gabriele, J. (2015, April). *The prevalence of chronic pain in OEF/OIF/OND Veterans with post-traumatic stress disorder.* Paper presented at the 36th Annual Meeting & Scientific Sessions for the Society of Behavioral Medicine. San Antonio, TX.

Chin, E. (2014, April). *Convergent and predictive validity of the 12-item Depression, Anxiety, and Stress Scale (DASS-12).* Paper presented at the 2014 University of Mississippi Conference on Psychological Science, Oxford, MS.

POSTER PRESENTATIONS

Johnson, L. R., **Chin, E.,** Buchanan, E., Kajumba, M., Kizito, S., & Bangirana, P. (2014). *Do concepts of depression predict help-seeking in Uganda? A closer look at explanatory models among community and clinical participants.* Poster submitted for 49th annual meeting of the Association for Behavioral and Cognitive Therapies, Chicago, IL.

Johnson, L. R., Kibanja, G., Johnson-Pynn, J. S., Drescher, C. F., **Chin, E**., Kyabaga, G. (2015, August). *Powering up participation: Photo-voice as research and intervention with adolescents in East Africa.* Poster submitted for the 2015 American Psychological Association Annual Convention, Toronto, Canada.

Kurz, S., **Chin, E.,** Drescher, C. F., Khor, K. L., Seak, W. C., Loo, A., Romeo, S., & Johnson, L. R. (2014, November). *Multigroup confirmatory factor analysis of the 14-item Marlowe Crowne-Social Desirability Scale across Chinese and English languages for a Malaysian population.* Poster presented at the 48th annual meeting of the Association for Behavioral and Cognitive Therapies, Philadelphia, PA.

Kurz, A. S., Drescher, C. F., **Chin, E**., Khor, K. L., Seak, R., Loo, A., Romeo, S. & Johnson, L. R. (2014, November). *General self-efficacy and psychological distress: Testing the moderating effects of questionnaire language using structural equation modeling.* Poster presented at the 48th annual meeting of the Association for Behavioral and Cognitive Therapies, Philadelphia, PA.

Darden, M. C., **Chin, E.,** Berkout, O., Drescher, C. F., Trent, L., Khor, K. L, Seak, R., Loo, A., Romeo, S., & Johnson, L. (2013, November). *Factor Structure and Other Psychometric*

Properties of the General Self Efficacy Scale in a Malaysian Sample. Poster presented at the 47th annual meeting of the Association for Behavioral and Cognitive Therapies, Nashville, T.

Drescher, C. F., **Chin,** E., Trent, L. R., Darden, M. C., Vosbein, M., Khor, K. L., Seak, R., Loo, A., Romeo, S. & Johnson, L. R. (2013, November). *An analysis of the psychometric properties of the English and Chinese versions of the Meaning in Life Questionnaire (MLQ): A Malaysian college sample.* Poster presented at the 47th annual meeting of the Association for Behavioral and Cognitive Therapies, Nashville, TN

Chin, E., Drescher, C. F., Trent, L., Darden, M., Kremer, A., Khor, K. L., Seak, R., Loo, A., Romeo, A., & Johnson, L. (2013, April). *Psychometric Properties of the 12-item General Health Questionnaire (GHQ-12) with a Malaysian sample.* Poster presented at the 3rd annual University of Mississippi Graduate Research Forum, Oxford, MS.

Chin, E., & Trent, L., & Young, J. (2012, November). *Examining the 21-item Depression, Anxiety, and Stress Scales with receiver operating characteristic curves in a college sample.* Poster presented at the 46th annual meeting of the Association for Behavioral and Cognitive Therapies, National Harbor, MD.

Chin, E., Ebesutani, C., Buchanan, E., & Young, J. (2011, November). *Applicability of the 21-item Depression, Anxiety, and Stress Scale (DASS-21) as a general measure of psychological distress.* Poster presented at the 45th annual meeting of the Association for Behavioral and Cognitive Therapies, Toronto, Canada.

Chin, E., Ebesutani, C., & Young, J. (2011, November). *Examining a temperamental reactivity-to-stress approach with the tripartite model of anxiety and depression.* Poster presented at the 45th annual meeting of the Association for Behavioral and Cognitive Therapies, Toronto, Canada.

Drescher, C. F., & **Chin, E.** (2010, November). *Developmental Assets Profile: A Ugandan youth population*. Poster presented at the 2011 American Psychological Association Annual Convention, Washington, D.C.

Chin, E., Drescher, C. F., & Trent, L., Ambrose, A., Heiden, L., & Young, J. (2010, October). *Dissemination in school systems: feedback from behavioral vital signs personnel.* Poster presented at the 2010 annual Center for School Mental Health Conference, Albuquerque, NM.

Chin, E., Heiden, L., Damon, J., Hight, Terry., & Young, J. (2010, November). *Fit of the tripartite model with residential youth referred for externalizing problems.* Poster presented at the 44th annual meeting of the Association for Behavioral and Cognitive Therapies, San Francisco, CA.

Chin, E., Schulenberg, S. E., Kua, E. (2010). *Psychometric review of the General Health Questionnaire for use with Malaysian populations.* Poster presented at the 3rd ASEAN Regional Union of Psychological Societies, Kuala Lumpur, Malaysia.

Chin, E., West, T., Lenhardt, J., & Brock, A. (2009, April). *Examining internalizing problems of sexually abused youth across time.* Poster presented at the Midwestern Psychological Association Convention – Psi Chi Program, Chicago, IL.

Chin, E., Wiebe, S., & Watts, K. (2009, April). *The effect of smoking during pregnancy on infant development: Visual expectations at six months*. Poster presented at the University of Nebraska Undergraduate Research Conference, Lincoln, NE.

Klinkebiel, C., West, T., **Chin E.,** Brock, A., Dostal, H., & Dawley, E. (2008, November). *Effectiveness of Teacher-Child Interaction Training in improving school readiness skills in a Head Start classroom.* Poster presented at 42nd annual meeting of the Association for Behavioral and Cognitive Therapies, Orlando, FL.

Brock, A., **Chin E.,** Lenhardt, J. (2008, April). *Examining the emotional and behavioral symptoms of siblings of sexually abused youth: Implications for assessment and treatment.* Poster presented at the University of Nebraska Undergraduate Research Conference, Lincoln, NE.

RESEARCH LABORATORIES

Dissemination of Evidence-Based Services for Children and Adolescents
Graduate Research Assistant, August 2009 - Present
University of Mississippi
Major Supervisor: John Young, PhD, Assistant Professor of Psychology

- Administration of evidence-based instruments in rural school environments – project funded by grant from the Mississippi Children's Home Society
- Secondary quantitative data analyses of brief, practical self-report measures
- Trained team of research assistants to operate multi-channel, multi-function equipment that monitors physiological indices (e.g., electrocardiogram signals) and conduct behavioral approach tasks
- Statistics consultant for research assistants and graduate students in the laboratory

Multicultural Laboratory
Graduate Research Assistant, August 2009 - Present
University of Mississippi
Major Supervisor: Laura Johnson, PhD, Assistant Professor of Psychology

- Awarded a grant to design and implement multi-site study in Malaysia (Methodist College Kuala Lumpur and Inti International College Subang Jaya) to assess the psychometric properties of brief, practical self-report measures in English and Chinese languages.
- Qualitative and quantitative secondary data analyses obtained from rural populations in Uganda to determine barriers and facilitators to dissemination and implementation of culturally-sensitive treatments for depression

Developmental Cognitive Neuroscience Laboratory
Undergraduate Research Assistant, August 2007 – May 2009
University of Nebraska-Lincoln
Major Supervisor: Sandra Wiebe, PhD, Research Assistant Professor

- Awarded a grant to develop an eye saccade coding system that measures the effects of prenatal tobacco exposure on emergent cognitive skills for six month-old babies

Sexual Abuse Family Education (SAFE)
Undergraduate Research Assistant, August 2007 – May 2009
University of Nebraska-Lincoln
Major Supervisor: David J. Hansen, PhD, Professor and Chair Department of Psychology

- Entered and reviewed data from empirically supported measures – such as MASC, CDI, YSR, CBCL – completed by sexually abused children and their non-offending caregivers.

Family Interaction Skills Clinic (FISC)
Undergraduate Research Assistant, January 2008 – May 2009
University of Nebraska-Lincoln
Major Supervisor: Mary Fran Flood, PhD, Director of Psychological Consultation Center

- Conducted live behavioral observations on preschool children at the Lincoln Head Start Center and other preschool centers beyond the vicinity of Lincoln to provide norming data for Teacher Child Interaction Training coding system.

Health and Addiction Vulnerability Laboratory
Undergraduate Research Assistant, January 2008 – May 2009
Major Supervisor: Dennis E. McChargue, PhD, Associate Director of Clinical Training

- Trained a team of undergraduate research assistants to collect data from a local residential drug treatment facility and conducted preliminary analyses to screen for errors in data entry

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TEACHING EXPERIENCE

Introduction to Psychology, Graduate Instructor, University of Mississippi (August 2013 – May 2014)

- Full design and oversight of the course; including preparing lecture materials, administering and scoring assignments, conducting exams and quizzes, and holding regular office hours

Social Psychology, Graduate Instructor, University of Mississippi (May 2013 – June 2013)

- Full design and oversight of the course; including preparing lecture materials, administering and scoring assignments, conducting exams, and holding regular office hours

Multicultural Psychology, Guest Presenter, University of Mississippi (August 2013)

- Adapted course materials, provided an overview of syllabus, assigned homework assignments, conducted cultural simulation activities, and provided consultation opportunities after class hours.

Invited Address: Writing American Psychological Association (APA) Style, Workshop Coordinator, Inti International College Subang Jaya (July 2009).

- Full design and oversight of the workshop; including designing agenda, preparing materials, and conducting workshop

Invited Address: Steps to Enter Graduate School, Workshop Coordinator, Inti International College Subang Jaya (June, 2009)

- Full design and oversight of the workshop; including designing agenda, preparing materials, and conducting workshop

PROFESSIONAL AFFILIATIONS

Association for Contextual Behavioral Science	2014 - Present
American Red Cross, Central Mississippi Chapter	2011 - Present
Student Affiliate of the Association for Behavioral and Cognitive Therapies	2010 - Present
Student Affiliate of the American Psychological Association	2008 – 2009