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Exploration of Test Anxiety Profiles in U.S. Undergraduate Students

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Abstract

The present study was conducted using latent profile analysis to determine whether homogeneous test anxiety groups could be identified among 625 undergraduates and to determine whether gender, self-critical perfectionism, and rigid perfectionism were significant predictors of class membership in the identified test anxiety groups. The students completed two multidimensional instruments, measures of test anxiety and perfectionism, online. Results of the latent profile analysis identified a test anxiety profile with three homogeneous groups as the best model. The three homogeneous groups were labeled low, medium, and high. Moreover, gender, self-critical perfectionism, and rigid perfectionism were found to predict class membership differentially in the three homogeneous groups. Implications of the results are discussed in relation to prevention and intervention in the fields of perfectionism and test anxiety.

Keywords: college students, gender differences, test anxiety, perfectionism, latent profile analysis

1. Introduction

Mental health issues are reported to be increasing on college campuses (Eleftheriades et al., 2020). Anxiety has been identified as a major concern affecting U.S. college students (Association for University and College Counseling Centers Directors Annual Survey, 2012). One of the sources of anxiety for college students is the anxiety experienced in testing situations (Furr et al., 2001). Test anxiety is the nervousness, uneasiness, and apprehension experienced in testing contexts, consists of physical, behavioral, and cognitive components (Lowe et al., 2008), and is negatively associated with students' academic performance, learning, and emotional functioning (Cassady & Johnson, 2002; Sub & Prabha, 2003; Lowe, 2021b). Therefore, test anxiety is an important topic to study in the undergraduate population. In the present study, latent profile analysis was conducted to identify different test anxiety groups among U.S. undergraduates and to determine whether certain predictors (gender, self-critical perfectionism, and rigid perfectionism) were significant predictors in the different test anxiety groups on a new, brief instrument of test anxiety.

1.1 Measurement of Test Anxiety

A new instrument to measure test anxiety is the Test Anxiety Measure for College Students-Short Form (TAMC-SF; Lowe 2021b). The measure was developed for undergraduate students. The TAMC-SF includes three cognitive dimensions, one physical dimension, and one behavioral dimension along with a facilitating anxiety dimension. The different dimensions were included on the measure to provide broad coverage of the construct, which researchers have struggled to identify, but also to make a brief and time efficient self-report measure (Lowe, 2021b).

1.2 Model of Test Anxiety

The biopsychosocial model of test anxiety (Lowe et al., 2008) was used to develop the TAMC-SF. The model explains the emergence of test anxiety and how it manifests itself through cognitive, physical, and behavioral symptoms. More specifically, the student's characteristics interact with how the individual perceives an exam (e.g., easy, difficult, or threatening) as well as one's environmental contexts. Through these interactions, anxiety may occur. Low levels of anxiety may have facilitating (i.e., facilitating anxiety) effects and may lead to improvements in test performance while medium or high levels of anxiety may manifest in the form of cognitive, physical, and/or behavioral symptoms and may lead to a decrease in test performance (Lowe et al., 2008).

1.3 Latent Profile Analysis

Latent profile analysis is a mixture model approach used in applied research (Ferguson et al., 2020). In this approach, it is believed that there are hidden homogeneous groups of individuals (e.g., test anxiety groups) within a heterogeneous population, and this approach is used to identify those homogeneous groups of individuals (Ferguson et al., 2020; Masyn, 2013). The individuals within a homogeneous group have a similar response pattern to the instrument(s) they complete and this response pattern is different from the response pattern of other homogeneous groups (Carey et al., 2017; Masyn, 2013). Predictors can be added to the best identified latent profile model and these predictors may possibly predict class membership differentially in the different homogeneous classes or groups (Collins & Lanza, 2013; Masyn, 2013). In the present study, latent profile analysis was conducted on the scale scores (i.e., indicators) of the TAMC-SF in undergraduate students to identify the best latent profile model, consisting of a specific number of homogeneous test anxiety groups.

Few studies in the area of test anxiety have been conducted using latent profile analysis. Lowe (2021a) conducted a latent profile analysis study with 592 adolescents on a comprehensive, 44-item instrument of test anxiety developed for secondary students. The best test anxiety profile identified consisted of three latent classes. Lowe also added gender and grade as covariates to the test anxiety profile with three latent classes and found both gender and grade were significant predictors of class membership in the three latent classes. Predictors were also examined in the current study among undergraduate students and included not only gender, but different dimensions of perfectionism.

1.4 Perfectionism and Test Anxiety

Burcas and Cretu (2021) conducted a meta-analytic study and found positive zero-order correlations between perfectionistic concerns (similar to self-critical perfectionism) and cognitive and affective factors of test anxiety and between perfectionistic strivings (similar to rigid perfectionism) and cognitive and affective dimensions of test anxiety. Likewise, Lowe (2021b) reported positive zero-order correlations between self-critical and rigid perfectionism and a behavioral dimension of test anxiety. Self-critical perfectionism assesses the individual's perception that other people expect one to be faultless or without any flaws (Feher et al., 2020). Review of the perfectionism literature has found positive associations between perfectionistic concerns (self-critical perfectionism), viewed as a maladaptive form of perfectionism, and negative mental health outcomes (Hewitt & Flett, 2004; Stoeber et al., 2009). On the other hand, rigid perfectionism assesses the perception that one must be faultless or without any flaws (Feher et al., 2020). Review of the perfectionism literature has found positive associations between perfectionistic strivings (rigid perfectionism), viewed as an ambivalent kind of perfectionism (Enns & Cox, 2002), and negative and positive mental health outcomes as well as positive attributes (Hewitt & Flett, 2004). Due to the reported relationships between perfectionism and test anxiety, latent profile analysis was performed to determine whether self-critical and rigid perfectionism could significantly predict class membership in the test anxiety groups once the best test anxiety profile model was identified among U.S. undergraduates.

1.5 Gender and Test Anxiety

Gender differences have been reported on instruments of test anxiety in the undergraduate population (Harris et al., 2019; Núñez-Peña et al., 2016). Female undergraduate students have self-reported higher levels of test anxiety than their male undergraduate counterparts (Harris et al., 2019; Núñez-Peña et al., 2016). Hembree (1988) and Seipp and Schwarzer (1996) conducted meta-analyses in the area of test anxiety and these researchers reported a medium effect in gender differences in test anxiety in the student population. Different explanations have been suggested for the gender differences in test anxiety in the student population, including socialization practices (Sutton & Farrall, 2005) and biological differences (Lewinsohn et al., 1998). No latent profile analysis has been conducted with undergraduate students where gender differences have been explored on a five-factor measure of test anxiety. The TAMC-SF, which consists of five test anxiety factors, was develop to provide broader coverage of the test anxiety construct (Lowe, 2021b). Due to the relationship between gender and test anxiety, latent profile analysis was performed to determine whether gender was a significant predictor of class membership in the best latent test anxiety profile identified among U.S. undergraduate students.

1.6 Objectives of the Current Study

The current study had two objectives. The first objective was to explore heterogeneity on a test anxiety instrument among U.S. undergraduates using a number of discrete test anxiety profiles. The second objective was to determine whether gender, self-critical perfectionism, and/or rigid perfectionism predicted class membership in the latent classes of the best test anxiety profile model identified among U.S. undergraduates.

2. Method

2.1 Participants

Participants for the current study included 625 undergraduate students. There were 314 (50.2%) males and 311 (49.8%) females. The average age of the undergraduates was 20.91 years (*SD* = 2.13; range = 18-26). The percentage of freshmen, sophomores, juniors, and seniors was 25.1%, 24.8%, 24.6%, and 25.4%, respectively. Ethnic distribution of the sample included 15.0% African Americans, 9.3% Asians, 54.4% Caucasians, and 18.2% Hispanics. Other ethnic groups made up an additional 3.1% of the sample. The students resided in and attend colleges in the United States.

2.2 Instruments

The Big Three Perfectionism Scale-Short Form (BTPS-SF; Feher et al., 2020) is a 16-item instrument used to measure perfectionism in secondary and postsecondary students as well as adults. The instrument includes three scales, but only two of the scales, Self-Critical Perfectionism and Rigid Perfectionism, were used in this study. Self-Critical Perfectionism measures the perception that others expect one not to have any flaws and Rigid Perfectionism is the perception that one has no flaws (Feher et al., 2020. Internal consistency reliability estimates of .86 for the Self-Critical Perfectionism scores and .85 for the Rigid Perfectionism scores were found in the current study.

The TAMC-SF is a 24-item self-report measure used to assess test anxiety in undergraduate students. The TAMC-SF has a Cognitive Interference scale (4 items), a Physiological Hyperarousal scale (4 items), a Social Concerns scale (4 items), a Task Irrelevant Behaviors scale (4 items), and a Worry scale (4 items). The Cognitive Interference scale measures concentration difficulties experienced in evaluative situations, and the Physiological Hyperarousal scale measures somatic symptoms and muscle tension related to test anxiety. The Social Concerns scale measures concerns an individual has about how others will react if inadequate test performance were to occur, and the Task Irrelevant Behaviors scale measures off-task behaviors in testing contexts. The Worry scale measures concerns about failing an exam (Lowe, 2021). Internal consistency reliability estimates of .76 to .86 for the test anxiety scale scores were found in the current study. The TAMC-SF also has a Facilitating Anxiety scale, but it was not included in the current study.

2.3 Procedures

This study was conducted online. A research review board approved the study and students gave their consent to participate in the study. Once the undergraduates gave their consent, they completed the instruments as well as demographic information requested.

2.4 Data Analysis

SPSS, Version 25 (IBM, 2017) and Mplus, Version 8.6 (L. K. Muthén & B. O. Muthén, 1998-2021) software were used to perform the analyses in the present study. SPSS was used to compute descriptive statistics and internal consistency reliability estimates and Mplus was used to perform latent profile analyses. Fit indices used to select the optimal latent test anxiety profile, included the Bayesian Information Criterion (BIC), the Sample-size Adjusted Bayesian Information Criterion (SABIC), Akaike's Information Criterion (AIC), and Consistent Akaike's Information Criterion (CAIC). Another fit index selected to be used in the current study was the Approximate Weight of Evidence (AWE). Profile models with lower fit indices are considered better models. In addition, the differences in index values from one latent test anxiety profile to the next across the different latent test anxiety profiles also needs to be considered in selecting the optimal test anxiety profile. Smaller differences in the magnitude of the index values from one test anxiety profile to the next test anxiety profile would support the more parsimonious test anxiety profile (Ferguson et al., 2020; Masyn, 2013). In addition, nonsignificant likelihood-based tests, including the Lo-Mendel-Rubin (LMR) test and the Bootstrapped Likelihood Ratio test (BLRT) were also considered in selecting the optimal latent test anxiety profile. The likelihood-based tests compare two adjacent test anxiety profiles and a nonsignificant likelihood test would support the parsimonious latent test anxiety profile, which consists of one less latent class, whereas significant likelihood-based tests would support the latent test anxiety profile with one additional class (Ferguson et al., 2020).

Once the optimal profile was selected, gender, self-critical perfectionism, and rigid perfectionism were added to the model and latent profile analysis was run again and logistic regression was performed to determine whether any of these three variables predicted membership differentially in any of the latent classes. Before the three variables were added to the model, each perfectionism scale (i.e., self-critical and rigid perfectionism scales) was dichotomized with scores +1 standard deviation above their respective perfectionism mean or higher were given

a value of "1" and scores below +1 standard deviation on their respective perfectionism mean were given a value of "0". Undergraduate students receiving a "1" were considered in the high self-critical or rigid perfectionism subgroup and those students receiving a "0" were considered in the low self-critical or rigid perfectionism subgroup. These three variables were regressed on the latent classes of the optimal test anxiety profile identified.

3. Results

Latent profile analysis was performed on the scale scores of the TAMC-SF. The scale scores served as indicators in the latent profile analysis performed. Four test anxiety profiles were examined, with one to four latent classes. The fit indices and results of the likelihood-based tests are presented in Table 1. The fit index (i.e., AIC, AWE, BIC, CAIC, and SABIC) values decreased with an increase in the number of latent classes. In addition, smaller differences were found in the magnitude of the index values from the three latent class profile to the four latent class profile. In addition, the result of the Lo-Mendel-Rubin (LMR) test was non-significant for the test anxiety profile with four latent classes, and all Bootstrapped Likelihood Ratio tests (BLRTs) were significant. Overall, these findings suggest that the profile with three latent classes is the optimal profile for the TAMC-SF because the fit index values were the second lowest for the three latent classes, the magnitude of the fit index values decrease substantially after the profile with three latent classes and the non-significant LMR between three and four latent classes support the profile with three latent classes as being more parsimonious than the profile with four latent classes. Furthermore, entropy values were examined and entropy values of .80 or higher for a test anxiety profile suggests less uncertainty in one's classification (Wang et al., 2017). All latent profiles with two, three, and four classes had entropy values of .80 or higher, suggesting less uncertainty in one's classification.

Table 1. Latent Test Anxiety Profiles

Class(es)	AIC	AWE	BIC	CAIC	SABIC	LMR	BLRT	Entropy
1	15 720.384	15 740.696	15 764.761	15 738.344	15 733.012	-------	------	
2	14 840.921	14 849.218	14 911.925	14 846.882	14 861.128	<.001	<.001	.82
3	14 593.051	14 589.348	14 690.682	14 587.012	14 620.835	<.050	<.001	.80
4	14 500.050	14 484.346	14 624.307	14 482.010	14 535.411	.308	<.001	.80
5	14 403.576	14 375.872	14 554.460	14 373.536	14 446.515	.034	<.001	.81

Average posterior class probabilities and cross-probabilities were also examined for the test anxiety profiles with different numbers of latent classes. The average posterior class probabilities and cross-probabilities assess class homogeneity and class separation. For the profile with three latent classes, the average posterior class probabilities were .90 or higher, indicating the probability of undergraduates belonging to their dominant or own class was high. The high average posterior class probabilities suggest the three groups are different from one another. On the other hand, the cross-probabilities were .09 or lower. The cross-probabilities support the accuracy in classifying the undergraduates in the three different groups.

The test anxiety profile with three latent classes is presented in Figure 1. The latent classes were labeled low test anxiety, medium test anxiety, and high test anxiety groups. Two hundred and seventy students (43.2% of the sample) were in the low group and this class had the lowest standardized means. Two hundred and eighty students (44.8% of the sample) were in the medium group and this class had the second lowest standardized means. Seventy five students (12.0% of the sample) were in the high group and this group had the highest standardized means. It is interesting to the note, the pattern of standardized means for the different dimensions within each group was similar, with the exception of the standardized mean for the Cognitive Interference dimension being higher than the standardized mean for the Task Irrelevant Behaviors dimension in the low group but not in the medium or high group, and the standardized mean for the Physiological Hyperarousal dimension being higher than the standardized mean for the Cognitive Interference dimension in the high group but not in the low or medium group.

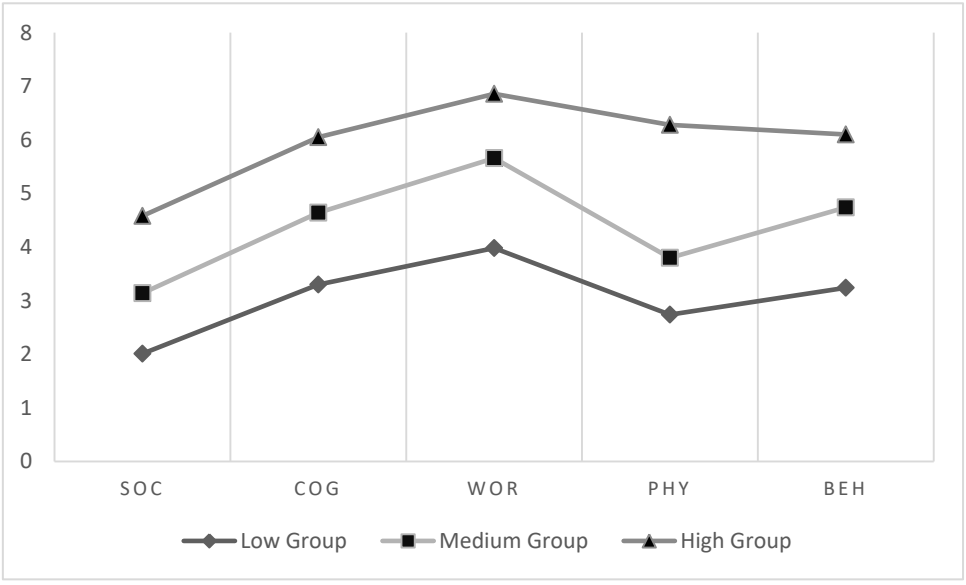

Figure 1. Latent Classes for the Optimal Test Anxiety Profile

Note. SOC= Social Concerns; COG = Cognitive Interference; WOR = Worry; PHY = Physiological Hyperarousal;

BEH = Task Irrelevant Behaviors

Latent profile analysis was conducted again with the test anxiety profile with three latent classes. Gender, self-critical perfectionism, and rigid perfectionism were added to the model to determine whether these added variables were significant predictors of class membership in the three groups. Results indicated that males had a greater likelihood of being in the low group than in the medium group (OR = .954, p < .001. Females had a greater likelihood of being in the high group than the low group (OR = 1.178, p < .001). For self-critical perfectionism, individuals in the high self-critical perfectionism subgroup had a greater likelihood of being in the high anxiety group than in the medium (OR = 1.974, p < .001) and low (OR = 4.098, p < .001) groups and had a greater likelihood of being in the medium anxiety group than in the low group (OR = 2.124, p = .001). Individuals in the high rigid perfectionism subgroup had a greater likelihood of being in the high anxiety group than in the medium (OR = 1.195, p = .003) and low (OR = 1.913, p < .001) groups.

4. Discussion and Conclusion

The first objective was to examine heterogeneity in U.S. undergraduate students. The findings indicated that there was heterogeneity among U.S. undergraduates. More specifically, the results uncovered three homogeneous groups. These findings are similar to the results reported in the Lowe (2021a) study with U.S. adolescents, but on a different instrument of test anxiety developed for adolescents. The findings also align with the biopsychosocial model with its behavioral, physical, and cognitive components (Lowe et al., 2008). It is interesting to the note that the pattern of test anxiety indicators were somewhat similar in the different classes in the current study; however, there were also some minor differences. Of particular interest was the pattern of test anxiety indicators in the highest group. In this group, Worry had the highest standardized mean reported followed in order by Physiological Hyperarousal, Task Irrelevant Behaviors, Cognitive Interference, and Social Concerns. Research has found that the worry component has a significant inverse relationship to academic performance (Hembree, 1988; Zeidner, 1990). Also, this pattern found in the highest group may have some relevance to clinicians in their work with college students in assisting professionals in their assessment and identification of students who are test anxious, although additional research is needed in this area.

Self-critical and rigid perfectionism were found to be significant predictors of class membership in the three groups identified. Students in the high self-critical perfectionism subgroup had a greater likelihood of being in the highest anxiety group. This result is in agreement with the literature supporting a direct relationship between socially prescribed perfectionism (self-critical perfectionism) and maladaptive psychological variables, including test anxiety (Hewitt & Flett, 2004; Stoeber et al., 2009). Moreover, undergraduate students in the in the high rigid perfectionism subgroup had a greater likelihood of being in the highest anxiety group. These findings are also aligned with the research showing a direct relationship between self-oriented perfectionism (rigid

perfectionism) and negative psychological variables (Hewitt & Flett, 2004).

Gender was also found to be a significant predictor of class membership. Females had the greatest likelihood of being in the highest anxiety group. This finding aligns with the research reported on gender differences (Lowe, 2015; Sunny et al., 2017). Lowe (2015) examined gender differences in samples of college students and adolescents on different self-report measures of test anxiety and found similar results.

Self-critical and rigid perfectionism predicted class membership differentially in the three different homogeneous groups. Therefore, latent profile analysis results suggest it might be helpful for clinicians to intervene and reduce the levels of self-critical and rigid perfectionism in college students to address the high test anxiety levels. However, perfectionism is viewed as a relatively stable trait (Flett & Hewitt, 2008) and as a result, Flett and Hewitt suggest some students may be resistant to treatment or even though treatment is found to be effective, the levels of perfectionism at the end of treatment may still be somewhat elevated. Research has suggested cognitive components may be at the core of dysfunctional types of perfectionism (Flett & Hewitt, 2008). Therefore, cognitive-behavioral approaches may be helpful in restructuring students' distorted thoughts and reducing self-critical and rigid perfectionism in the college student population. Research has found a decrease in perfectionism levels when cognitive behavioral approaches have been used alone or in combination with psychoeducation or interpersonal interventions either online or in a group format (Grieve et al., 2022; Kutlesa & Arthur, 2008; Tulbure et al., 2021). Reduction of perfectionism levels may lead to a reduction in test anxiety in U.S. undergraduates.

Current gender findings suggest that females may be more vulnerable to test anxiety. Therefore, mental health professionals who work with undergraduate students in counseling centers on college campuses should be encouraged to engage in prevention and intervention efforts to prevent or reduce test anxiety in the college student population, with close attention to the female student population. Efforts to prevent or reduce test anxiety reported in the literature include training in test and study skills as well as relaxation training. Other strategies reported in the literature to be effective include using cognitive behavioral approaches, developing more effective coping strategies, modifying the test environment, and relaxing time pressures (Ergene, 2003; Zeidner, 1998).

As with all studies, there are some limitations. First, the students who participated in the study were recruited online. Therefore, the sample was not a random stratified sample, which may have limited the generalizability of the findings of the current study. Second, undergraduate students recruited for the present study were between the ages of 18 and 26. There are students who attend college as undergraduates who are older than 26 years of age. If these non-traditional students had been included in the present study, they may have responded differently to the measures used in the study, resulting in findings that may have been different. Therefore, future studies should be conducted with a non-traditional student sample to determine whether similar findings would be found. Third, the measures used in the present study consisted of self-reports. The use of reports completed only by the participant can possibly introduce error variance into a study. Future studies should be conducted where different informants (e.g., instructors, partners, close friends) complete similar or different versions of the same measures, providing their perceptions about participants' perfectionism and test anxiety as well as the severity of those symptoms.

There are a number of different avenues for future research. First, latent profile analyses could be conducted with the TAMC-SF to analyze different potential predictors or covariates and outcome variables with other samples of U.S. undergraduates. Different possible covariates that could be examined include year in college and ethnicity and possible outcome variables could include academic performance measures. A second direction for future research is latent profile analyses could be conducted with the same variables used in the present study, but with samples of undergraduates from different countries to explore heterogeneity with the TAMC-SF and to determine whether gender, and self-critical and rigid perfectionism are significant predictors of class membership in homogeneous groups identified in these samples. A final direction for future research could be to conduct a similar study with a sample of upper elementary students with a measure of test anxiety with similar dimensions to the TAMC-SF to see if similar results would be found. Few latent profile analysis studies have been carried out with elementary students.

In sum, the current study was the first study to identify homogeneous groups on a brief five dimensional instrument of test anxiety among postsecondary students using latent profile analysis and determining whether gender, and self-critical and rigid perfectionism were significant predictors of class membership differentially in these homogeneous groups. Latent profile analysis results indicated that the latent test anxiety profile with three classes provided the optimal model fit. The results of latent profile analysis also indicated that self-critical

perfectionism, gender, and rigid perfectionism predicted class membership differentially in these three homogeneous test anxiety groups, with females, and individuals in the high self-critical and high rigid perfectionism subgroups having a greater likelihood of being in the highest group. These findings may have implications for U.S. undergraduate students in the areas of prevention and intervention in the fields of perfectionism and test anxiety.

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