The relationships among dimensions of test anxiety and math exam performance

Author: Lauren Szymczak
Ball State University
Student Symposium
Spring 2021

Test Anxiety

- Test Anxiety encompasses the behavioral, cognitive, or physiological responses which arise due to stressors and perceived threats.
- Examples of text anxiety include if the person is concerned with negative consequences, like failure on an exam or other evaluative situations, experience a loss of academic or social standing, and/or experience poor performance (in comparison with others).
- Basically, some anxiety is okay, but a lot of anxiety is bad.
- Cognitive test anxiety includes the factors of worry and distraction.
- The RTT scale includes those factors, but also takes other factors into account, like tension and bodily symptoms.

Current Study

- **Overall topic being studied:** The impact of test anxiety on math performance
- **Research Question:** Is the level of anxiety connected with different performance rates and different levels of difficulty (ex: high vs. low vs. moderate anxiety and easy vs. moderate vs. hard items)?
- **Why is this important and will it fill a gap in other studies?:** One of the things my study does is that it looks at the curvilinear relationships.
- We looked at if the level of test anxiety is reliably connected to GPA.

Methods

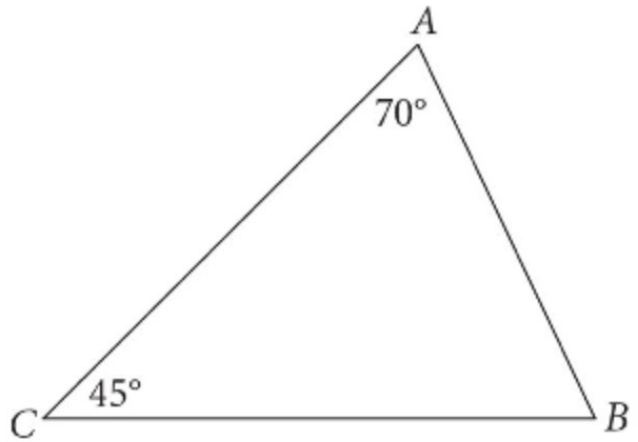
- **How were the data collected?:** The data were collected by distributing online surveys to undergraduate volunteers through Qualtrics. The data were analyzed with Excel, SPSS, and Jamovi.
- **What did the participants have to do?:** The participants were asked to fill out the online Qualtrics surveys. They could receive research participation credit for participating in the study.
- **What scales were used?:** Reactions to Tests (RTT) Scale (Sarason, 1984), Cognitive Test Anxiety-2 (CTAS-2) Scale (Thomas, Cassady & Finch, 2017), and Sample Standardized Math Test Items

Measures

Sample Math Test Questions

If r = 3 and s = 1, then $r^2 - 2s = ?$

- O 2
- O 4
- O 6
- O 7
- O 9



In the triangle above, what is the degree of angle *B?*

- O 45
- O 60
- O 65
- O 75
- O 80

Descriptive Statistics

Gender

		N	%
Male		9	7.7%
Female		101	86.3%
Missing	System	7	6.0%
Total		117	100.0%

Race

		N	%
White		95	81.2%
Black		6	5.1%
Hispanic		4	3.4%
multiracial		6	5.1%
Missing	System	6	5.1%
Total		117	100.0%

Class

		N	%
Freshperson		34	29.1%
Sophomore		32	27.4%
Junior		23	19.7%
Senior		22	18.8%
Missing	System	6	5.1%
Total		117	100.0%

Age (Mean, SD): (*M* = 20.59, *SD* = 3.769)
GPA (Mean, SD): (*M* = 3.01, *SD* = 0.602)

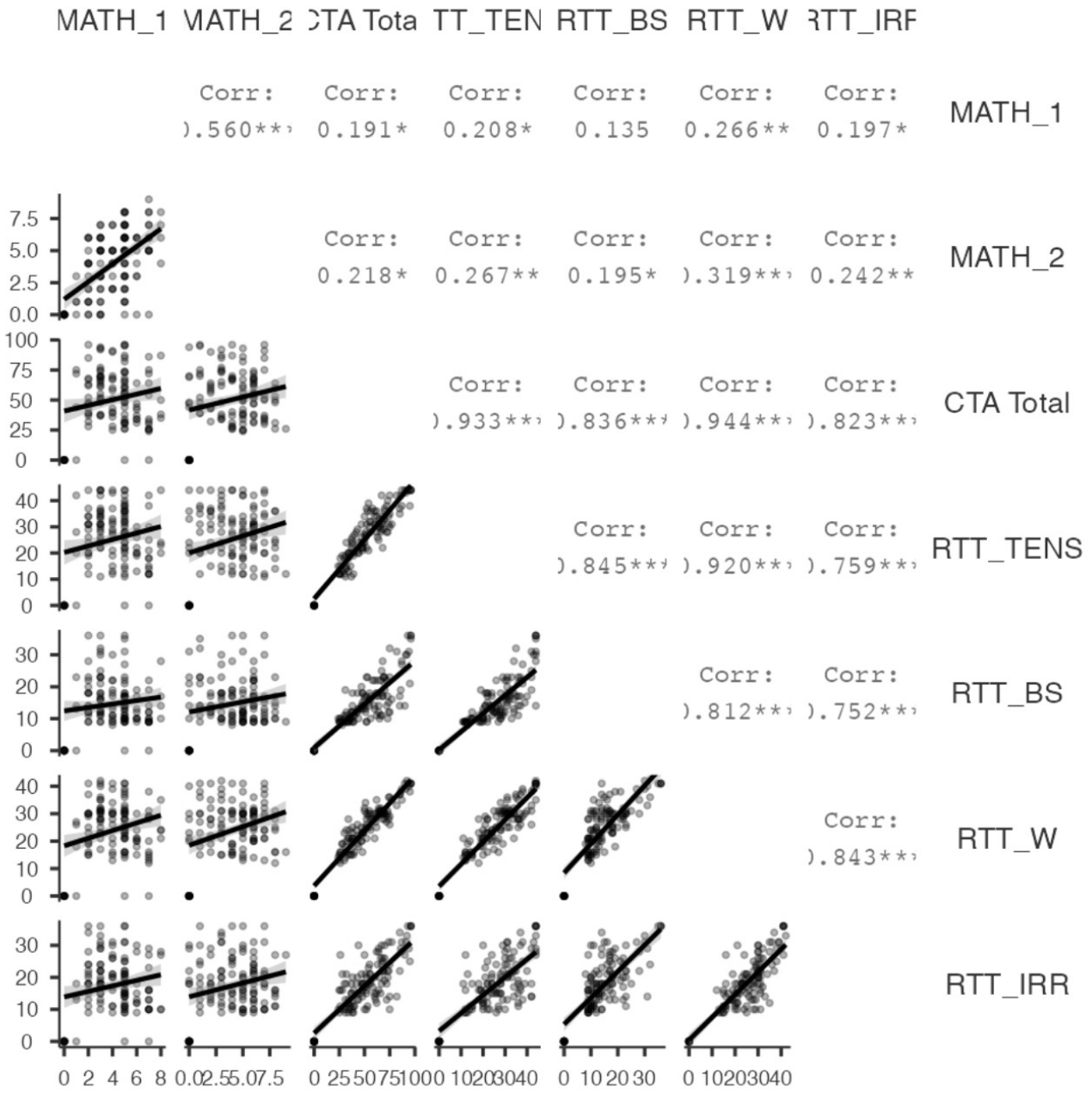
Results

Correlation Matrix

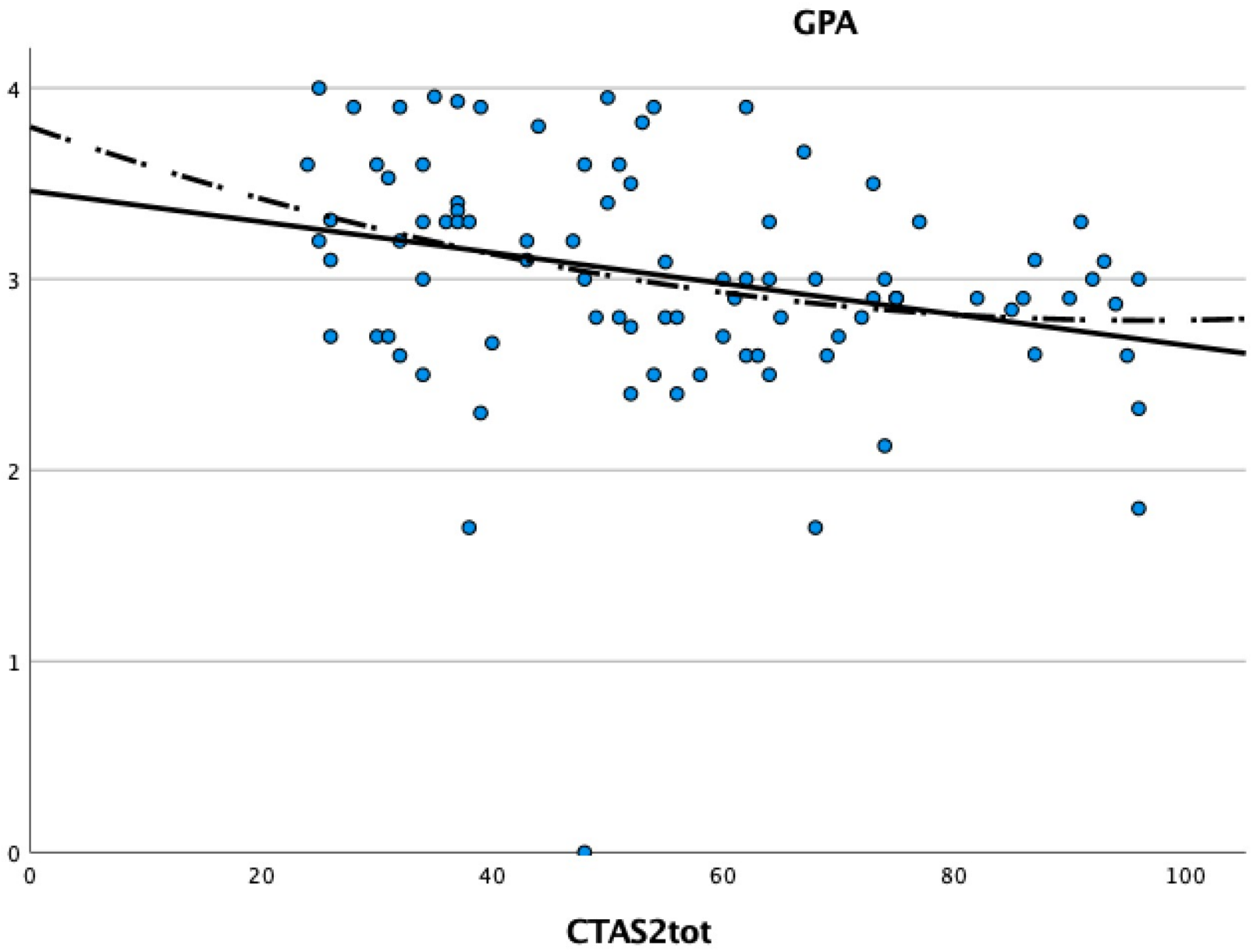
Correlation Matrix

		MATH_1	MATH_2	CTA Total	RTT_TENS	RTT_BS	RTT_W	RTT_IRR
MATH_1	Pearson's r	—						
	p-value	—						
	95% CI Upper	—						
	95% CI Lower	—						
	N	—						
MATH_2	Pearson's r	0.56***	—					
	p-value	<.001	—					
	95% CI Upper	0.67	—					
	95% CI Lower	0.43	—					
	N	128	—					
CTA Total	Pearson's r	0.19*	0.22*	—				
	p-value	0.031	0.014	—				
	95% CI Upper	0.35	0.38	—				
	95% CI Lower	0.02	0.05	—				
	N	128	128	—				
RTT_TENS	Pearson's r	0.21*	0.27**	0.93***	—			
	p-value	0.019	0.002	<.001	—			
	95% CI Upper	0.37	0.42	0.95	—			
	95% CI Lower	0.04	0.10	0.91	—			
	N	128	128	128	—			
RTT_BS	Pearson's r	0.14	0.19*	0.84***	0.85***	—		
	p-value	0.129	0.028	<.001	<.001	—		
	95% CI Upper	0.30	0.36	0.88	0.89	—		
	95% CI Lower	-0.04	0.02	0.78	0.79	—		
	N	128	128	128	128	—		
RTT_W	Pearson's r	0.27**	0.32***	0.94***	0.92***	0.81***	—	
	p-value	0.002	<.001	<.001	<.001	<.001	—	
	95% CI Upper	0.42	0.47	0.96	0.94	0.86	—	
	95% CI Lower	0.10	0.15	0.92	0.89	0.74	—	
	N	128	128	128	128	128	—	
RTT_IRR	Pearson's r	0.20*	0.24**	0.82***	0.76***	0.75***	0.84***	—
	p-value	0.026	0.006	<.001	<.001	<.001	<.001	—
	95% CI Upper	0.36	0.40	0.87	0.82	0.82	0.89	—
	95% CI Lower	0.02	0.07	0.76	0.67	0.66	0.78	—
	N	128	128	128	128	128	128	—

Note. * p < .05, ** p < .01, *** p < .001



Curvilinear Regression



Dependent Variable: GPA

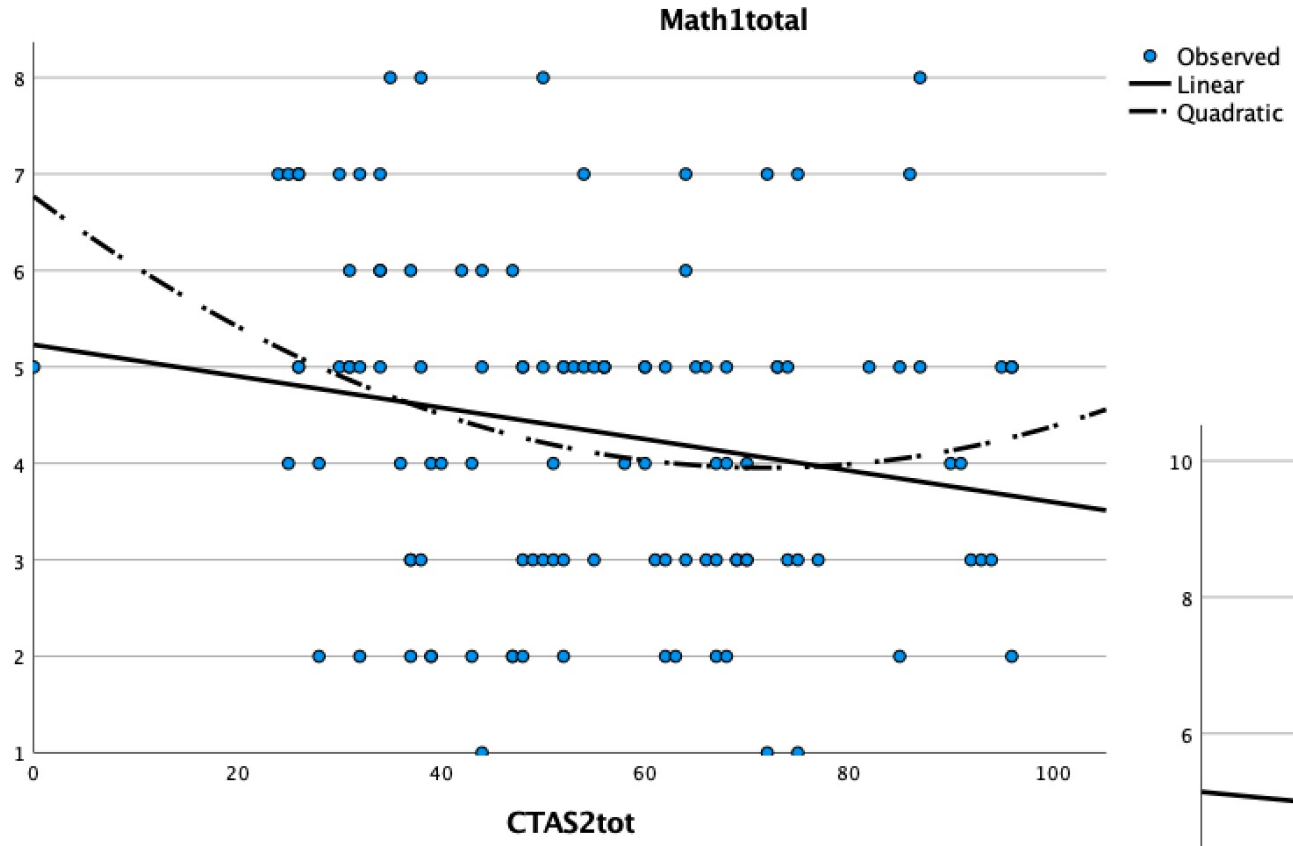
Model Summary

Equation	R Square	F	df1	df2
Linear	.078	7.493	1	89
Quadratic	.083	4.006	2	88

The independent variable is CTAS2tot.

Parameter Estimates

Sig.	Constant	b1	b2
.007	3.462	-.008	
.022	3.796	-.021	.000



Model Summary and Parameter Estimates

Dependent Variable: Math1total

Equation	Model Summary					Parameter Estimates		
	R Square	F	df1	df2	Sig.	Constant	b1	b2
Linear	.037	4.441	1	115	.037	5.230	-.016	
Quadratic	.061	3.700	2	114	.028	6.767	-.078	.001

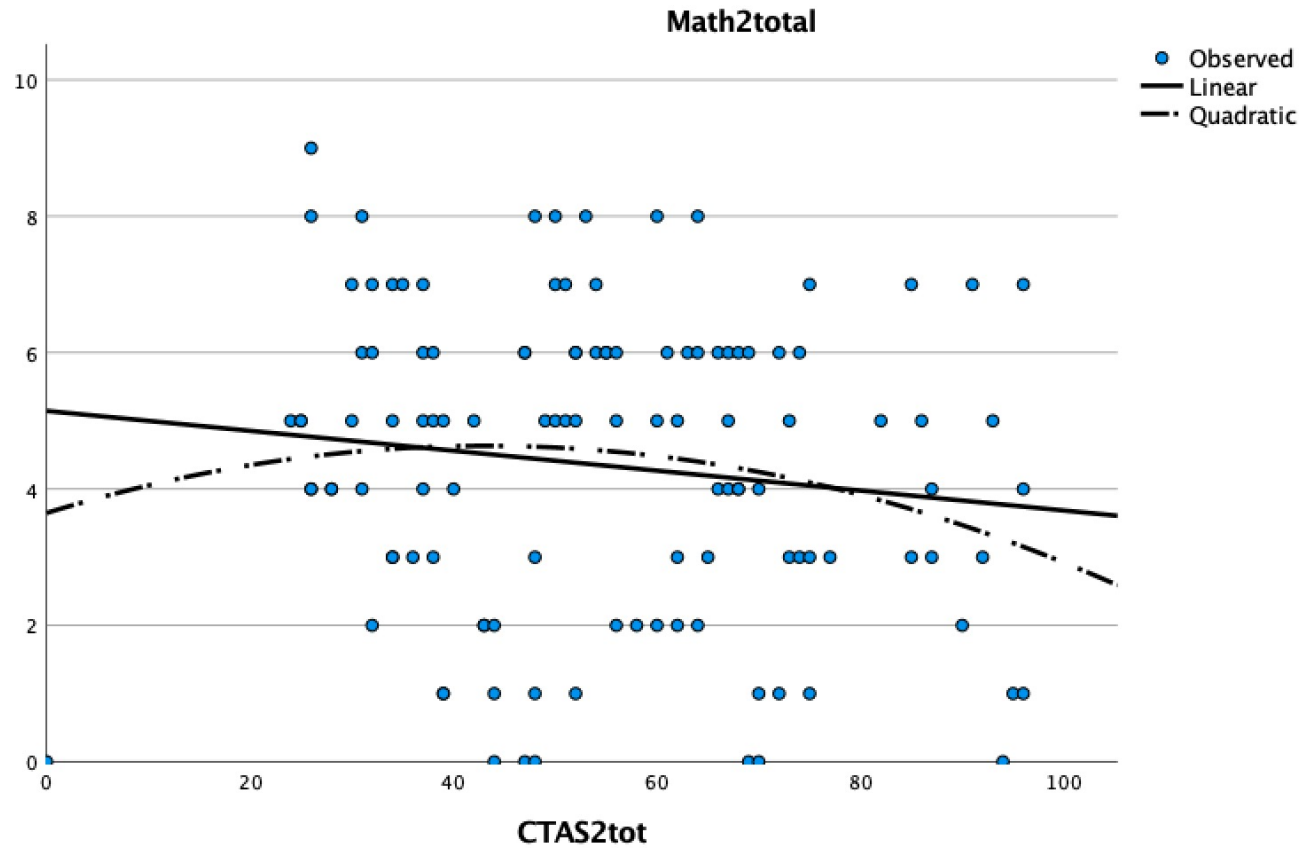
The independent variable is CTAS2tot.

Model Summary and Parameter Estimates

Dependent Variable: Math2total

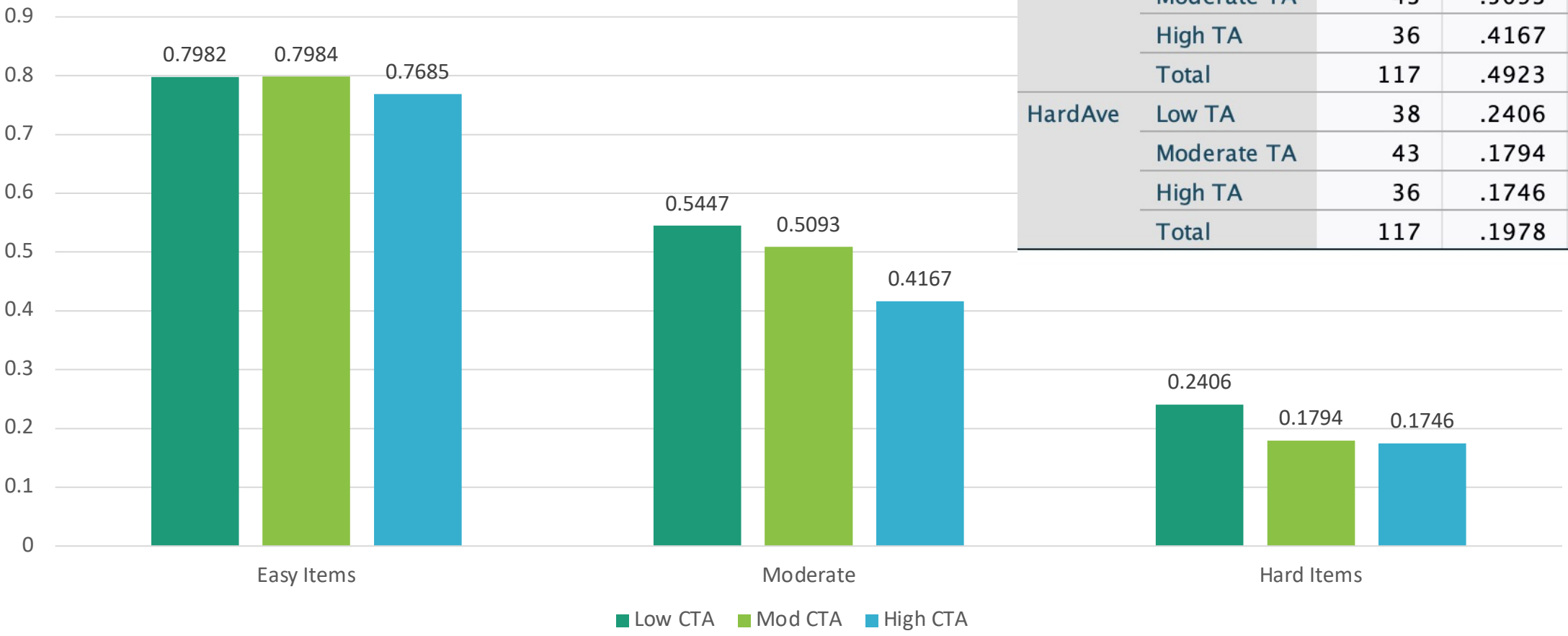
Equation	Model Summary					Parameter Estimates		
	R Square	F	df1	df2	Sig.	Constant	b1	b2
Linear	.017	2.018	1	115	.158	5.145	-.015	
Quadratic	.030	1.779	2	114	.173	3.648	.046	-.001

The independent variable is CTAS2tot.



Math Performance By Item Difficulty

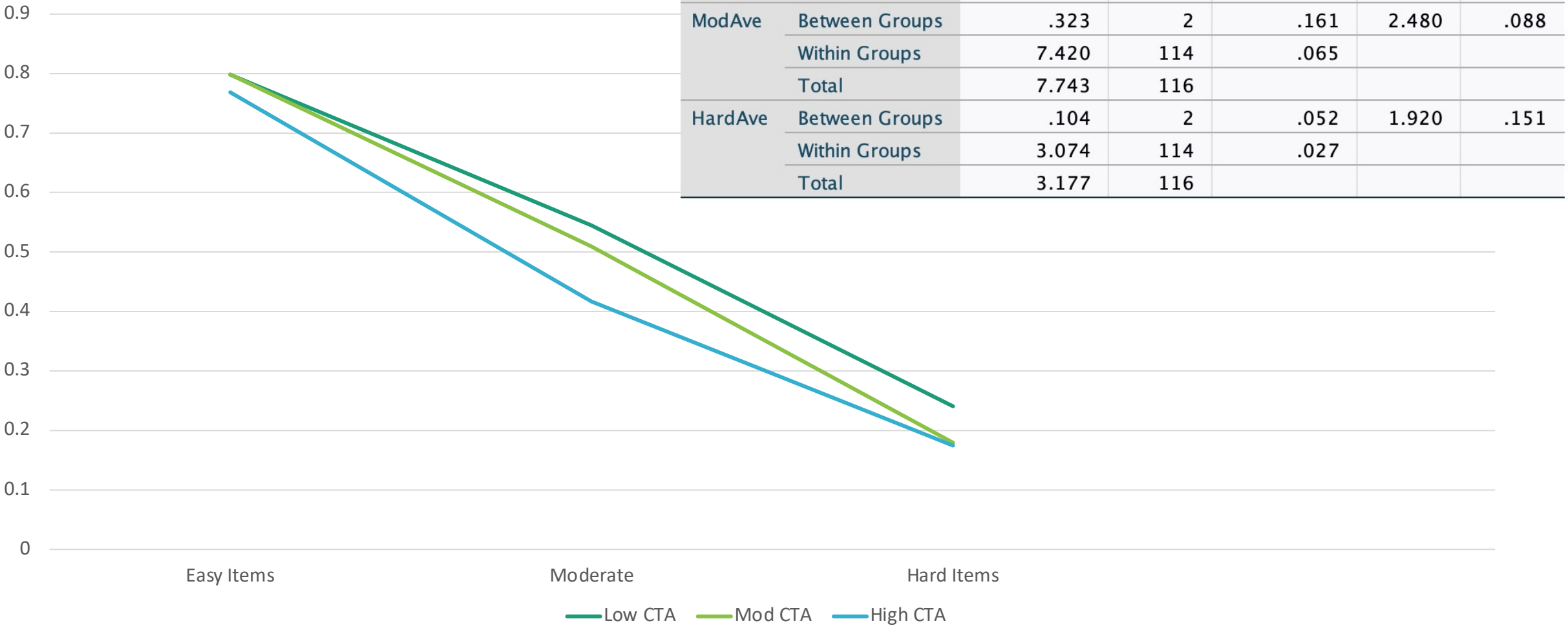
		N	Mean	Std. Deviation
EasyAve	Low TA	38	.7982	.27443
	Moderate TA	43	.7984	.25344
	High TA	36	.7685	.29621
	Total	117	.7892	.27192
ModAve	Low TA	38	.5447	.25753
	Moderate TA	43	.5093	.26887
	High TA	36	.4167	.23483
	Total	117	.4923	.25836
HardAve	Low TA	38	.2406	.19679
	Moderate TA	43	.1794	.14317
	High TA	36	.1746	.14929
	Total	117	.1978	.16550



Math Performance By Item Difficulty

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
EasyAve	Between Groups	.022	2	.011	.148	.863
	Within Groups	8.555	114	.075		
	Total	8.577	116			
ModAve	Between Groups	.323	2	.161	2.480	.088
	Within Groups	7.420	114	.065		
	Total	7.743	116			
HardAve	Between Groups	.104	2	.052	1.920	.151
	Within Groups	3.074	114	.027		
	Total	3.177	116			



Discussion

- Regarding items that are in the middle (moderately difficult items), the people who tend to fail are the people with test anxiety.
- With moderate items, test anxiety had the biggest impact on test performance. People with high test anxiety tended to perform lower than everybody else. Test anxiety has a greater impact on moderate items (the items where there is a 50/50 shot of getting it right).
- In comparison, for easy questions, high levels of test anxiety did not impair performance. Test anxiety has no impact on easy items. The hard items are just hard. Everybody tends to miss the hard items.

Discussion

- This research focused on the impact of test anxiety on math exam performance and if one's level of test anxiety impacts their performance on math tests (regarding the level of difficulty).
- We looked at test anxiety, state factors, and anxiousness.
- We did a curvilinear regression focusing on GPA vs. Test Anxiety.
- The curvilinear regression graph of GPA and Test Anxiety is a real-world example of the inverted "U" shape.

Limitations and Future Directions

- There were more females than males who participated in my study.
- Not having many males as participants is common in research.
- I was not able to effectively evaluate gender differences due to the limitation of not having very many male participants.
- Some people did not answer all the questions and left some questions blank, so there was less data to work with.
- In the future, an equal number of males and females would be preferred.
- We need a greater number of males to participate in studies and research in general so we would be able to look at gender differences and have a more representative sample of the overall population.

References

Rost, D. H., & Schermer, F. J. (1992). "Reactions to tests" (RTT) and "manifestations of test-anxiety" (DAI-MAN): Same or different concepts?. *Advances of Test Anxiety Research*, 7. 114–129.

Sarason, I. G. (1984). Stress, anxiety, and cognitive interference: Reactions to tests. *Journal of Personality and Social Psychology, 46*, 929–938.

Thomas, C. L., & Cassady, J. C., & Finch, W. H. (2017). Identifying severity standards on the cognitive test anxiety scale: Cut score determination using latent class and cluster analysis. *Journal of Psychoeducational Assessment*, *36,* 492–508. https://doi.org/10.1177/0734282916686004.