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Test anxiety among Czech pupils in lower-secondary education

EMERGING RESEARCHERS

TEST ANXIETY AMONG CZECH PUPILS IN LOWER-SECONDARY EDUCATION

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ABSTRACT

Test anxiety remains a compelling focus of contemporary research. This attention may be, in part, due to the continued reliance on high-stakes testing, which plays a pivotal role in students' academic trajectories. Our research had several objectives. Given the lack of research on test anxiety in the Czech Republic, our primary aim was to adapt and validate the Children's Test Anxiety Scale (CTAS) on a sample of 740 lower-secondary students (ages 13-15). The results demonstrated adequate construct validity, supporting the three-factor model of the CTAS. Moreover, we investigated the relationship between test anxiety, academic self-concept, and educational outcomes alongside other demographic variables. Our findings revealed a strong negative correlation linking students' academic self-concept and test anxiety. Although no direct correlation emerged between test anxiety and educational outcomes, a linear regression indicated a significant shift: educational outcomes (grades) became significant predictors when considered in conjunction with academic self-concept. Additionally, our study confirmed a significant impact of gender on test anxiety levels (girls exhibited higher test anxiety than boys) and a modest but significant correlation with parental educational background.

KEYWORDS

test anxiety; examination anxiety; fear of failure; academic self-concept; school well-being; educational outcomes

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Introduction

"We live in a test-conscious, test-giving culture in which the lives of people are in part determined by their test performance." (Sarason, 1959, p. 26)

Test anxiety, a debilitating feeling of fear and apprehension associated with tests and exams, affects millions of students worldwide (McDonald, 2001). While often dismissed as mere nerves, the impact of test anxiety is far-reaching, hindering academic performance (Cassady & Johnson, 2002), self-esteem (Peleg, 2009), and overall well-being (Steinmayr et al., 2016). Traditional education may often prioritize memorizing and achieving the "right" answer over fostering deeper understanding. Even though the idea that mistakes are a crucial part of learning has long been known – pointed out by John Stuart Mill, John Dewey, and Karl Popper – many students and educators may view mistakes as something that should be totally avoided or concealed from others (Swartz, 1976). Such a tense environment of worry over educational outcomes may easily pave the way for test and examination anxiety that is further amplified by the widespread prevalence of high-stakes testing, which continues to be a tool for decision making that critically affects students' lives. In the United States, the implementation of the No Child Left Behind (NCLB) legislation, with its mandate for standardized testing, fueled a surge of interest in understanding and addressing test anxiety within the education system (Heath, 2007; Mulvenon et al., 2005; Segool et al., 2013; von der Embse et al., 2018). Despite the frequent use of standardized tests in the Czech Republic (high school entrance exams, maturita exams, talent exams) little scientific attention has been devoted to examining test anxiety or validating the measurement scales for this phenomenon – the Test Anxiety Inventory (TAI) was validated on a sample of only 185 Czech secondary students (Kubíková et al., 2018). The Czech School Inspectorate (Felcmanová et al., 2021) published a methodological recommendation for addressing challenging student behaviors, but these guidelines fall short of encompassing strategies tailored to address anxiety in students. This identified gap fuels a need for the comprehensive exploration of test anxiety within the Czech educational landscape.

In the global context of contemporary research, various findings have suggested the detrimental impact that test anxiety has on educational outcomes (Heath, 2007; Mulvenon et al., 2005; Segool et al., 2013; von der Embse et al., 2018). The exact relationship between educational errors and test anxiety has not been explored. The present study does not investigate this connection, but its findings may contribute to broadening the understanding, as fear of failure and negative self-talk about mistakes are central features of test anxiety, as measured by most test anxiety scales.

This article serves several purposes. We see an increased necessity for a validated and functional research scale that would enable further investigation of test anxiety and its related correlates. Therefore, the first purpose of the present study is to adapt the widely used Children's Test Anxiety Scale (CTAS) and examine its construct validity on a sample of Czech lower-secondary students ($n = 740$). If proven functional, this scale could open possibilities for future test anxiety research in different educational correlates and conditions. Our further aim was to explore potential differences in test anxiety levels based on student gender, academic self-concept, educational outcome, and highest achieved parental education level. This investigation is important for validating the psychometric properties of the CTAS and for offering insights into the underlying factors that contribute to test anxiety, enabling subsequent research and the informed development of interventions to support anxious students.

1 Conceptualizing Test Anxiety

In a scientific context, test anxiety is one of many constructs occurring at the intersection of pedagogy and psychology. Publications can be found in both pedagogical and psychological journals. Research on test anxiety has a long and fruitful history. The first studies concerning test anxiety were conducted as early as 1914 when research by Folin, Denis, and Smillie (1914) confirmed the role of stress-induced hyperglycemia during a test situation in a sample of medical students. Nevertheless, the concept of test anxiety as such was not investigated under its current name until 1952 when Sarason and Mandler (1952) published a series of studies on test anxiety and its relationship to academic performance. A few years later, Sarason et al. (1958) constructed the first standardized scale – the Test Anxiety Scale for Children (TASC) – that soon became a gold standard in test anxiety research. In the 1960s and 1970s, research on test anxiety made significant progress. One advance was the conceptual separation of anxiety as a transitional stage and anxiety as a stable personality trait – anxiousness (Stöber & Pekrun, 2004).

The scientific literature presents various definitions of test anxiety or more commonly "fear of failure." Sieber et al. (1977) defined test anxiety as a scientific construct that involves a set of physiological, psychological, and behavioral responses that appear alongside concerns about the negative consequences of failure in tests, exams, or other assessment situations. Cassady and Johnson (2002) described test anxiety as a subjectively perceived condition of mental discomfort associated with worries experienced before, during, or after a test or exam. It is vital to understand test anxiety as a situation-specific trait – a tendency to respond with increased worry and emotionality to situations in

which performance will be judged or evaluated (Spielberger & Vagg, 1995). Students with test anxiety can be characterized by a low-response threshold for anxiety in assessment situations and a tendency to perceive those situations as personally threatening (Zeidner, 1998). As a result, the students are prone to react with reduced feelings of self-efficacy and with self-derogatory conditions (Sarason et al., 1960). A considerable role in test anxiety levels in students may be played by the social dimension – how their performance might be evaluated by peers in the same situation (Putwain, 2008).

1.1 Related phenomena

Given the multifaceted and multi-dimensional character of test anxiety, the existing research has suggested that a number of related phenomena function as predictors of the test anxiety levels of students. The ongoing research has indicated that female students at various levels of education manifest significantly higher levels of test anxiety than male students (Chapell et al., 2005; Eum & Rice, 2011; Putwain & Daly, 2014). In addition to lower self-esteem, which appeared to be a significant predictor of test anxiety (Alam, 2013; Peleg, 2009), the results from You and Yang (2014) and from Khalaila (2015) suggested that a lack of academic self-concept is closely associated with increased test anxiety, particularly with its cognitive and emotional components (Zeidner & Schleyer, 1999). The influence of test anxiety on academic performance has been researched in various studies (Alam, 2013; Benjamin & Mohammed, 2023; Chapel et al., 2005; Eum & Rice, 2011) indicating lower educational outcomes for the proportion of students with higher test anxiety. Research has also underlined the negative effect of test anxiety on working memory capacity (Ikeda et al., 1996; Lee, 1999). Despite its predictability, a clear link between test anxiety and educational errors lacks closer exploration. Further correlates of test anxiety can involve various phenomena, including student test preparation strategies (Nwosu et al., 2022) and a potential decline in test anxiety with age (Duraku, 2017; King et al., 1989). Parental socioeconomic background and educational attainment may also play significant roles; lower parental socioeconomic status (Chen, 2012) and lower educational background (Akanbi, 2013) may predict higher levels of test anxiety in students.

2 Methodology

Although research has frequently highlighted the multidimensional composition of test anxiety and tested different variables, the cross-cultural validation of measurement tools remains crucial. This research addressed this gap in the Czech context by pursuing several aims:

- Adapting and validating the CTAS for Czech students:
  The first goal was to adapt a standardized scale that would preferably capture the various dimensions of test anxiety. This was accomplished by adapting the CTAS developed by Wren and Benson (2004) for use in Czech lower-secondary schools. We examined its psychometric properties (e.g., reliability, construct validity) to establish its suitability for assessing test anxiety in this population. This was particularly important because the Czech Republic has lacked research on test anxiety, creating a need for validated tools to study this phenomenon and its links with relevant variables within the specific educational environment.
- Exploring the relationship between test anxiety and academic self-concept:
  Building on existing knowledge about the role of academic self-concept (academic self-belief) in the test anxiety levels of students at different education levels, we decided to investigate the relationship between these two constructs on a sample of Czech lower-secondary pupils.
- Analyzing the impact of demographic variables:
  We analyzed the influence of several demographic variables commonly associated with test anxiety:
  – gender: We investigated whether female students experienced significantly higher test anxiety than male students;
  – grade level: We explored potential differences in test anxiety levels between students in eighth and ninth grade;
  – educational outcomes: We examined whether there was a negative correlation between current academic performance (self-reported grades) and test anxiety levels;
  – parental educational background: We investigated whether the highest level of education achieved by students' parents affects their test anxiety.

Based on previous research and theoretical understanding, we formulated the following hypotheses:
  – *H1: Female students exhibit significantly higher levels of test anxiety.*
  – *H2: There is no significant difference in student test anxiety between eighth and ninth grades.*
  – *H3: There is a significant negative correlation between academic self-concept and test anxiety.*
  – *H4: The highest level of education attained by students' parents has no significant effect on their individual level of test anxiety.*
  – *H5: There is a significant negative correlation between educational outcomes and test anxiety.*

2.1 Participants and procedure

Our study involved 740 students from 13 lower-secondary schools in Moravia, Czech Republic. These students were in either the eighth or ninth year (age 13 to 15) lower-secondary education – the last two years of compulsory education in the Czech Republic. The researched schools were located in the South Moravian region (7 schools) and in the bordering regions of Vysočina (4 schools) and Zlín (2 schools).

The questionnaire administration took place during the spring and fall of 2023. Following agreements with school principals and parental informed consent (research proposals were sent electronically), a researcher visited classrooms during scheduled class time. Participation was voluntary and students were informed of their right to withdraw at any point. Anonymous questionnaires (respondents were strictly asked not to sign the papers) were distributed in a paper format, typically targeting two classes per school (one eighth grade and one ninth grade). The administration process usually lasted around 30 minutes. The researchers' presence enabled a high return rate and contributed to data reliability as any student questions could be addressed during the process. To promote open discussion and understanding, a brief post-collection discussion focusing on test anxiety and coping strategies was held with the remaining available class time. We commend the students' organization and commitment to providing accurate information, which resulted in a minimal number of questionnaires being discarded due to unreliable completion.

Table 1
Sample

	N	Missing	%
Total	740		100.00
Gender		2	
Male	395		53.40
Female	343		46.40
Grade			
Eighth	374		50.50
Ninth	366		49.50

2.2 Measures

2.2.1 Test anxiety

In order to measure individual student levels of test anxiety, the 30-item CTAS constructed by Wren and Benson (2004) was adapted. The CTAS is considered a refined and modernized version of the TASC (Sarason et al., 1958). While the TASC was groundbreaking, its use was increasingly questioned

over time due to concerns about its outdated nature (Ludlow & Guida, 1991; Wigfield & Eccles, 1989). Importantly, the CTAS addresses the limitations of earlier scales by assessing multiple dimensions of test anxiety. Wren and Benson (2004) theorized that test anxiety in children manifests as a situation-specific trait with cognitive, somatic, and behavioral dimensions. Therefore, the CTAS comprises three primary factors:

– thoughts (13 items): a cognitive component that evaluates negative self-talk and worries related to test performance (e.g., *I think most of my answers are wrong*, *I think I am going to get a bad grade*, *I think about how poorly I am doing*);

– autonomic reactions (9 items): measures the physiological manifestations of anxiety (e.g., *My heart beats fast*, *my hands shake*, *I feel nervous*);

– off-task behavior (8 items): assesses test-irrelevant behaviors and difficulty concentrating (e.g., *I look around the room*, *I look at other people*, *I play with my pencil*).

Each item is evaluated using a four-point Likert scale (1 = almost never, 2 = some of the time, 3 = most of the time, 4 = almost always). An individual's overall CTAS score is the sum of their responses, or alternatively the mean score can be used for comparisons between dimensions or for correlations with other variables.

Prior research has demonstrated the CTAS's internal consistency and construct validity. Wren and Benson (2004) conducted a validation study with 261 pupils (third through sixth grade) and reported satisfactory internal consistency coefficients; 0.92 for the total scale (thoughts – 0.89, autonomic reactions – 0.82, off-task behavior – 0.76) and a good fit for the three-factor model. The CTAS was subsequently adapted multiple times in various countries and contexts confirming good psychometric properties (e.g., Aydın, 2019; Nyroos et al., 2012; Segool et al., 2013; Soffer, 2008).

2.2.2 Academic self-concept

To assess academic self-concept in our Czech lower-secondary student sample, we adapted a well-established questionnaire originating from Dutch research (Smits & Vorst, 1982). This multi-dimensional instrument, initially developed for a large Flemish student population (*n* = 4,759) (Damme et al., 2002), was further refined by Opdenakker and Damme (2000) and extended with additional items based on the questionnaire by Jansen (1982) and the school questionnaire by Stoel (1980). Importantly, the academic self-concept subscale that was used in our research demonstrated strong internal consistency (α = 0.80–0.82) within our target group. This subscale, consisting of eight items rated on a five-point Likert scale, was extracted from a broader "school well-being" questionnaire (eight subscales in total).

We obtained the English version of the academic self-concept scale from the research of Damme et al. (2002); the CTAS was received directly from one of its authors. Both questionnaires were professionally translated into Czech and back translated for verification. Both scales were piloted in a lower-secondary school class in Brno to adjust the wording for clarity based on student feedback.

2.2.3 Educational outcomes

Educational outcomes were assessed through three self-reported items included in the demographic section of the questionnaire. Students indicated their final grades from their last semester's report cards for three core subjects: Czech language, English, and mathematics. These grades ranged from 1 (excellent) to 5 (insufficient). To analyze these self-reported grades, we reversed the coding scheme (a higher value indicates a better outcome) and calculated the mean score of the three subjects for each participant.

2.2.4 Parental education level

At the beginning of the questionnaire, respondents reported the highest level of education attained by both parents. This information was coded using a five-point scale:
   – 0: no formal education
   – 1: compulsory education *(primary and lower-secondary, ISCED 2)*
   – 2: apprenticeship *(ISCED 3)*
   – 3: high school graduation *(equivalent to the Czech maturita exam, ISCED 3)*
   – 4: higher vocational school *(lower-tertiary education, ISCED 6)*
   – 5: university education *(ISCED 7 or 8)*
To create a single indicator of parental education level, we calculated the mean of the reported education levels for each student's mother and father (for a few respondents, only one parent's education level was registered).

3 Data analysis

We began by assessing the internal consistency and normality of the data. Cronbach's alpha, a measure of internal consistency, revealed high reliability for the CTAS questionnaire ($\alpha = 0.91$), with subscale values: off-task behavior – 0.70, autonomic reactions – 0.85, and thoughts – 0.87. The academic self-concept questionnaire also demonstrated strong consistency ($\alpha = 0.82$). However, the Shapiro-Wilk test indicated that the data for both the CTAS (0.98; $p < 0.01$) and academic self-concept (0.994; $p = 0.004$) scales significantly deviated from a normal distribution. Given the relatively large sample size ($n = 740$), we rely on the central limit theorem. To confirm the three-factor

structure of the CTAS, we conducted a confirmatory factor analysis (CFA). The fit indices from the CFA (see Table 2) closely resemble those reported by Wren and Benson (2004) in their original validation study, supporting the functionality of the three-factor model within our sample.

Table 2
Fit Measures of CTA

				RMSEA 90% CI			
CFI	**TLI**	**SRMR**	**RMSEA**	**Lower**	**Upper**	**AIC**	**BIC**
0.822	0.808	0.0593	0.0664	0.0631	0.0697	54292	54717

Table 3
Fit Measures (Wren & Benson, 2004)

Models	χ^2	**df**	χ^2/df	**TLI**	**RMSEA**	**CI**
Development sample Model 1 (30-item 3 factors)	853	402	2.12	0.806	0.074	0.068−0.080

Table 4
Factor loadings of CFA

				95% Confidence Interval				
Factor	Indicator	Estimate	SE	Lower	Upper	Z	p	Stand. Estimate
thoughts	TA01	0.373	0.0335	0.307	0.438	11.11	<.001	0.415
	TA05	0.481	0.0313	0.420	0.543	15.40	<.001	0.553
	TA06	0.361	0.0296	0.303	0.419	12.20	<.001	0.452
	TA09	0.771	0.0318	0.709	0.833	24.28	<.001	0.783
	TA11	0.722	0.0323	0.659	0.786	22.37	<.001	0.740
	TA13	0.422	0.0345	0.354	0.490	12.24	<.001	0.453
	TA15	0.354	0.0315	0.292	0.416	11.23	<.001	0.419
	TA16	0.550	0.0361	0.479	0.621	15.24	<.001	0.548
	TA19	0.593	0.0323	0.530	0.656	18.37	<.001	0.638
	TA21	0.553	0.0340	0.487	0.620	16.25	<.001	0.578
	TA24	0.738	0.0376	0.665	0.812	19.65	<.001	0.672
	TA27	0.697	0.0335	0.631	0.763	20.83	<.001	0.702
	TA29	0.607	0.0417	0.525	0.689	14.57	<.001	0.527

Factor	Indicator	Estimate	SE	95% Confidence Interval		Z	p	Stand. Estimate
				Lower	Upper			
autonomic reactions	TA02	0.636	0.0327	0.572	0.700	19.42	< .001	0.671
	TA04	0.719	0.0327	0.655	0.783	22.01	< .001	0.736
	TA08	0.527	0.0340	0.461	0.594	15.49	< .001	0.560
	TA10	0.688	0.0351	0.619	0.757	19.57	< .001	0.675
	TA17	0.438	0.0325	0.374	0.502	13.47	< .001	0.497
	TA20	0.562	0.0357	0.492	0.631	15.73	< .001	0.567
	TA23	0.668	0.0379	0.593	0.742	17.60	< .001	0.621
	TA25	0.164	0.0277	0.109	0.218	5.91	< .001	0.231
	TA28	0.811	0.0353	0.742	0.880	22.97	< .001	0.759
off-task behavior	TA03	0.521	0.0374	0.448	0.594	13.91	< .001	0.543
	TA07	0.531	0.0446	0.444	0.619	11.91	< .001	0.473
	TA12	0.417	0.0448	0.330	0.505	9.31	< .001	0.378
	TA14	0.698	0.0430	0.614	0.783	16.24	< .001	0.619
	TA18	0.534	0.0366	0.462	0.606	14.57	< .001	0.564
	TA22	0.239	0.0411	0.158	0.319	5.80	< .001	0.241
	TA26	0.528	0.0471	0.436	0.621	11.20	< .001	0.448
	TA30	0.544	0.0361	0.473	0.614	15.05	< .001	0.580

The total CTAS score could range between 30–120; *thoughts: 13–52*, *off-task behavior: 8–32*, and *autonomic reactions: 9–36*. The average CTAS score was 71 (*sd* = 15.5); the mean score (ranging between 1 – *almost never* and 4 – *almost always*) was 2.37 (*SD* = 0.52). Based on these results, the test anxiety level in our sample reached a score nearly 10 points higher than the one reported by Wren and Benson (2004) in their validation study (CTAS = 61.7). Higher scores than in the study by Wren and Benson (2004) were also recorded for each CTAS factor, with the cognitive and behavioral dimensions showing the most substantial difference.

In terms of examining high levels of test anxiety, our analysis revealed that over 12% of respondents exhibited extensive deviations from the mean CTAS score, scoring 3 or higher (out of a maximum of 4). To further explore the test anxiety levels, it is important to consider the context of the research. Following guidance from the developer of CTAS (Wren, personal communication, January 25, 2024), respondents with scores exceeding one *SD* above the mean (86.5 in our study) are considered to experience high test anxiety. Employing this criterion, our research showed 15.8% (*n* = 117) of the students had high levels of test anxiety.

Significant differences in test anxiety levels were revealed between genders. On average, girls (M = 76.7, SD = 15.2) had nearly 9% higher test anxiety scores than boys (M = 66.2, SD = 14.2). This difference was confirmed by an independent samples t-test (t(736) = −9.59, p < 0.001). The higher scores for girls were consistent across all CTAS dimensions (thoughts, autonomic reactions, off-task behavior), all showing significant differences (p < .001). This finding supports our first hypothesis, suggesting that female students in our sample experience significantly higher levels of test anxiety than male students. Using Cohen's d (−0.71), we can determine the variance of test anxiety explained by gender. Applying the formula *r-squared = (Cohen's d)^2 / ((Cohen's d)^2 + 4)* yields r-squared = 0.112. Thus, approximately 11.2% of the variance in CTAS scores can be attributed to the effect of student gender.

While some previous studies (Duraku, 2017; King et al. 1989) suggested that age might play a significant role in test anxiety levels, we did not anticipate a significant difference between eighth and ninth graders, considering the small age gap (usually one year). As expected, the average CTAS scores between these groups showed minimal difference (eighth grade: M = 71.2, SD = 15.3; ninth grade: M = 71.0, SD = 15.8). Therefore, we accept our second null hypothesis, indicating no significant difference in test anxiety levels between eighth and ninth graders in our sample.

Table 5
Descriptive statistics for CTAS

| Subsample | | | | subscales | | | | | |
| | | | | autonomic reactions | | off-task behavior | | thoughts | |
	n	M	SD	M	SD	M	SD	M	SD
gender									
girls	343	76.7	15.2	19.7	5.72	21.1	4.99	35.9	7.48
boys	395	66.2	14.2	15.8	4.98	19.2	4.45	31.3	7.37
Grade									
eighth	374	71.2	15.3	17.7	5.49	19.8	4.79	33.8	7.59
ninth	366	71.0	15.8	17.5	5.84	20.3	4.80	33.1	7.94
Total	740	71.1	15.5	17.6	5.67	20.0	4.80	33.5	7.77

3.2 Correlational analysis and linear regression

Table 6 presents the descriptive statistics (means) and Pearson correlations between the variables investigated in our research. The data indicates that the cognitive dimension *thoughts* and behavioral dimension *off-task behavior* exhibit higher mean scores than the *autonomic reactions* dimension, suggesting

a stronger emphasis on cognitive and behavioral aspects of test anxiety in this sample. Despite varying means, all CTAS dimensions displayed strong positive correlations with each other, indicating their interconnectedness.

As hypothesized (H3), a significant negative correlation was found between the CTAS score and academic self-concept ($r = -0.532$, $p < 0.001$). This confirms our expectation that a higher self-concept is associated with lower levels of test anxiety. Additionally, a small but significant negative correlation emerged between CTAS and parental education level ($r = -0.106$, $p < 0.001$), suggesting that children of parents with higher educational attainment may experience slightly lower test anxiety. However, the correlation between CTAS and students' own educational outcomes was not significant ($r = -0.069$, $p > 0.05$)

Table 6
Correlation matrix

Variable	*M*	*SD*	CTAS	*Thoughts*	*Aut. Reactions*	*Off-task Beh.*	Self-concept	Edu. outcomes	Parents' education
CTAS	2.37	0.517	–						
Thoughts	2.58	0.596	0.897**	–					
Aut. Reactions	1.96	0.629	0.867**	0.662**	–				
Off-task Behavior	2.51	0.597	0.761**	0.502**	0.553**	–			
Acad. Self-concept	2.98	0.745	0.532**	0.532**	0.426**	0.357**	–		
Edu. outcomes	1.97	0.781	−0.069	−0.091*	−0.015	−0.058	0.447**	–	
Parents' education	3.23	0.987	−0.106**	−0.105**	−0.077*	−0.084*	0.203**	0.283**	–

Incorporating these variables into a linear regression model yielded further findings. Both academic self-concept and educational outcomes were found to have significant relationships with test anxiety ($p < 0.001$); parental education remained insignificant. Even though the effect of educational outcomes does not seem strong (see Table 7), this may be attributed to a moderating relationship between academic self-concept and educational outcomes. When included together in the model, their combined effect becomes more prominent in explaining the variance of test anxiety (Adjusted $R^2 = 0.317$; $p < 0.001$). As expected from previous analysis, student gender also appeared as a significant predictor of test anxiety, noticeably improving the model – Adjusted $R^2 = 0.357$; $p < 0.001$ (Table 8). This suggests that both self-perceptions of academic self-concept and actual academic performance play a significant role in influencing test anxiety, all boosted by the gender of students.

Table 7
Linear regression – model coefficients

Predictor	Estimate	SE	95% Confidence Interval		t	p	Stand. Estimate
			Lower	Upper			
Intercept[a]	110.785	3.8821	103.16	118.407	28.538	< 0.001	
Ac. Self-con.	−1.315	0.0843	−1.48	−1.150	−15.606	< 0.001	−0.5584
Parental edu.	−0.401	0.5076	−1.40	0.596	−0.790	0.430	−0.0253
Ed. outcomes	−3.110	0.7385	−4.56	−1.660	−4.212	< 0.001	−0.1541
Gender:							
Girl – Boy	6.610	1.0123	4.62	8.597	6.530	< 0.001	0.4237

[a] Represents reference level

Table 8
Model Fit

			Overall Model Test							
Model	R	R²	Adjusted R²	AIC	BIC	RMSE	F	df1	df2	p
1	0.601	0.361	0.357	5444	5471	12.5	96.5	4	684	< 0.001

4 Discussion

Test anxiety is a complex phenomenon significantly influencing many aspects of a student's school experience. The growing prominence of high-stakes testing, determining crucial life events (entrance exams, final exams, etc.), often bolstered by legislation (e.g., NCLB in the US), has demonstrably heightened test anxiety among students (Heath, 2007; Mulvenon et al., 2005; Segool et al., 2013; von der Embse et al., 2018). There has been a lack of in-depth research investigating test anxiety among Czech students. Furthermore, no concrete strategies have been established to help support students experiencing anxiety at different education levels.

The present research pursued several goals. We sought to adapt the CTAS, a frequently used instrument, and evaluate its construct validity on a sample of 740 Czech lower-secondary students. We aimed to explore the relationship between the academic self-concept of students and their test anxiety level. For this purpose, we adapted the multi-dimensional school questionnaire by Damme et al. (2002) and further extracted an academic self-concept subscale that seemed to be a functional tool for addressing this construct. Finally, we analyzed the potential influence of several demographic variables, including gender, grade level, educational outcomes, and achieved parental education.

Following the analyzed results, which closely corresponded with those reported by Wren and Benson (2004), we can confirm the validity of three-factor model of CTAS within our sample. However, the factor loadings of confirmatory factor analysis suggest that substantial modifications could be made on the basis of weakly intercorrelated items – similarly to the research by Nyroos et al. (2012). The tests of internal consistency indicated that the instrument, along with its three dimensions, was reliable: full scale $\alpha = 0.91$ (off-task behavior – $\alpha = 0.70$; autonomic reactions – $\alpha = 0.85$; thoughts – $\alpha = 0.87$). Similar reliability was achieved with the academic self-concept scale ($\alpha = 0.82$).

The descriptive analysis of the results revealed that the cognitive and behavioral dimensions of the CTAS reached higher mean scores than the emotional dimension of autonomic reactions, corroborating the findings of Wren and Benson (2004). Notably, the CTAS scores in our sample were approximately 10 points (8%) higher than the scores from the validation study conducted by Wren and Benson (2004). In addition, more than 12% of all students reached CTAS scores of 3 and higher (out of a maximum of 4), and nearly 16% of students in our sample could be considered as highly test anxious, according to the guidelines of the CTAS developer (Wren, personal communication, January 25, 2024). This result may appear insignificant on its own, but considering the lower overall test anxiety scores in other studies using the same scale (Aydın, 2019; Fergus et al., 2020; Kader & Eissa, 2014; Clipa, 2021; Segool et al., 2013; Shoahosseini & Baghaei, 2020; Yeo et al., 2016; Soffer, 2008), it could imply a potential pattern of relatively higher test anxiety levels among Czech lower-secondary students (ages 13 to 15). This finding requires further investigation on larger samples across different age groups.

The significant effect of gender on test anxiety level has been supported by countless findings across different samples (Eum & Rice, 2011; Chapell et al., 2005; Putwain & Daly, 2014). The analysis of our sample produced the same results: girls had nearly 9% higher CTAS scores than boys. Counting r-squared yielded evidence that more than 11% of variance in test anxiety can be attributed to the effect of gender. In terms of grade level, no statistical difference was found between eighth graders and ninth graders in our sample. This result was anticipated as the age gap based on only one grade is probably insufficient for noticeable psychological and educational differences.

Building upon established research demonstrating the significant influence of academic self-concept on test anxiety (Kaur & Kumaran, 2016; Khalaila, 2015; You & Yang, 2014; Zeidner & Schleyer, 1999) we hypothesized (H2) a negative correlation between these variables in our sample. This hypothesis was confirmed by the data analysis, revealing a strong negative correlation ($r = -.532$, $p < 0.001$) between students' academic self-concept and their test anxiety levels. Our analysis additionally revealed a weak but significant positive correlation between CTAS scores and parental education levels. Even though

this result may reflect the significant impact of parental socioeconomic status on test anxiety level of students (Chen, 2012), this finding warrants further investigation as the relationship between parental education and test anxiety has not been frequently explored in research.

Interestingly, the educational outcomes of students did not exhibit a significant correlation with test anxiety in our study, which may contradict the findings of some previous research (Alam, 2013; Benjamin & Mohammed, 2023; Chapel et al., 2005; Eum & Rice, 2011). Nevertheless, when examined together with the academic self-concept in a linear regression model, both academic self-concept and educational outcomes emerged as significant predictors of test anxiety, along with student gender. This switch could be attributed to a prominent moderating role between self-concept and educational outcomes – a compelling finding that could warrant further research.

While our study works with a seemingly adequate sample size, it is crucial to acknowledge the potential limitations. First, we cannot claim that our study is generalizable to the entire target population due to the potential selection bias. School recruitment challenges, such as refusal from school directors, limited our access to a truly random sample. Second, the reliance on self-reported data brings potential inaccuracies. Test anxiety and other related phenomena can be a sensitive topic. Although respondents were assured of the fully anonymized character of the study, they might still provide more socially desirable answers. Third, while all the research variables were based on a theoretical background and prior research findings, the complex and interconnected nature of test anxiety within the school environment introduces the possibility of unmeasured latent variables influencing our data. These limitations underscore the need for further exploration of test anxiety in educational contexts.

Although the present study was not designed to thoroughly investigate the relationship between educational errors and test anxiety, the researchers perceive a necessity to consider hypothesizing test anxiety as a phenomenon partially predisposing students to making an increased number of errors within an educational setting. This is particularly paradoxical considering the well-established importance of learning from mistakes and overcoming failure – a cornerstone of effective learning throughout the educational journey (Käfer et al., 2018; Swartz, 1976, 2018; Zhao, 2011). As test anxiety commonly involves a fear of failure (Hagtvet, 1982; Herman, 1990) many students may experience a powerful motivational drive to completely avoid failure or any kind of error in educational settings. This pervasive "culture of zero mistakes" (Rami, 2009) fosters a tense environment that tends to contribute to test anxiety for students. Further investigation in this context could produce various results indicating the significance of the relationship between test anxiety and educational error or the types of errors typically committed by students with increased test anxiety levels.

References

Abdul Kader, F. A. H., & Eissa, M. A. (2014). Measuring test anxiety in students aged 10-17 years in Egypt: Factor analysis and psychometric properties. *Psycho-Educational Research Reviews*, *3*(3), 102–109.
Retrieved from https://perrjournal.com/index.php/perrjournal/article/view/350

Akanbi, S. T. (2013). Comparisons of test anxiety level of senior secondary school students across gender, year of study, school type and parental educational background. *IFE PsychologIA: An International Journal*, *21*(1).
https://hdl.handle.net/10520/EJC131394

Alam, M. M. (2013). A study of test anxiety, self-esteem and academic performance among adolescents. *The IUP Journal of Organizational Behavior*, *12*(4), 33–43.
Retrieved from https://www.proquest.com/scholarly-journals/study-test-anxiety-self-esteem-academic/docview/1468902503/se-2

Aydın, U. (2019). Test anxiety: Gender differences in elementary school students. *European Journal of Educational Research*, *8*(1), 21–30. https://doi.org/10.12973/eu-jer.8.1.21

Benjamin, L. S., & Mohammed, K. E. A. (2023). Test anxiety and academic performance: A correlational study among nursing college students. *The Journal of Palembang Nursing Studies*, *2*(3), 173–178.
https://doi.org/10.55048/jpns80

Benson, J. (1998). Developing a strong program of construct validation: A test anxiety example. *Educational Measurement: Issue and Practice*, *17*(1), pp. 10–22.
https://doi org/10.1111/j.1745-3992.1998.tb00616.x

Cassady, J. C., & Johnson, R. E. (2002). Cognitive test anxiety and academic performance. *Contemporary Educational Psychology*, *27*(2), 270–295.
https://doi.org/10.1006/ceps.2001.1094

Chapell, M. S., Blanding, Z. B., Silverstein, M. E., Takahashi, M., Newman, B., Gubi, A., & McCann, N. (2005). Test anxiety and academic performance in undergraduate and graduate students. *Journal of Educational Psychology*, *97*(2), 268–274.
https://doi.org/10.1037/0022-0663.97.2.268

Chen, H. (2012). Impact of parent's socioeconomic status on perceived parental pressure and test anxiety among Chinese high school students. *International Journal of Psychological Studies*, *4*(2).
https://doi.org/10.5539/ijps.v4n2p235

Clipa, O. (Ed.). (2021). *Challenges in education: Policies, practice and research, Vol. 88*. Peter Lang.
https://doi.org/10.3726/b19119

Duraku, Z. H. (2017). Factors influencing test anxiety among university students. *The European Journal of Social & Behavioural Sciences*, *18*(1), 69–78.
https://doi.org/10.15405/ejsbs.206

Eum, K., & Rice, K. G. (2011). Test anxiety, perfectionism, goal orientation, and academic performance. *Anxiety, Stress, & Coping*, *24*(2), 167–178.
https://doi.org/10.1080/10615806.2010.488723

Felcmanová, L., Krejčová, L., Myšková, L., Němec, Z., Winkler, P., Dvořáková, K., Houška, P., Franke, H., Korbel, M., Kubíčková, A., Šimáčková-Laurenčíková, K., Nosál, I., Salomonová, M., Smrž, J., Turková, K., Zatloukal, T., Andrys, O., Pražáková, D., Folwarczný, R., & Borkovcová, I. (2021). *Přístupy k náročnému chování dětí a žáků ve školách a školských zařízeních a možnosti jeho řešení: metodické doporučení*. Česká školní inspekce.

Fergus, T. A., Limbers, C. A., & Bocksel, C. E. (2020). Associations between metacognitive beliefs and test anxiety among middle school students. *Translational Issues in Psychological Science*, *6*(1), 70–80.
https://doi.org/10.1037/tps0000216

Folin, O., Denis, W., & Smillie, W.G. (1914). Some observations on "emotional glycosuria" in man. *Journal of Biological Chemistry*, *17*(4), 519–520.

Hagtvet, K. A. (1982). *A construct validation study of test anxiety: A discriminant validation of fear of failure, worry and emotionality*. Paper presented at International Congress of Applied Psychology (20th, Edinburgh, Scotland).

Heath, E. V. (2007). *Teacher perceptions of post no child left behind elementary teacher and student test anxiety* [Doctoral dissertation]. Virginia Polytechnic Institute and State University.

Herman, W. E. (1990). Fear of failure as a distinctive personality trait measure of test anxiety. *Journal of Research & Development in Education*, *23*(3), 180–185.

Ikeda, M., Iwanaga, M., & Seiwa, H. (1996). Test anxiety and working memory system. *Perceptual and Motor Skills*, *82*(3), 1223–1231.
https://doi.org/10.2466/pms.1996.82.3c.1223

Janssen, P. (1982). *Vragenlijst studiebeleving* [Study experience questionnaire]. K. U. Leuven, Afdeling Psychodiagnostiek en psychologische begeleiding, Centrum voor Schoolpsychologie.

Käfer, J., Kuger, S., Klieme, E., & Kunter, M. (2018). The significance of dealing with mistakes for student achievement and motivation: Results of doubly latent multilevel analyses. *European Journal of Psychology of Education*, *34*(4), 731–753.
https://doi.org/10.1007/s10212-018-0408-7

Kaur, G. & Kumaran, S. (2016). Test anxiety and academic self-concept of students, *International Journal of Indian Psychology*, *3*(4), 90-98.
https://dx.doi.org/10.25215/0304.009

Khalaila, R. (2015). The relationship between academic self-concept, intrinsic motivation, test anxiety, and academic achievement among nursing students: Mediating and moderating effects. *Nurse Education Today*, *35*(3), 432–438.
https://doi.org/10.1016/j.nedt.2014.11.001

King, N. J., Ollier, K., Iacuone, R., Schuster, S., Bays, K., Gullone, E., & Ollendick, T. H. (1989). Fears of children and adolescents: A cross-sectional Australian study using the revised-fear survey schedule for children. *Journal of Child Psychology and Psychiatry*, *30*(5), 775–784.
https://doi.org/10.1111/j.1469-7610.1989.tb00789.x

Kubíková, K., Lukavská, K., Boháčová, A., Mainz, D., Svobodová, S. (2018). Test anxiety inventory (tai) validization and psychometric properties of czech version. In F. Uslu (Ed.), *Proceedings of INTCESS 2019- 6th International Conference on Education and Social Sciences* (p. 167–175).

Lee, J. H. (1999). Test anxiety and working memory. *The Journal of Experimental Education*, *67*(3), 218–240.
https://doi.org/10.1080/00220979909598354

Ludlow, L. H., & Guida, F. (1991). The test anxiety scale for children as a generalized measure of academic anxiety. *Educational and Psychological Measurement*, *51*(4), 1013–1021.
https://doi.org/10.1177/001316449105100421

McDonald, A. S. (2001). The prevalence and effects of test anxiety in school children, *Educational Psychology*, *21*(1), 89 –101.
https://doi.org/10.1080/01443410020019867

Mulvenon, S. W., Stegman, C. E., & Ritter, G. (2005). Test anxiety: A multifaceted study on the perceptions of teachers, principals, counselors, students, and parents. *International Journal of Testing*, *5*(1), 37–61.
https://doi.org/10.1207/s15327574ijt0501_4

Nwosu, K. C., Wahl, W., Ofojebe, E. N., Okafor, A. U., & Okwuduba, E. N. (2022). Associations between students' test preparation strategies and test anxiety: gender, age, and parents' level of education as control variables. *Education Research International*, 1–9.
https://doi.org/10.1155/2022/9228910

Nyroos, M., Korhonen, J., Linnanmäki, K., & Svens-Liavåg, C. (2012). A cross-national comparison of test anxiety in Swedish and Finnish grade 3 pupils: Measured by the CTAS. *Education Inquiry*, *3*(4), 615–636.
https://doi.org/10.3402/edui.v3i4.22057

Opdenakker, M.-Ch., & Van Damme, J. (2000). Effects of schools, teaching staff and classes on Achievement and Well-Being in Secondary Education: Similarities and differences between school outcomes. *School Effectiveness and School Improvement*, *11*(2), 165–196.
https://doi.org/10.1076/0924-3453(200006)11:2;1-q;ft165

Peleg, O. (2009). Test anxiety, academic achievement, and self-esteem among Arab adolescents with and without learning disabilities. *Learning Disability Quarterly*, *32*(1), 11–20.
https://doi.org/10.2307/25474659

Putwain, D. W. (2008). Deconstructing test anxiety. *Emotional and Behavioural Difficulties*, *13*(2), 141–155.
https://doi.org/10.1080/13632750802027713

Putwain, D. W., & Daly, A. (2014). Test anxiety prevalence and gender differences in a sample of English secondary school students. *Educational Studies*, *40*(5), 554–570.
https://doi.org/10.1080/03055698.2014.953914

Rami U. (2009). *Fehlermanagement im Baugewerbe: Fehler erkennen, kommunizieren und zukünftig verhinder*n [Error management in the building trade: Recognise, communicate and prevent]. Eigenverlag.

Sarason, I. G. (1959). Intellectual and personality correlates of test anxiety. *The Journal of Abnormal and Social Psychology*, *59*(2), 272–275.

Sarason, S. B., Davidson, K. S., Lighthall, F. F., Waite, R., & Ruebush, B. K. (1960). *Anxiety in elementary school children*. Wiley.

Sarason, S. B., Davidson, K., Lighthall, F., & Waite, R. (1958). A test anxiety scale for children. *Child Development*, *29*(1), 105–113.

Sarason, S.B. & Mandler, G. (1952). Some correlates of test anxiety. *Journal of Consulting and Clinical Psychology*, *47*(1), 810-817.
https://doi.org/10.1037/h0060009

Segool, N. K., Carlson, J. S., Goforth, A. N., von der Embse, N. P., & Barterian, J. A. (2013). Heightened test anxiety among young children: Elementary school students' anxious responses to high-stakes testing. *Psychology in the Schools*, *50*(5), 489–499.
https://doi.org/10.1002/pits.21689

Shoahosseini, R., & Baghaei, P. (2020). Validation of the Persian translation of the Children's Test Anxiety Scale: A multidimensional rasch model analysis. *European Journal of Investigation in Health*, *Psychology and Education*, *10*(1), 59–69.
https://doi.org/10.3390/ejihpe10010006

Sieber, J. E., O'Neil Jr., H. F., Tobias, S. (1977). *Anxiety, learning and instruction*. Routledge.

Smits, J., & Vorst, H. (1982). *Schoolvragenlijst voortgezet onderwijs*. Berkhout Nijmegen.

Soffer, M. E. (2008). *Elementary students' test anxiety in relation to the Florida Comprehensive Assessment Test (FCAT)* [Dissertation]. Florida State University.

Spielberger, C. D., & Vagg, R.P. (1995). Test anxiety: A transactional process model. In C. D. Spielberger & P. R. Vagg (Eds.), *Test anxiety: Theory, assessment and treatment* (pp. 3–14). Taylor & Francis.

Steinmayr, R., Crede, J., McElvany, N., & Wirthwein, L. (2016). Subjective well-being, test anxiety, academic achievement: Testing for reciprocal effects. *Frontiers in Psychology*, *6*.
https://doi.org/10.3389/fpsyg.2015.01994

Stöber, J. & Pekrun, R. (2004). Advances in test anxiety research. *Anxiety, Stress & Coping*, *17*(3), 205–211.
https://doi.org/10.1080/1061580412331303225

Stoel, W. (1980). *De relatie tussen de grootte van scholen voor voortgezet onderwijs en het welbevinden van leerlingen*. Rion.

Swartz, R. (1976). Mistakes as an important part of the learning process. *The High School Journal* *59*(6), 246–257.
https://www.jstor.org/stable/40365921

Van Damme, J., De Fraine, B., Van Landeghem, G., Opdenakker, M., & Onghena, P. (2002). A new study on educational effectiveness in secondary schools in Flanders: An introduction. *School Effectiveness and School Improvement*, *13*(4), 383–397.
https://doi.org/10.1076/sesi.13.4.383.10285

von Der Embse, N., Jester, D., Roy, D., & Post, J. (2018). Test anxiety effects, predictors, and correlates: A 30-year meta-analytic review. *Journal of Affective Disorders*, *227*, 483–493.
https://doi.org/10.1016/j.jad.2017.11.048

Wigfield, A., & Eccles, J. S. (1989). Test anxiety in elementary and secondary school students. *Educational Psychologist*, *24*(2), 159–183.
https://doi.org/10.1207/s15326985ep2402_3

Wren, D. G., & Benson, J. (2004). Measuring test anxiety in children: Scale development and internal construct validation. *Anxiety, Stress, & Coping*, *17*(3), 227–240.
https://doi.org/10.1080/10615800412331292606

Yeo, L. S., Goh, V. G., & Liem, G. A. D. (2016). School-based intervention for test anxiety. *Child & Youth Care Forum*, *45*(1), 1–17.
https://doi.org/10.1007/s10566-015-9314-1

You, H. S., & Yang, Y. K. (2014). The influence of self-resilience and academic self-concept on test anxiety in undergraduates. *Journal of Korean Academy of Fundamentals of Nursing*, *21*(3), 275–282.
https://doi.org/10.7739/jkafn.2014.21.3.275

Zeidner, M. (1998). *Test anxiety: The state of the art*. Plenum Press.

Zeidner, M., & Schleyer, E. J. (1999). The big-fish–little-pond effect for academic self-concept, test anxiety, and school grades in gifted children. *Contemporary Educational Psychology*, *24*(4), 305–329.
https://doi.org/10.1006/ceps.1998.0985

Zhao, B. (2011). Learning from errors: The role of context, emotion, and personality. *Journal of Organizational Behavior*, *32*(3), 435–463.
https://doi.org/10.1002/job.696