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DEVELOPMENT OF MULTIDOMAIN TEST ANXIETY SCALES FOR ENGINEERING AND SOCIAL SCIENCES

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ABSTRACT
Test anxiety adversely affects students academically, but most current assessment tools do not capture multidisciplinary nuances. This research describes the creation and validation process of the Multidomain Test Anxiety Scale (MTAS), which aims to measure the specific anxiety attributes of engineering and social science students. The scale creation process included defining the construct, generating items and drawing on expert feedback, as well as conducting pilot tests and psychometric validation. In the main study, 400 undergraduate students were sampled, and the results uncovered four reliable anxiety dimensions: Cognitive Worry, Somatic Anxiety, Verbal Expression Fear, and Task-Specific Stress. Engineering students showed stronger cognitive and task-oriented anxiety, whereas social science students were more concerned with emotional and expressive aspects. Statistical calculations verified the scale's reliability as well as its structural validity, which showed strong internal consistency and domain discrimination illustrated by a Domain Separation Index of 0.81. The MTAS offers culturally relevant assessment mapping that aids the development of focused academic strategies. The study illustrates the need for psychological instruments that consider the wide-ranging educational contexts and domain-specific complexities.
KEYWORDS: Test anxiety, psychometric scale, engineering education, social sciences, factor analysis, cognitive worry, domain-specific assessment

INTRODUCTION

Test anxiety is a psychological condition impacting a student's academic performance and overall wellbeing. It can include emotions, thoughts, and physical responses to anxiety inducing situations [4]. Considerable research has been done on test anxiety, however, most of it is not domain specific. The fields of engineering and social sciences, for example, have very specific triggers for anxiety. A good example of a field which has specific anxiety triggers is engineering. Engineering students face a great deal of test anxiety due to intense competition, and to severe time limits, multi-step problem solving, and rigid accuracy expectations; and social science students grappling with the pressures of vague grading, open-ended reasoning, and the demand to express complex, often abstract, thoughts. These differences are not effectively captured by generalized anxiety scales. Test anxiety is often viewed as a homogenous experience by most traditional instruments, thus ignoring the differences between disciplines [10]. This gap creates a demand for multi domain specific assessment tools that capture deeper and more intricate details [8]. The academic anxiety framework would more effectively enhance academic support systems with focused, contextual measurements of test anxiety.Test anxiety is multifaceted [2]. It includes worry, emotionality, avoidance behavior, and intrusive thinking [3]. The intensity and expression of these factors differs across academic streams. Engineering students, for example, may be more susceptible to cognitive worry, while students from the social sciences may display more emotional or expressive anxiety [1][7]. As academic disciplines diversify and as cross-disciplinary collaboration flourishes, there is a need to create responsive, flexible, and adaptive tools which reflect and address these differences. This is the goal of the current study which focuses on creating a multidomain test anxiety scale for social science and engineering students. Furthermore, the academic climate is becoming more complex due to the increasing prevalence

of interdisciplinary programs, online learning, and shifting evaluation norms which, in many cases, may increase or change students' test anxiety. These developments underscore the necessity of having a scale that does not only reflect general anxiety trends but is able to respond to the distinctive pressures of different disciplines. This study seeks to address this gap by developing a diagnostic tool in test anxiety that assists social sciences and engineering, two pedagogically disparate fields, and in doing so enhance the equitable and responsive academic support systems in the disciplines.

II. LITERATURE SURVEY

The attentions of test anxiety have been captured using overarching symptoms, worry, tension, and physical symptoms. While these tools have been effective, they lack sensitivity regarding the academic context. Students in disciplines such as engineering endure tremendous stress due to the rigorous time constraints imposed on tasks and their quantitative nature. Interpreting and communicating in the social sciences may incite evaluative anxiety. These area-specific considerations are neglected by a universal model.Several studies show how there are differences in anxiety manifestation by field [13]. Students majoring in engineering report feeling cognitive overload to a greater degree, while social science students worry more about subjective interpretation and expression.Nonetheless, most instruments continue to depend on uniform items. Very few items have been aimed at distinguishing anxiety based on disciplines. Such a lack of tools for properly evaluating and meeting the needs of students is concerning. Today, modern psychometric methods permit [11] the development of sophisticated, multidimensional tools. Exploratory and confirmatory factor analyses, item response theory, and other methods lend themselves to the development of reasonable scales [5][6]. These approaches are rarely applied to the creation of tools sensitive to specific disciplines.Examining test anxiety from a contextual lens provides insight for both research and practical intervention. The goal of this research is to develop a reliable, multifaceted scale that illustrates anxiety specific to engineering and social sciences.In addition to academic fields, culture, institutions, and evaluation systems also shape the experience and reporting of test anxiety [15]. Students from more competitive or exam-oriented systems may experience higher anxiety, exhibiting a discipline-agnostic pattern of anxiety. In more discussion-oriented or project-oriented environments, the anxiety students exhibit may differ from discipline-agnostic patterns [9]. There is insufficient research looking at the interplay of these contextual factors with academic discipline [12]. Most literature appears to focus on general anxiety symptoms or on single-discipline samples, which hinders the applicability of results [14]. This highlights the need for a scale with multiple domains which can adapt to different academic cultures, along with the sensitivity to the particular characteristics of some disciplines such as engineering and social sciences.

III METHODOLOGY

From the information provided in the Figure 1, the Multidomain Test Anxiety Scale (MTAS) was developed using a step-by-step psychometric approach. The approach integrtes construct definintion, item creation, seeking expert approval, piloting, performing statistical evaluation, and all necessary adjustments.

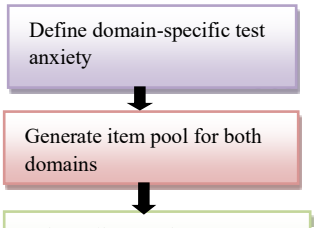

Figure 1. Framework for the Development and Validation of the Multidomain Test Anxiety Scale

The first step in the process was outlining the parameters of test anxiety in relation to different academic fields. Engineering anxiety was associated with technical, time-bound challenges, while social science anxiety was more concerned with expression and interpretive reasoning.

Both shared and domain-specific anxiety symptoms were targeted in the creation of 60 initial items. The items were captured in a simple wording and ranged in response from a 5-point Likert scale of "Strongly Disagree" to "Strongly Agree" without going too complex.

Language and relevance of the items was evaluated by a panel of eight experts in psychology and education. Any item with, a content validity index (CVI) of less than 0.78 was either adjusted or discarded. This brought the item pool down to 42 after undergoing this refinement process.

The scale underwent initial testing with a sample of 100 students, split evenly between engineering and social sciences. Changes were made after reviewing feedback and performing initial analysis. For complete validation, a sample of 400 students, 200 from each domain, was used. Through EFA, four core factors were identified: Cognitive Worry, Somatic Anxiety, Verbal Expression Fear, and Task-Specific Stress. Any items with weak loadings below 0.4, or cross-loadings were removed. Final reliability testing used Cronbach's alpha:

$$\alpha = \frac{N.\bar{C}}{\bar{v}+(N-1).\bar{C}} \qquad \text{Eq (1)}$$

Where N is the number of items, $\bar{C}$ is average covariance, and $\bar{v}$ is average variance. Alpha values for all subscales exceeded 0.78.Confirmatory Factor Analysis (CFA) confirmed structural validity. Fit indices such as CFI (>0.90), RMSEA (<0.08), and SRMR (<0.08) showed good model fit. The final scale contained 36 items across four factors.

IV. RESULTS AND DISCUSSION

Domain-specific analyses were performed after 400 students completed the MTAS. The mean scores indicated distinct patterns: Engineering students exhibited stronger Cognitive Worry and Task-Specific Stress, while students from the social sciences displayed greater Somatic Anxiety and Verbal Expression Fear.

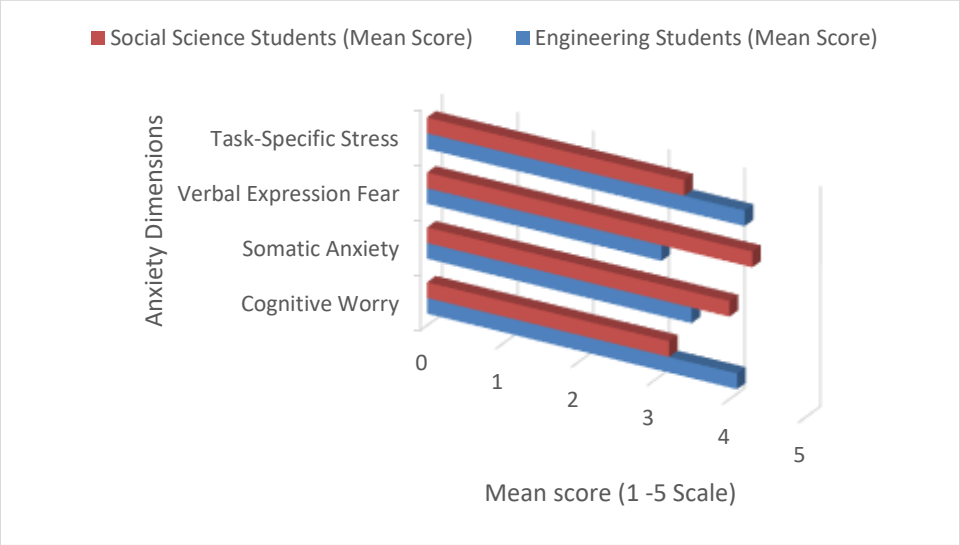

Figure 2. Mean Scores of Anxiety Dimensions by Domain

A Domain Separation Index (DSI) was calculated to quantify scale discriminability:

$$DSI = \frac{\sum_{i=1}^{k} |M_{e,i} - M_{s,i}| . w_i}{k} \qquad Eq\ (2)$$

Where $M_{e,i}$ and $M_{s,i}$ are domain-specific means, w_i is the weight from standard deviation, and k=4k = 4k=4. The resulting DSI was 0.81, confirming the scale's effectiveness in differentiating test anxiety profiles across domains. These findings validate the MTAS as a reliable and sensitive instrument. It not only measures anxiety intensity but captures its academic context, supporting discipline-specific insights and interventions.

V. CONCLUSION AND FUTURE WORK

This research created and validated a multidomain test anxiety scale to capture the unique psychological experiences of engineering and social science students. The instrument showed good reliability and a distinctly revealing factor structure which demonstrated how anxiety varies between disciplines. These findings contribute to the growing literature on context-sensitive evaluation in educational psychology.

Future research should consider adapting MTAS for new fields such as medicine, law, or the arts. Different teaching methods could be studied for anxiety over time in longitudinal studies. A brief version could be created for quick assessments. Incorporation of the scale into digital monitoring would also enhance self-directed learning and proactive mental health assessment in higher education.Aside from its practical uses, the MTAS revamps the prospects for future analyses concerning educational psychology and assessment frameworks. Further research could investigate how educational disruption programs like stress-reduction workshops, tailored instruction, and certain modifications to formative assessments would influence students' anxiety regarding tests as measured on this scale. In addition, validating the MTAS across different cultures would increase its usefulness in multicultural settings, allowing schools from different educational cultures to understand and resolve anxiety related to specific academic tasks. With broader and more refined research tools and frameworks such as this one, educators and researchers are capable of fostering a more inclusive academic climate that attends to the psychology of education and learner support in every discipline.

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