RESEARCH ARTICLE

Investigation of the factors affecting cognitive test anxiety in university students

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ABSTRACT

Objective: The aim of the present study was to investigate the relationship between cognitive test anxiety and sociodemographic data, anxiety and depressive symptoms as well as the mediating role of the level of depression in the relationship between general anxiety and cognitive test anxiety among university students.

Method: Data were collected from 171 volunteer Turkish university students. A sociodemographic information form, the Beck Depression Inventory, the State and Trait Anxiety Inventory, and the Cognitive Test Anxiety Scale were administered to the participants.

Results: There was a statistically significant correlation between all scales used (p<0.01). Cognitive test anxiety was predicted by trait anxiety level and depressive symptom intensity (p<0.05), but it was not predicted by state anxiety level (p=0.114). In mediation analysis, depression was a mediator between trait anxiety and cognitive test anxiety (p<0.05).

Conclusion: Results will contribute to a better understanding of the relationship between different psychological variables such as anxiety and depression.

Keywords: Anxiety, anxiety disorders, depression, students

INTRODUCTION

Test anxiety refers to the physiological and behavioral reactions to tests. These reactions are accompanied by the examinee's thoughts and stress before or after the test (1). Test anxiety is not addressed under a separate heading in the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders but can be assessed under specific phobias (2).

One of the most important reasons why test anxiety has occupied researchers' agendas is its negative impact on performance. The literature on test anxiety includes results showing the link between individual expectations of test outcomes and actual performance (1,3,4). Studies exist that show increases in test anxiety to relate to decreased academic performance while decreases in test anxiety level relate to better performance (5,6). Test anxiety is associated with sociodemographic

characteristics such as ethnic minority participation, socioeconomic status, being female, and mood changes such as depression (2,7-12).

The first methods used for assessing the construct only evaluated test anxiety during the test while not dealing with the state of anxiety before or after the examination (4). In the late 1960s, two dimensions for test anxiety were identified, emotionality and worry (13). The affective dimension of test anxiety includes physiological responses such as high heart rates, headaches, and cortisol production triggered by anxiety (14-16).

The worry dimension of test anxiety includes a person's self-deprecating thoughts, fear of failure, guilt about not working enough, the idea that he/she is unsuccessful and inadequate compared to others, distraction during study and test, concerns about the result of the test, perception of the test as a threat to self-esteem and peer status, avoiding situations of preparation and evaluation, and focusing one's attention on oneself (3,8,17,18). High levels of anxiety and evaluating increased anxiety as a threat increase students' beliefs and cognitions related to the cognitive dimension of test anxiety, promote related behaviors, and affect learning performance (15). Several studies on the relationship between test anxiety and performance have shown the cognitive dimension to outweigh the emotional dimension (12,13). Therefore, the research focus has turned towards evaluating the cognitive dimension (5).

Test anxiety has been found to relate to both state and trait (chronic) anxiety (5). Although test anxiety appears to be a form of state anxiety, it is more closely related to trait anxiety according to Baspinar et al. (19). Spielberger et al. (20) consider test anxiety a form of constant anxiety. Ongoing anxiety in a highly anxious person is triggered by a particular situation (i.e., the test), and emotional responses emerge. The effect of trait anxiety on performance is greater than that of state anxiety (6). Test anxiety is said to begin before and continue after taking the test (21). Cognitions related to the cognitive dimension of test anxiety are not only present during the test but also before and after (9,18).

Test anxiety has been associated with social phobia, generalized anxiety, and depression (2,12). Beidel et al. found a rate of test anxiety of 54% in children who had not been diagnosed with any psychiatric disorder other than anxiety disorders (22). Another study confirmed these findings and found phobic or anxiety disorders to be present in 61% of grade 9 and 10 students with test anxiety (11).

Depression is associated with test anxiety but not as much as other anxiety disorders (2). Depressive symptoms and hopelessness levels were found to be higher in the group with high test anxiety levels compared to the lower-level group (11). Warren et al. (23) found anxiety and depression levels to be higher in children with high test anxiety than in children with low test anxiety. It has been stated that anxiety related to tests in educational institutions can lead to the development of depression (24).

First, we aimed to determine and measure the variables related to and/or affecting cognitive test anxiety in university students, and second, we intended to evaluate the role of depression in the relationship between general anxiety and cognitive test anxiety, as no studies evaluating this relationship with more advanced methods are available in the existing literature.

The first hypothesis of our study is that cognitive test anxiety is associated with depression and anxiety, and the second hypothesis assumes it to be more associated with trait anxiety than situational anxiety. Depression is related with both chronic anxiety and test anxiety. The possibility exists for a mediating role between these two variables. Therefore, our third hypothesis considers depression a mediating variable in the relationship between trait anxiety and cognitive test anxiety. We think that our study may contribute to a better understanding of the relationship between cognitive test anxiety, depression, and anxiety. The results may help develop more effective intervention methods for test anxiety.

METHOD

The study sample consisted of 171 university students attending undergraduate education. The students were reached through announcements at Corum Hitit University. Non-probability convenience sampling was used for recruitment. The participants were informed in writing about the study through an informed consent form. Corum Hitit University is the universe from which the sample has been selected, consisting of approximately 18.000 students.

Inclusion criteria for this research were that the participant is enrolled in undergraduate education, knows enough Turkish to complete the self-report scales without help, and has provided written and verbal consent for participating in the study. The absence of written and verbal consent, the presence of a current psychiatric or medical problem that may prevent the candidate from completing forms, and not completing

forms were criteria for exclusion. All 302 students accepted to participate in the study.

Measures

Sociodemographic Data Form: This form was prepared by the researchers to record the participants' sociodemographic characteristics. The form is intended for collecting information about the participants' age, gender, education, and background.

Beck Depression Inventory (BDI): The original form was developed in 1961 by Beck et al. (25) and aims to assess the severity of depression symptoms. It is a self-report scale consisting of 21 questions. Each question is scored between 0 and 3 by the participant. The total score ranges from 0-63. In 1989, Hisli (26) adapted the scale to Turkish.

Cognitive Test Anxiety Scale-Revised (CTAS-R): This instrument was designed by Cassady and Finch in 2015 to evaluate the cognitive aspect of test anxiety as a revision of the Cognitive Test Anxiety Scale developed by Cassady and Johnson in 2002 (3,15). The validity and reliability of the Turkish adaptation was examined by Bozkurt et al. in 2017 (9). It is a 4-point Likert-type self-report scale consisting of 25 questions, offering a reliable and valid method for assessing the cognitive dimension of test anxiety.

State and Trait Anxiety Inventory (STAI): The original form was prepared by Spielberger et al. in 1983 (27). The validity and reliability of the Turkish adaptation was tested by Oner and Le Compte in 1985 (28). It is a 4-point Likert-type self-report scale consisting of two separate scales each with 20 items that measure state and trait anxiety. Higher scores obtained from the scales indicate higher levels of anxiety and concern.

Procedure

Before beginning the study, written permission was obtained from the local ethics committee in Turkey. Participants were informed about the nature of the study and written informed consent has been obtained through an informed consent form.

To recruit the research sample, advertisements with information about the nature of the study summarizing the participation requirements and containing contact information were posted on boards in places students frequently use in the university, and the people included in the sample were reached by these means. Pre-interviews were conducted with the participants, verbal and written informed consent was obtained, and the researchers evaluated the participants' sociodemographic information using the sociodemographic data form. The

participants completed the self-report forms. Data were collected between May and November 2018. The researchers completed the data collection process in a separate room set aside for this purpose in a single session, working for about 1 hour outside the classroom environment in the university the students attended. During the study, 302 individuals were reached; 131 people completed neither the forms nor the data collection process, even though they had agreed to participate in the study. Data from the 171 persons who had completed the data collection were included in the statistical analysis. No payment or extra test grades were given to the participants.

Statistical Analysis

The obtained data were evaluated by computer using the Statistical Package for Social Sciences (SPSS version 20.0.0 on Mac OS 10.14.3), applying correlation, regression, and mediation analyses and appropriate comparison methods such as t-test or ANOVA. The t-test was used to determine the difference between independent groups, and the Pearson correlation test and regression analysis were used to examine the relationships among the scales. The results were evaluated using a 95% confidence interval, and statistical significance was accepted for $p < 0.05$.

RESULTS

Sociodemographic Data

The research sample consisted of 111 (64.9%) women and 60 (35.1%) men. The mean age of the sample was 21.51±1.60 years, with the mean age of women (n=111) being 21.32±1.70 and the mean age of men (n=60) 21.85±1.37 years. The entire research sample answered the question about the class. Of the whole sample, 15 (8.8%) were freshmen, 42 (24.6%) were sophomores, 59 (34.5%) were juniors, and 55 (32.2%) were seniors. For income level, the categories were low (monthly household income is less than one minimum salary), medium (monthly household income is between 1-3 minimum salaries), and high (monthly household income is more than 3 minimum salaries). Of the participants, 28 (16.4%) had low, 84 (49.1%) had medium, and 59 (34.5%) had high income levels.

Measuring Test Anxiety and its Psychological Variables

The distribution of continuous variables measured by STAI and its sub-dimensions, BDI, and CTAS-R was examined using a histogram and Q-Q plot graphs, and

Table 1: Descriptive statistics and Pearson correlation test between scales

(n=171)	Mean	SD	BDI	STAI-t	STAI-s	CTAS-R
BDI	11.80	10.75	—			
STAI-t	42.63	10.19	0.662*	—		
STAI-s	43.85	8.88	0.491*	0.557*	—	
CTAS-R	47.48	17.16	0.548*	0.553*	0.427*	—

SD: Standard deviation, BDI: Beck Depression Inventory, CTAS-R: Cognitive Examination Anxiety Scale - Revised, STAI: State and Trait Anxiety Inventory, STAI-t State and Trait Anxiety Inventory, Trait Anxiety Scale, STAI-s State and Trait Anxiety Inventory, State Anxiety Scale

Table 2: Results of linear regression analysis for CTAS-R as dependent variable and BDI, STAI-t, STAI-s as independent variables

	R^2	B	β	t	p
BDI	0.375	0.476	0.298	3.584	<0.001
STAI-t		0.560	0.290	3.321	<0.001
STAI-s		0.200	0.119	1.583	0.115

CTAS-R: Cognitive Examination Anxiety Scale - Revised, BDI: Beck Depression Inventory, STAI-t: State and Trait Anxiety Inventory - Trait Anxiety, STAI-s: State and Trait Anxiety Inventory - State Anxiety

the distribution of these variables was found to correspond to a normal distribution. Descriptive statistics for the scales are shown in Table 1.

The independent sample t-test for variables with two distinct categories and ANOVA for variables with three or more distinct categories were used to examine the differences among groups. Gender, class, and financial status groups were taken as the independent variables and the CTAS-R score as the dependent variable (29).

One-way t-test was used to determine the differences in cognitive test anxiety according to gender. No statistically significant difference exists between the genders regarding cognitive test anxiety (F=3.05, t=-1.10, p=0.28). One-way ANOVA test was performed to determine the differences in cognitive test anxiety according to the year of study. In the ANOVA analysis, no statistically significant difference was found between freshmen, sophomores, juniors, and seniors regarding cognitive test anxiety (F [3, 145]=0.10, p=0.958). To assess the relationship between income level and test anxiety, the participants were divided into three groups according to their families' income levels, and the one-way ANOVA test was performed to determine the differences among groups. In the ANOVA analysis, no statistically significant difference was found for cognitive test anxiety levels according to income (F [3, 140]=0.73, p=0.484).

Relationships Among Scales

In the first step to investigate the strength and direction of the basic relationship between cognitive test anxiety, trait anxiety level, state anxiety level, and depressive symptom intensity, Pearson correlation test was used. Levels of 0.10<r<0.29 were considered to indicate a low correlation, 0.30<r<0.49 a medium, and 0.50<r<1.0 to show a high-level correlation (29). Table 1 also shows the r and p values.

In the second stage, linear regression analysis was used to evaluate how well trait anxiety level, state anxiety level, and depressive symptom intensity were able to predict cognitive test anxiety. Aim of the regression analysis was a more sophisticated exploration of the relationship between these variables (29).

The sub-dimensions of trait anxiety and state anxiety for STAI and BDI were considered as the independent variables and the CTAS-R score as the dependent variable. According to the regression analysis, the CTAS-R score is predicted by the intensity of depression symptoms and trait anxiety (p<0.01) but not by state anxiety (p=0.115). The results of the regression analyses are given in Table 2.

In the third step, our study evaluated the relationships between the scales using the mediation analysis model established among the sub-dimension of trait anxiety of STAI, BDI, and CTAS-R. Trait anxiety is associated with test anxiety, as shown in our analysis and previous studies (2,5). We evaluated the BDI score as an intermediary variable to measure the magnitude of the effect of depression in this relationship between trait anxiety and cognitive examination anxiety. Trait anxiety is associated with test anxiety. Andrew Hayes' hypotheses were used for mediation analysis (30).

Regression tests, bootstrapping method, and the Sobel test were applied to determine whether the effects of the evaluated mediation model are statistically significant, using the program PROCESS for SPSS 2.16.3. The bootstrapping method was chosen to reduce Type 1

errors and to check for variables that may have the potential to affect relationships. The statistical significance of the mediator variable was evaluated with 5.000 bootstraps; p<0.001 was considered statistically significant. The independent variable of the study is the variable of the trait anxiety instrument, the intensity of depression symptoms is the mediating variable, and the criterion variable is cognitive test anxiety. (A) The total effect of trait anxiety on cognitive test anxiety is significant (F=74.61, t=8.64, SE=0.12, ß=0.55, p<0.001). (B) The effect of trait anxiety on the mediating variable of depression symptoms is significant (F=131.51, t=11.47, SE=0.07, ß=0.66, p<0.001). (C) The effect of the mediating variable of depression symptoms on cognitive test anxiety is significant (F=48.37, t=3.96, SE=0.13, ß=0.32, p<0.001). (D) When simultaneously evaluating the relationship between trait anxiety and the mediating variable of depressive symptoms, the relationship between trait anxiety and cognitive test anxiety decreases; however, the significance level remains the same (F=48.37, t=4.14, SE=0.16, ß=0.34, p<0.001). According to this result, depression symptoms are seen to mediate the relationship between trait anxiety and cognitive test anxiety and all significance levels were found below 0.001 in mediation analysis (p<0.001). Both the Sobel test and the value of significance support mediation (z=3.73, p<0.001). The mediation analysis model and its results are shown in Figure 1.

DISCUSSION

Correlations at various levels between the scales used have been found. A significant relationship has been determined between cognitive test anxiety and depression symptoms and state and trait anxiety. According to our analysis, trait anxiety predicts cognitive test anxiety and depression levels predict test anxiety. When the mediation analysis was performed, the direct relationship between trait anxiety, the leading variable, and cognitive test anxiety, which was the outcome variable, was seen to decrease while the significance level of this relationship did not change.

In the context of test anxiety, while trait anxiety signifies that a person generally assesses examinations as threatening, situational anxiety can be exemplified as evaluating a particular test as threatening. Thus, we can say that it is more appropriate to examine the relationship of test anxiety with different psychological structures rather than only evaluating its effect on academic performance. These assessments appear to be necessary for a better understanding of the differences

Figure 1. Mediation analysis diagram.
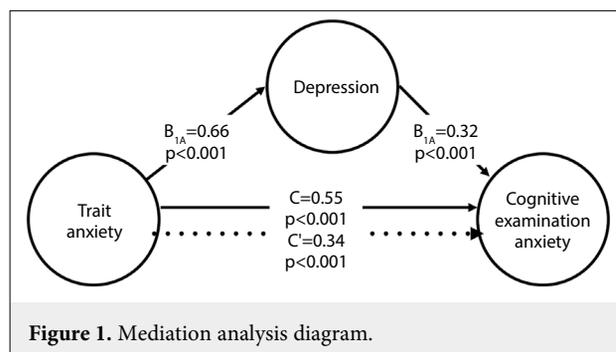
in test anxiety among the groups and a better interpretation of its relationship to performance.

Our study has found no significant difference between genders in cognitive test anxiety levels. Studies in the literature have shown women's level of test anxiety to be generally higher than that of men (8,12,31). This difference is said to exist for both general test anxiety and cognitive test anxiety, and women are said to have more negative evaluations and expectations regarding tests and themselves (3,5). However, studies have indicated that such a difference does not exist, or the detected differences are at least controversial (9,23).

In one study, no difference was found between women and men in the cognitive dimension of test anxiety, but the emotional dimension was found to be higher in women; these data are similar to those from our research (18). Gender differences in test anxiety have been reported to decrease during the university period (5). This information is similar to the results of our study. In sum, although the literature generally indicates the level of test anxiety to be higher in women, controversial results can be said to emerge when different statistical analyses are performed or when evaluating the sub-dimensions of test anxiety.

No significant difference has been found between years of study regarding test anxiety. A study with university students in Turkey showed general test anxiety to be higher in freshmen than in seniors, and the cognitive dimension of test anxiety was higher in both freshmen and sophomores compared to seniors (31). Although the results of our study differ from Kapikiran's (31), no results in the literature have shown the relationships between year of study and test anxiety.

Cognitive test anxiety does not significantly differ by income groups. Several papers on test anxiety found a relationship between socioeconomic level and test anxiety (5). Studies evaluating larger samples in the United Kingdom and Israel concluded that anxiety increases as socioeconomic levels decrease (10,32). Although no difference exists in our groups, a study with a larger sample may have the potential to find a significant difference.

In the correlation analysis, a high correlation has been found for CTAS-R with STAI and STAI-trait and a moderate correlation with STAI-state. Test anxiety can be considered a kind of anxiety specific to a state. The positive relationship of test anxiety with anxiety occurring in other areas is expected and has been shown in the literature (2,5). Cognitive test anxiety can be said to have more to do with trait anxiety. This assertion may be related to how cognitive test anxiety is maintained before and after the test, rather than just occurring during the test. In the regression analysis, correlation analysis confirmed that trait anxiety also predicts cognitive test anxiety continuously, but not situational anxiety. Different articles have stated test anxiety to display the features of trait anxiety (3,18,19,33). The relationship of cognitive anxiety with state and trait anxiety has been found compatible with our hypotheses.

The correlation between BDI and CTAS-R and BDI predicting CTAS-R scores are in line with the information in the literature, which indicates a positive correlation to exist between depression symptoms and test anxiety (11,12). Although the literature has shown the relationship between test anxiety and anxiety disorders to be greater than that of test anxiety with depressive symptoms, a similar difference has not been found in our study (2).

In accordance with our hypothesis, the statistical analysis in our study has shown depression to be a mediating variable in the relationship between trait anxiety and cognitive test anxiety. The reason for this mediator effect of depression may be insufficient preparation for the test, negative thoughts about self, lack of motivation, and loss of concentration, which may coexist with depression. These possible factors can lead to worries about the test in the presence of anxiety, and cognitive test anxiety may increase accordingly. As mentioned above, previous studies have shown results related to the relationship between depression, general anxiety, and test anxiety (2,11,12,22,23). However, no study was found in the literature review in which the relationships between depression, general anxiety, and test anxiety had been evaluated using mediation analysis.

The biggest limitation of our research is that academic performance was not evaluated. Evaluating academic performance can help understand the relationship between test anxiety and various psychological variables better. Another limitation of the study is its cross-sectional structure. To examine change in test anxiety, longitudinal observational studies may be more appropriate. Another limitation is the use of self-report scales as measurement instruments in the research. This method can be more susceptible to inaccurate or incomplete evaluations than structured or intervention-based measurement techniques. As a result of reaching students with open advertisements, the less random sample selection decreases the representation of the universe. Even if the results obtained give an idea about university students in Turkey, due to the sampling method these results cannot be generalized to the universe of university students in Turkey. An imbalance can be said to exist between the numbers of the subgroups that make up the sample, as the people included in the sample have been accepted at a specific time interval. When selecting subjects, psychiatric or medical diagnoses and history were not evaluated, which is another limitation. The sample size of the study is low, especially considering that self-assessment scales are used and no clinical diagnoses are available. This may be due to the limited duration of the research and the lack of rewards for the participants. Some of the participants have not completed one or more of the self-assessment scales or have left them completely empty. Therefore, the collected data were evaluated and the missing part of that data was not included in the study. Class and gender differences of the participants were not taken into account when creating the sample; therefore, a noticeable difference emerged between gender and class distribution.

Our study has importance in the literature in that it has examined data about test anxiety in a sample of university students. The novelty of this study is that it evaluates the relationship of cognitive test anxiety, general anxiety, and depression differently from the literature. We think the results we obtained, especially the results from mediation analysis, will provide a better understanding of the relationships among the qualities of cognitive test anxiety and various psychological variables such as anxiety and depression. For future studies, it may be advisable to evaluate the relationship between depression, general anxiety, and test anxiety with larger samples in prospective studies and to consider depression when developing interventions to test anxiety.

Contribution Categories		Author Initials
Category 1	Concept/Design	M.E.K., Y.S., T.K.
	Data acquisition	M.E.K., H.S.B.
	Data analysis/Interpretation	M.E.K., H.S.B.
Category 2	Drafting manuscript	H.S.B., M.E.K., Y.S., T.K.
	Critical revision of manuscript	M.E.K., T.K.
Category 3	Final approval and accountability	H.S.B., M.E.K., Y.S., T.K.
Other	Technical or material support	H.S.B., M.E.K., Y.S., T.K.
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