IOSR Journal of Research & Method in Education (IOSR-JRME)
e-ISSN: 2320–7388, p- ISSN: 2320-737x Volume 13, Issue 3 Ser. III (May. – June. 2023), 56-62
www.iosrjournals.org

Structural Equivalence Of Cognitive Test Anxiety And Students' Academic Performance In Liberia

Hinneh, Johnson Tekay and Mao, Qiming
School of Education, Central China Normal University, People Republic of China

Abstract:
Problems of student underachievement continue to worry educators all over the world especially in developing countries such as Liberia. Attempts to investigate causes of underachievement among students found relationship between anxiety and intelligence amongst students. Several studies sparked interests to study the test anxiety in more detail to assess its causes, effects, and levels across different sub-populations. These led to the development of different instruments to measure existence of different forms of test. Validation studies for these instruments led Cassady and Johnson to develop the Cognitive Test Anxiety Scale (CTAS). Some Western and European countries had begun investigating the relationship and found that Test anxiety has detrimental effects on learner academic performance, but such research is to a large extent non-existent in African countries such as Liberia. Hence, this study assessed the structural equivalence of the original models underlying the CTAS, verified with samples from senior secondary school students in Liberia. The purpose of the study was to validate the dimensionality of the cognitive test anxiety scale, to determine the mean difference between female students and male students test anxiety score, and to determine the extent to which level of test anxiety influences students' performance. A descriptive survey design was used with a simple random sample of (n=300) 12th grade students from 6 senior secondary schools in Liberia. Measure Students completed a 27-item English version of a Cognitive Test Anxiety Scale (CTAS). The scale was developed to assess cognitive aspects of test anxiety found to affect student performance such as tendency to compare themselves with others during test taking, likelihood to have intruding thoughts during tests (Cassady & Johnson, 2002). Responses were measured on a four- point Likert scale from 'Not typical of me to Very typical of me'. Exploratory Factor Analysis was computed to identify the factor structure of the CTAS as used in Liberia. Further analysis was performed to determine the impact of cognitive test anxiety on students' academic performance. The study found that the cognitive test anxiety scale is not unidimensional in the context of Liberia, but all factors loaded on two factors rotated factor loadings suggest that factor one represents emotionality and factor two strongly describes worry. It also found no statistically significant difference between the mean cognitive test anxiety scores of the female student group and the male student group. Importantly, the study found a no significant effect of the cognitive test anxiety scores and students' academic performance.

Keywords*: Structural equivalence, Cognitive Test Anxiety, academic performance*

Date of Submission: 09-06-2023 Date of Acceptance: 19-06-2023

I. Introduction

Nowadays secondary school students are challenged to produce desirable quality performance on national and regional examinations in other to be comparatively advantageous for enrollment in tertiary education and employment. This situation may largely be attributed to the quality of the education system but way comparably on the level of anxiety during test and examination among senior secondary school students in Liberia. Test anxiety is one of the serious problems that challenge students today in many countries and continues to attract more attention especially in the wake of recent trend in international test (Ryan & Brown, 2005; Whitaker Sena, Lowe, & Lee, 2007). According to Driscoll (n.d) high test anxiety affect a significant portion of students largely between 15-35 percent depending on the standard for inclusion and sampling.

At this point it is necessary to point out the difference between general anxiety and test anxiety. Anxiety is a complex term that has been associated with varied meanings. Generally, most researchers and authors considered anxiety as an unpleasant feeling of possible harm which tends to evoke an avoidance response. In spite of the diverse meaning of anxiety, McReynolds (1968) concludes, "It can be said that the construct of anxiety, though conceptually imprecise, has nevertheless proved generally useful, and seems basically well founded (p. 247)." On the other hand, test anxiety is regarded as a predisposition to feel anxious in test and test-like situations either before or during a test. This implies that under certain conditions test anxiety interferes with students cognitive functioning in terms of academic performance. However, in other to empirically investigate the concept 'anxiety' McReynolds (1968) asserts that many authors have treated anxiety as a multidimensional construct.

Along one dimension, anxiety may be dichotomized as "characteristic (trait) anxiety" versus "current (state) anxiety" whiles along yet another dimension, anxiety is regarded as (worry) "existent anxiety" versus (emotional) "proneness to anxiety". This multidimensional conceptualization of anxiety challenges the curious mind and induces the need to investigate more into this area.

According to Nolting (2000) test anxiety originates from several sources: test anxiety as a learned behavior, the association of grades and personal worth, a feeling of a lack of control, a teacher embarrassing a student in front of their classmates, a student being placed into course above his/her ability, fear of alienation from parents, family, and friends due to poor grades, timed tests and the fear of not finishing the test, even if one can attempt all the tasks. Despite the numerous causes of text anxiety, there are two types of text anxiety identified so far: somatic or what a student feels at a moment or state and cognitive or what a student is thinking at the moment. Consequently, students leave the testing hall or room early rather than counterchecking their responses to test items mainly because their anxiety level gets so high that they have to leave or they don't want to be the last one in the test hall or room (Nolting, 2000). Realistically, increased anxiety among students is a problem and is one of considerable concern in colleges today because many youngsters fail or are struggling to realize their full potentials within these high learning institutions.

Globally, over the past decades, students continue to underachieve despite efforts to improve teaching and learning. Attempts to investigate causes of underachievement among students, researchers found a relationship between anxiety and intelligence, which is often manifested in college students' academic achievement. Sarason, et al. (1960) embarked on an investigation and presented empirical support for this notion. However, their finding did not determine exactly how, under what condition, and to what extent test anxiety influences performance. Unfortunately, none of these studies have been conducted in the context of Africa. The persistent problem of underachievement among college students is one of great importance, which test anxiety is a contributing factor.

As a result, since the 1960s, anxiety has been an international focus for research within the behavioral sciences especially in the field of education and psychology. Generally, validation studies have been traditionally concerned with relating test anxiety instrument with previously similar validated instrument or lower test performance. But most of these studies on test anxiety have been largely concentrated in developed countries such as Germany, England, the Netherlands, and the United States (Putwain & Daniels, 2010; Tsianos, Lekkas, Germanakos, Mourlas, & Samaras, 2009), Asia (Chen, 2007; Zheng, 2010), (Furlan, Cassady, & Perez, 2009) in North and South America and Cassady et al. (2004) in the Middle East have conducted a cross-cultural validation research but with little or no attempts in the context of Liberia. Even though the commitment to test anxiety internationally is important, there is an urgent need to bring an African perspective in the discussion. In other words, validation of cognitive test anxiety has been conducted in other parts of the world but no such studies have been conducted in the African context. Comparatively little or no attention has been given to the validation and effects of test anxiety on students' performance in Africa.

II. Statement of the Problem

Validity of cognitive test anxiety has been conducted in other parts of the world specifically at the tertiary level, but no such studies have been conducted in the African context. Therefore, this study will be implemented at the senior secondary school level in Liberia to validate the dimensionality of the 25 items cognitive test anxiety scale and determine whether test anxiety influences college students' performance in the Liberian context. The problem is that nowadays secondary school students are challenged to produce desirable quality performance on national and regional examinations in other to be comparatively advantageous for enrollment in tertiary education and employment; a situation which evokes some level of anxiety during test and examination. Therefore, it is important currently to extend this global search 'the dynamics of test anxiety' in the African context to help deal appropriately with test anxiety and help improve students' performance at the senior secondary school level as they prepare for tertiary education and subsequently the world of work.

III. Purpose of the Study and Significance

The purpose of this comparative study is to validate the dimensionality of the 25 items cognitive test anxiety scale and determine whether test anxiety affects college students' performance. The significance of the study provides information in the African context and informs teachers and school leaders of the dimensionality of cognitive test anxiety and its influence on students' performance. Teachers and school leaders will use the information gathered to provide appropriate support and improve students' performance.

IV. Research question

Specifically, this study was guided by the following:

- To validate the dimensionality of the cognitive test anxiety scale.
- To determine the mean difference between female students and male students test anxiety score.

- To determine the extent to which level of test anxiety influences students' performance.

V. Hypotheses

Based on literatures and theoretical foundations, the following hypotheses are proposed:

1. The construct cognitive test anxiety is a unidimensional scale.
2. Female 12th grade students' show significantly high level of test anxiety than male students.
3. Level of cognitive test anxiety significantly influences 12th grade students' performance.

VI. Limitations

This study was only examining the dimensionality of cognitive test anxiety scale and the relationships between test anxiety and test performance in with 12th grade students. It excluded test conditions and consistency of intra-individual performance and de facto measures of students' performance that is first semester average scores of students in their favorite subjects.

VII. Theoretical Framework

Hebb's Theory of Arousal will guide this study. It was first proposed by Dodson-Law (1908) and adapted in 1972 by Hebb. Hebb's theory postulates that human beings seek out an optimal level of arousal, in this case anxiety, in that lower arousal brings about boredom while higher arousal leads to stress. The theory predicts a U-shaped function between the arousal (anxiety) and outcome of the arousal (performance). Furthermore, the theory assumes that both low and high levels of the arousal (anxiety) produce minimum performance while a moderate level results in maximum performance. In order words, the Hebb's theory of arousal provides meaningful explanation of the relationship between test anxiety and academic performance; hence the theory was used to guide this study.

VIII. Literature Review

Structure of the Cognitive Test Anxiety Scale

Test anxiety scale has been reportedly examined using different analytic techniques, but structure of the test anxiety scale has yielded differing dimensionalities or components. For example, Sarason (1961) described test anxiety as a construct that could be measured with unidimensional scales but according to Cassady and Johnson (2002) early studies examining unidimensional measures of test anxiety found at least two manifestations of test anxiety. Prominent among these manifestations are the famous two dimensions: emotionality and worry. As the result, several studies (Liebert & Morris, 1967; Spielberger, Gonzalez, Taylor, Algase, & Anton, 1978) were geared towards the designing of better measures of test anxiety and the determination of the consequences of the two factors (Hembree, 1988, cited in Cassady & Johnson, 2002). However, in line with the purpose of this study, the worry type of test anxiety that is highly associated with cognitive test anxiety scale will be expanded and termed cognitive test anxiety. According to Cassady and Johnson (2002), the cognitive test anxiety consists of a person's cognitive reactions to evaluative conditions prior to, during, and after evaluative tasks.

Akinsola and Nwajei, (2013) of the cognitive test anxiety scale reported a single factor structure. Baghaei and Cassady (2014) validated a 17-item revised version of the cognitive test anxiety scale with 297 undergraduate students. Using the Rash rating scale model to examine the dimensionality of the translated scale, they found that the scale was a valid measure of cognitive test anxiety.

Gender and Level of Cognitive Test Anxiety

Traditionally, students are categorized according to their biological make up as male or female. It is believed that the gender of students is associated with their mental, physical, and psychological characteristics. Several studies (Bandalos, Yates, & Thorndike-Christ, 1995; Cassady, 2001; Hembree, 1988; Volkmer & Feather, 1991; Zeidner, 1990; Zeidner, 1998) reported concurrent findings that females tend to have higher levels of average test anxiety than their males counterpart. Furthermore, in their independent study, Farooqi, Ghanl, and Spielberger (2012) examined gender differences in test anxiety and academic performance. They found that female medical students significantly showed higher test anxiety levels than male medical students. In another study, Cassady and Johnson (2002) worked with 168 undergraduate students to examine the psychometric quality of the cognitive test anxiety scale. Their study found gender differences in cognitive test anxiety, but maintained such difference does not dispose them to low academic performance. Contrarily, Akinsola and Nwajei (2013) found no significant difference in the test anxiety levels of males and females.

Cognitive Test anxiety and Students' Academic Performance

Poor academic performance among students is a worrisome situation for teachers, parents, educationalists as well as national governments. Most of the time, researchers try to find solution to the recurring problem of poor performance. The main focus of most studies on test anxiety has been because of its correlation

with students' performance. This notion is accredited to Hembree's (1988) who through meta-analysis demonstrated that the cognitive test anxiety has the greatest negative impact on performance. The level of intelligence or cognitive functioning of students before or during test or examination is one of the contributing factors. Hembree (1988) found that cognitive test anxiety is the ever present factor that interfers with students' performance. Some authorities (Deffenbacher, 1980; Depreeuw, 1984; Hembree, 1988; Morris et al., 1981) in the area of cognitive test anxiety emphasize that cognitive test anxiety is characterized by (a) comparing self-performance to peers, (b) considering the consequences of failure, (c) low levels of confidence in performance, (d) excessive worry over evaluation, (e) causing sorrow for their parents, (f) feeling unprepared for tests, and (g) loss of self-worth.

Several authors (Eysenck, 1992; Eysenck, Deakshan, Santos, & Calvo, 2007; Sarason, Sarason, & Pierce, 1990, cited in Northern, 2010) also maintained that there is an association between anxiety and low cognitive performance on academic. Cassady and Johnson (2002), Kassim, Hanafi, and Hancock (2008); Farooqi, Ghanl, and Spielberger (2012); Rana and Mahmood (2010), and Chapell, Blanding, Takahashi, Silverstein, Newman, Gubi, and McCann (2005) in their separate studies found that cognitive test anxiety have significant negative impact on students' academic performance. Hancock (2001) also found that students with high level of anxiety performed poorly than those with low level of anxiety. This was also reported by Ndirangu, Muola, Kithuka, and Nassluma (2009) who found that secondary school students showed higher levels anxiety before the examination in all subjects. Cassady (2004) carried out a study to determine the impact of cognitive test anxiety in the learning – testing cycle. Data from 124 participants was used for the study. The result revealed that the high-anxiety group performed worse on tests than the low-anxiety group.

IX. Methodology

This study adopted a descriptive survey design and used simple random sampling technique to select three hundred (300) 12th grade students from six randomly selected schools. The sample students completed a 25-item English version of a Cognitive Test Anxiety Scale (CTAS). The scale was developed by Cassady (2001) to assess cognitive aspects of test anxiety found to affect student performance such as tendency to compare themselves with others during test taking, likelihood to have intruding thoughts during tests (Cassady & Johnson, 2002). Responses were measured on a five- point Likert scale from 'Not typical of me to Very typical of me'. Exploratory Factor Analysis was computed to identify the factor structure of the CTAS as used in Liberia. The statistical package: SPSS AMOS, was used to compute Confirmatory Factor Analysis to assess the model fit for the data as well as t-test.

X. Results

Dimensionality of the Cognitive Test Anxiety Scale

A principal axis factor analysis was conducted on the 27 items with oblique rotation. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for analysis, KMO = .73. An initial analysis was run to obtain eigenvalues for each factor in the data. Nine factors had eigenvalues over Kaiser's criterion of 1 and in combination explained 64.1% of the variance. However, the scree plot was ambiguous and showed inflexions that justify retaining 2 or 4 factors, but two factors were retained because of the small sample size and the convergence of the scree plot (see figure 1. Table 1 shows the factor loadings after rotation with 14 items clustering on factor one and 10 items clustered around factor two. These rotated factor loadings suggest that factor one represents emotionality and factor two strongly describes worry.

Three factors including performance on test make me believe that I am not a good student, getting good marks means I got luck and I feel likely to fail loaded below .4 and were removed for further analysis. This finding show that the cognitive test anxiety scale is not unidimensional in the context of Liberia and consistent with Cassady and Johnson (2002) early studies examining unidimensional measures of test anxiety that found at least two manifestations of test anxiety: emotionality and worry. It also confirmed Baghaei and Cassady (2014) validation of a 17-item revised version of the cognitive test anxiety scale that found the scale being a valid measure of cognitive test anxiety. However, the findings do not support Akinsola and Nwajei (2013) findings that the cognitive test anxiety scale is a single factor structure.

Table 1
Rotated Factor loadings of items

	Rotated Factor Loadings	
Item	Emotionality	Worry
Afraid to see my score after test	**.674**	
unexpected questions challenge me on test	**.635**	
Feel to have done better on a test	**.612**	
realize mistake after taking test	**.517**	
make careless errors on test	**.496**	

feel under pressure to do well on test	**.494**	
have difficulty remembering	**.490**	
take while to calm down on test	**.480**	
do not perform well on test	**.471**	
I feel I am not doing well on test	**.434**	
freeze up on test	**.433**	
forget facts I really know	**.417**	
get distracted from studying	**.456**	
mind goes blank when I am pressured	**.410**	
performance on test make me believe that I am not a good student		.366
getting good mark means I got luck		.380
lose sleep over worrying		**.573**
worry more about doing well		**.420**
Feel likely to fail		.381
feel defeated before taking test		**-.580**
think about consequences of failing		**-.486**
don't have much control over my test scores		**.458**
not good at taking test		**-.415**
often nervous at the beginning of test		**.581**
wonder about other students doing better than me		**.517**
Poor test taker		**-.495**
thought of not being tool bright		**-.483**
Eigenvalues	5.70	2.18
% of variance	21.11	8.09

Note: only factor loading over .40 are bold.

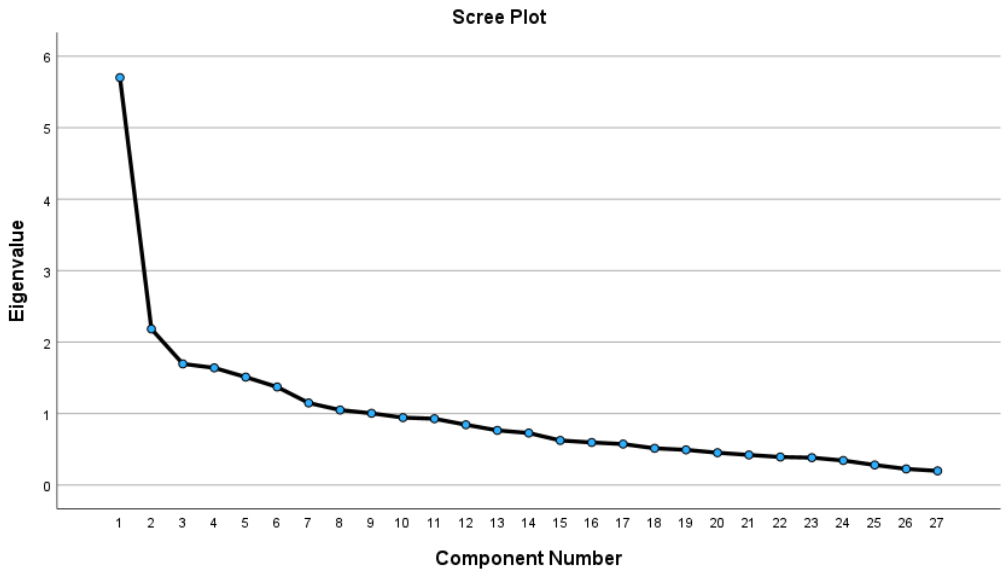

Figure 1. Scree of component number and eigenvalue

Students' Gender and cognitive Test Anxiety score

The purpose of this section was to determine the mean difference between female students and male students on their cognitive test anxiety score. The mean test score for the female students' group was 2.23, with a standard deviation of .471 while the mean test score for the male student group was 2.20, with a standard deviation of .489. An independent sample t-test was conducted to compare the means of the two groups. The t-statistics was .335, with df = 134, (p = .738). The results indicate that there was no statistically significant difference between the mean cognitive test anxiety scores of the female student group and the male student group. The findings suggest that both female and male students experience cognitive test anxiety in like manner with no group worse or better than the other. This finding is consistent with Akinsola and Nwajei (2013) found no significant difference in the test anxiety levels of males and females. However, the finding is contrary to Farooqi, Ghanl, and Spielberger (2012) which found that female medical students significantly showed higher test anxiety levels than male medical students and Cassady and Johnson (2002) study which found gender differences in cognitive test anxiety, but maintained such difference does not dispose them to low academic performance.

Table 3
Independent samples t-test of students' gender and cognitive test anxiety

	Levene's Test for Equality of Variances		Independent Samples Test				
Cognitive test anxiety	F	Sig.	T	df	Sig.		
Equal variances assumed	.156	.694	.335	134	.738		
Equal variances not assumed			.332	1118.026	.740		

Effect of student age and cognitive Test Anxiety on Students' Performance

A two-way ANOVA was performed to analyze the effect of students age and cognitive test anxiety on their performance in their favorite subject. A two-way ANOVA revealed that there was not a statistically significant interaction between the effects of age and cognitive test anxiety score on their performance in their favorite subject $F(10, 42) = .963$, $p = .561$). Simple main effects analysis showed that students' age and cognitive test anxiety did not have a statistically significant effect on student performance in their favorite ($p < .05$). This findings is not consistent with earlier researchers (Eysenck, 1992; Eysenck, Deakshan, Santos, & Calvo, 2007; Sarason, Sarason, & Pierce, 1990 as cited in Northern, 2010) who found that there is an association between anxiety and low cognitive performance on academic. Similary, it is contrary to Cassady and Johnson (2002), Kassim, Hanafi, and Hancock (2008); Farooqi, Ghanl, and Spielberger (2012); Rana and Mahmood (2010), and Chapell, Blanding, Takahashi, Silverstein, Newman, Gubi, and McCann (2005) in their separate studies which revealed that cognitive test anxiety have significant negative impact on students' academic performance and Hancock (2001) who found that students with high level of anxiety performed poorly than those with low level of anxiety. Ndirangu, Muola, Kithuka, and Nassluma (2009) also found that secondary school students showed higher levels anxiety before the examination in all subjects. It did not support the findings of Cassady (2004) study which revealed that the high-anxiety group performed worse on tests than the low-anxiety group.

Table 4
Two-way ANOVA test of between subject effects on cognitive test anxiety and students' performance

Source	Type I Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3169.013[a]	66	48.015	.963	.561
Intercept	956393.111	1	956393.111	19176.463	<.001
Favorite subject	428.063	10	42.806	.858	.576
Age	653.538	13	50.272	1.008	.454
Anxiety	2086.761	42	49.685	.996	.496
Error	3441.256	69	49.873		
Total	963003.380	136			
Corrected Total	6610.269	135			
a. R Squared = .479 (Adjusted R Squared = -.019)					

XI. Discussion and implication

The main purpose of this study was to validate the structural equivalence of the cognitive test anxiety scale. Further analysis was performed to determine the mean difference between female students and male students test anxiety score and the extent to which level of test anxiety influences students' performance. The finding on the structure equivalence of the cognitive test anxiety scale showed that it is not unidimensional in the context of Liberia and consistent with Cassady and Johnson (2002) early studies examining unidimensional measures of test anxiety that found at least two manifestations of test anxiety: emotionality and worry. It also confirmed Baghaei and Cassady (2014) version of the cognitive test anxiety scale that found the scale being a valid measure of cognitive test anxiety. However, the finding nullifies Akinsola and Nwajei (2013) findings that the cognitive test anxiety scale is a single factor structure.

Finding on gender differences on the cognitive test anxiety scale revealed no statistically significant difference between the mean cognitive test anxiety scores of the female student group and the male student group. The findings suggest that both female and male students experience cognitive test anxiety in like manner with no group worse or better than the other. This finding is consistent with Akinsola and Nwajei (2013) found no significant difference in the test anxiety levels of males and females. However, the finding is contrary to Farooqi, Ghanl, and Spielberger (2012) which found that female medical students significantly showed higher test anxiety levels than male medical students and Cassady and Johnson (2002) study which found gender differences in cognitive test anxiety, but maintained such difference does not dispose them to low academic performance.

The finding on the possible effect of level of cognitive test anxiety on students academic performance was not statistically significant, which is not consistent with earlier researchers (Eysenck, 1992; Eysenck, Deakshan, Santos, & Calvo, 2007; Sarason, Sarason, & Pierce, 1990 as cited in Northern, 2010) who found that there is an association between anxiety and low cognitive performance on academic. Similary, it is contrary to Cassady and Johnson (2002), Kassim, Hanafi, and Hancock (2008); Farooqi, Ghanl, and Spielberger (2012); Rana

and Mahmood (2010), and Chapell, Blanding, Takahashi, Silverstein, Newman, Gubi, and McCann (2005) in their separate studies which revealed that cognitive test anxiety have significant negative impact on students' academic performance and Hancock (2001) who found that students with high level of anxiety performed poorly than those with low level of anxiety. Ndirangu, Muola, Kithuka, and Nassluma (2009) also found that secondary school students showed higher levels anxiety before the examination in all subjects. It did not support the findings of Cassady (2004) study which revealed that the high-anxiety group performed worse on tests than the low-anxiety group.

XII. Conclusion

The main purpose of this study was to validate the structural equivalence of the cognitive test anxiety scale. Further analysis was performed to determine the mean difference between female students and male students test anxiety score and the extent to which level of test anxiety influences students' performance. The cognitive test anxiety scale is not unidimensional in the context of Liberia, but dimensional in that all factors loaded on two factors rotated factor loadings and suggest that factor one represents emotionality and factor two strongly describes worry. Being a male or female student does not determine the level of cognitive test anxiety one possess. In line with the finding, the level of cognitive test anxiety does not necessary affect the academic of performance students especially in the favorite subject. This finding could be limited because of the fact that instead of using students' performance in general in the class, the researcher used students' performance scores in their favorite subjects.

Reference

[1]. Akinsola, E. F. & Nwajei, A. D. (2013). Test Anxiety, Depression and Academic Performance: Assessment and Management Using Relaxation and Cognitive Restructuring Techniques. Psychology Journal, 4 (6A1), 18-24. Retrieved from http://www.scirp.org/journal/psych

[2]. Baghaei, P. & Cassady, J. (2014). Validation of the Persian Translation of the Cognitive Test Anxiety Scale. SAGE: 1– 11. doi: 10.1177/2158244014555113

[3]. Bandalos, D. L., Yates, K., & Thorndike-Christ, T. (1995). Effects of math self-concept, perceived self-efficacy, and attributions for failure and success on test anxiety. Journal of

[4]. Educational Psychology, 87, 611–623.

[5]. Cassady, J. C. (2001). Self-reported GPA and SAT: A methodological note. Practical Assessment, Research, and Evaluation 7(12). Retrieved from http://www.ericae.net/pare/getvn

[6]. Cassady, J. C. (2004). The influence of cognitive test anxiety across the learning-testing cycle. Learning and Instruction, 14, 569-592. Retrieved from http://www.Elsevier.com

[7]. Cassady, J. C. & Johnson, R. E. (2002). Cognitive Test Anxiety and Academic Performance. Contemporary Educational Psychology 27, 270–295 (2002). doi:10.1006

[8]. Furlan, L. A., Cassady, J. C., & Perez, E. R. (2009). Adapting the Cognitive Test Anxiety Scale for use with Argentinean university students. International Journal of Testing, 9,

[9]. 3-19.

[10]. Hembree, R. (1988). Correlates, causes, and treatment of test anxiety. Review of Educational

[11]. Research, 58, 47–77.

[12]. Nolting, P. D. (2000). Math Study Skills Workbook, Your Guide to Reducing Test Anxiety and Improving Study Strategies. Houghton Mifflin Company.

[13]. Northern, J. J. (2010). Anxiety and cognitive performance: A test of predictions made by Cognitive Interference Theory and Attentional Control Theory

[14]. Tsianos, N., Lekkas, Z., Germanakos, P., Mourlas, C., & Samaras, G. (2009). An experimental assessment of the use of cognitive and affective factors in adaptive educational hypermedia. IEEE Transactions on Learning Technologies, 2, 249-258. Retrieved from http://dx.doi.org/10.1109/TLT.2009.29

[15]. Volkmer, R. E., & Feather, N. T. (1991). Relations between Type A scores, internal locus of control and test anxiety. Personality and Individual Differences, 12, 205–209.

[16]. Zeidner, M. (1990). Does test anxiety bias scholastic aptitude test performance by gender and sociocultural group? Journal of Personality Assessment, 55, 145–160.