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A RELATIONSHIP OF COPING STRATEGIES WITH TEST ANXIETY AND ITS RECOLLECTION

***Summary:** Test anxiety (TA) tends to change depending upon the closeness of the exam. When trying to overcome TA, students can use different coping strategies. We examined a relationship between coping strategies and TA made at three time points: 1) TA prior to midterm exam (t1), 2) TA experienced during the exam, with ratings made right after (t2), 3) recollection of the TA levels during the exam, rated seven days later (t3). The TA levels were measured on 76 (80.3% female) university students in t1 and t2; 68/76 students showed up for t3. The TA level was the highest in t1, then dropped substantially during t2 and t3. All three TA levels were significantly different ($t1 > t2$: $g=0.84$; $t1 > t3$: $g=1.12$; $t2 > t3$: $g=0.31$). Both task-focused ($r=.38$) and emotion-focused ($r=.40$) coping strategies correlated with t1 TA. Only emotion-focused coping correlated with t2 ($r=.64$) and t3 ($r=.57$) TA. The results shown that TA prior to the exam can be elevated in relation to both task-focused and emotion-focused coping. While students will later remember lower TA than it was during the exam, the rate of TA drop, and the level of recalled TA will be only related to the levels of emotional coping. Thus, students who excessively rely on the regulation of their own emotions as a coping strategy will tend to have higher levels of TA during and after the testing situation, potentially impeding their achievement.*

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Introduction

Formal education involves many written and oral assessments of students' knowledge. Frequent knowledge assessments, however, can lead to different psychosomatic symptoms and consequences for students, with the most common being the test anxiety (TA). According to one common definition, TA refers to "the set of phenomenological, physiological, and behavioral responses that accompany concern about possible negative consequences or failure on an exam or similar evaluative situation" (Zeidner, 1998, p. 17). Another definition of TA refers to it as "the individual's disposition to react with extensive worry, intrusive thoughts, mental disorganization, tension, and physiological arousal when exposed to evaluative situations" (Zeidner, 1998, p. 18).

According to the body of TA research, students with high TA levels tend to have poorer results on knowledge tests and lower academic achievement, as TA is significantly negatively related (with small to moderate intensity) to outcomes on all major educational performance measures, including standardized tests, university entrance exams, grade point average (GPA), etc. (von der Embse, Jester, Roy, & Post, 2018).

Although more complex multidimensional TA models were proposed (e.g., Hodapp & Benson, 1997; Stöber, 2004), the most commonly used TA conceptualization assumes two underlying factors (Gaye-Valentine & Credé, 2013; Stöber, 2004; von der Embse et al., 2018; Ware, Galassi, & Dew, 1990; Zeidner, 1998): 1) "Worry" – which refers to the cognitive responses to testing situation, such as concerns about performance (before and after the test), and concerns regarding the consequences of poor performance. 2) "Emotionality" – which refers to emotional and autonomic physiological responses (and their perception) that occur during the testing situation. This two-factor model is the basis of some of the most prominent TA measures, including Spielberger's (1980) widely used Test Anxiety Inventory (TAI).

In order to overcome potentially stressful circumstances, including TA, students can use different coping mechanisms and strategies. Coping strategies are ways in which a person overcomes stressful situations (Lazarus & Folkman, 1984). Relationship between coping and TA has often been studied. For example, meta-analytic findings suggest that TA is inversely

related to problem-focused/active coping (pooled $r=-.15$) and positively related to avoidance coping (pooled $r=.38$) (von der Embse et al., 2018). Note, however, that some authors challenge the findings regarding the former coping type. For example, Stöber (2004) found out that, after controlling for overlap between the TA dimensions, both Worry and Emotionality are positively related to task-orientation coping (stronger in females). Additionally, Stöber (2004) reported that Worry is inversely related to cognitive avoidance, while Emotionality is related to seeking more social support.

Although common, research regarding TA and coping is limited in scope. Specifically, Genc (2017) points out that studies typically do not simultaneously examine the relationships between TA, various coping strategies as mediators, and the outcomes of the testing situation. In this regard, she found out that emotion-focused coping mechanism mediates the relationship between TA and test achievement, in such a way that students with high TA, who employ predominantly emotion-focused coping strategies, tend to score lower on a knowledge exam.

Another important aspect related to TA, refers to the changes in TA over time. Although this has not been studied in detail, several studies have confirmed the trend of state TA levels increasing as an exam draws near, in both shorter-term (e.g., days and weeks; Bolger, 1990; Raffety, Smith, & Ptacek, 1997) and longer-term time periods (e.g., over the course of a semester; Lotz & Sparfeldt, 2017).

While the changes in TA preceding the testing situation are fairly understood, changes in TA levels in post testing situation time periods, including reflections, i.e., later recollections of the TA experienced during the testing situations, are basically unstudied. There is also a lack of data regarding the associations between the coping strategies and post-test levels of TA. Specifically, it is unknown: 1) how anxious students might remember being when asked weeks following the testing situation and 2) how are these levels related to specific coping strategies actually used during the test. Hence, the goal of this research was to examine the relationship between various coping strategies used during the testing situation and TA measured at three time points: 1) before the (midterm) exam, 2) after the (midterm) exam, and 3) a week later, when the testing situation was over, and students had to recall how anxious were they during the actual (midterm) exam. The coping strategies framework relied upon in this study is proposed by Matthews and Campbell (1998) and includes three dimensions: 1) task-focused coping, 2) emotion-

focused coping, and 3) avoidant coping mechanism. This coping model was used in prior TA research by Genc (2017), who identified emotion-focused coping, used to regulate emotions, as the most relevant in relation to both TA and testing outcomes. Therefore, we would expect the emotion-focused coping to be related to all three TA measures, but without any specific expectations regarding variation in the strength of correlations at different time points and pattern of associations with other coping strategies. Furthermore, we would expect the TA levels prior to test to be higher than the levels during the test or remembered levels a week later, but we do not have any specific expectation regarding the difference between the two latter levels.

Method

Sample and procedure

The levels of TA were measured using pen & paper procedure, at three time points: 1) t1 – TA immediately prior to midterm psychology course exam, 2) t2 – TA experienced during the exam, with ratings made right after the exam, and 3) t3 – recollection of the TA levels experienced during the exam, rated seven days later, prior to revealing the midterm exam results. When making the TA assessments, instructions were modified to properly address the targeted time frame (i.e., for t1: “Before this exam...”; for t2: “During the previous exam...”; t3: “During the last week’s exam...”). Coping strategies were measured right after the TA measurement, following the exam (t2).

Measurements were made on 76 (80.3% female) BA university students (Faculty of Natural sciences and Mathematics) in t1 and t2, with 68 (80.9% females) out of initial 76 students showing up for the t3 measurement. All measurements were made anonymously and answers from three time points were paired using random id codes made up by the students themselves.

Note that the average midterm test achievement was 68%, i.e. $M=22.55$, $SD=7.97$, out of maximal 33 points, with slight negative score distribution skew ($Sk=-1.03$, $Ku=0.54$).

Measures

Test anxiety was measured using a 14-item questionnaire constructed for this research¹, using a two-dimensional (i.e., Worry and Emotionality) TAI's structure (Spielberger, 1980) as a template. Despite having two factors in mind, the EFA revealed a single factor solution as the most appropriate for this new TA measure (with two-factor solution being suboptimal, due to high item cross loadings and very high factor correlations). Note that studies typically report very high correlations between Worry and Emotionality TA dimensions, which goes as high as .88 (Gaye-Valentine & Credé, 2013; Ware et al., 1990). Because of this, two-dimensional TA measures, including TAI, are often treated as practically unidimensional, i.e., a single, general TA score is used (e.g., Genc, 2017). Hence, a single factor solution obtained here, representing both Worry and Emotionality TA aspects, is not unusual. Obtained general TA factor was strongly internally consistent and congruent between the measurement points (see the Appendix).

Coping strategies were measured using the Coping Inventory for Task Stress questionnaire (CITS; Matthews & Campbell, 1998). CITS is typically used to measure coping in situations that involve execution of various cognitive tasks (here: taking a midterm exam). CITS comprises 21 Likert items and has three subscales: 1) task-focused coping (problem-solving related strategy, which involves defining a problem, seeking alternative solutions, selection of a solution, and taking action; $\alpha=.80$, $\omega=.81$), 2) emotion-focused coping (this mechanism is used to regulate emotions, direct self-criticism, etc.; $\alpha=.88$, $\omega=.89$) and 3) avoidant coping mechanism (includes cognitive or behavioral avoidance of problems and denial of existence of problems; $\alpha=.70$, $\omega=.72$).

Results

As seen from Figure 1, TA levels were the highest in t1, with a pronounced drop during t2 and t3. Although highly correlated (see Table 1), the TA levels from all three measurements are significantly different: $t1 > t2$: $t(75)=7.36$, $g=0.84$, $p<.001$; $t1 > t3$: $t(67)=9.37$, $g=1.12$, $p<.001$; $t2 > t3$: $t(67)=2.55$,

¹ Established test anxiety measures are mostly copyrighted, and as such are not easy to modify to be used in different situational measurement circumstances. Therefore, new test was constructed, with the intention to be less restrictive and easily modifiable to different testing needs and modalities.

$g=0.31$, $p=.013$. The first two differences (as judged by the g values) can be considered large, while the third difference has a small effect size (Cohen, 1992).

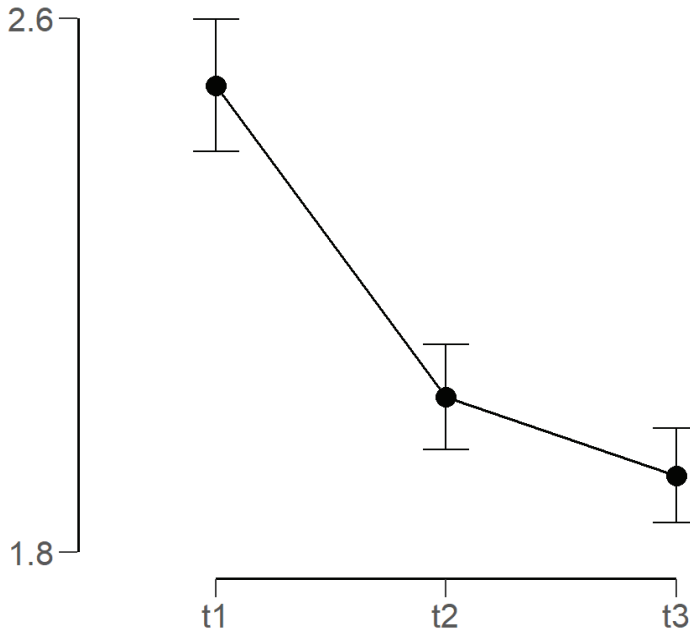


Figure 1. Levels of TA measured at t1 ($M=2.59$, $SD=0.86$, $Sk=0.40$, $Ku=-0.53$), t2 ($M=2.11$, $SD=0.77$, $Sk=0.84$, $Ku=0.12$), and t3 ($M=1.91$, $SD=0.57$, $Sk=0.93$, $Ku=0.47$). Scores are normalized to 1-5 range.

Table 1. Correlations between TA and coping strategies

Variables		t1 TA	t2 TA	t3 TA	Task	Emotion	Avoidance
t1 TA	r	—					
	p	—					
t2 TA	r	.766	—				
	p	<.001	—				
t3 TA	r	.769	.840	—			
	p	<.001	<.001	—			
Task	r	.383	.106	.201	—		
	p	<.001	.364	.101	—		
Emotion	r	.402	.640	.567	-.129	—	
	p	<.001	<.001	<.001	.266	—	
Avoidance	r	-.040	-.038	.150	-.125	.262	—
	p	.747	.757	.222	.310	.031	—

As shown in Table 1, both task-focused and emotion-focused coping strategies have moderately strong positive correlations with t1 TA levels. However, only emotion-focused coping correlates with t2 and t3 TA levels. These two correlations can be considered large (Cohen, 1992). Furthermore, it can be calculated that correlation between the t1 TA and t2 TA is 20.8% mediated by emotion-focused coping ($\beta_{\text{direct}} = .607, p < .001; \beta_{\text{indirect}} = .159, p = .005$), and the t1 TA and t3 TA correlation is 15.9% mediated by emotion-focused coping ($\beta_{\text{direct}} = .696, p < .001; \beta_{\text{indirect}} = .131, p = .007$). Mediation between t2 TA and t3 TA is not significant ($\beta_{\text{direct}} = .877, p < .001; \beta_{\text{indirect}} = .048, p = .546$).

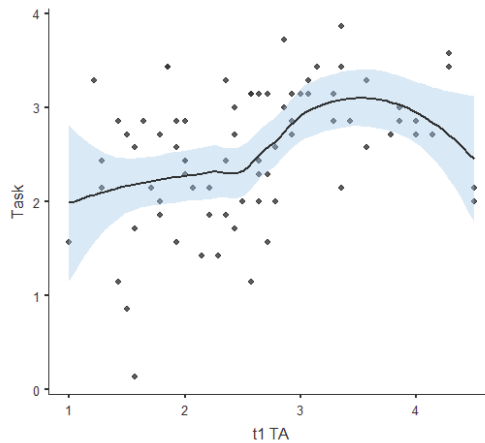


Figure 2. Scatterplot of the correlation between t1 TA and task-focused coping.

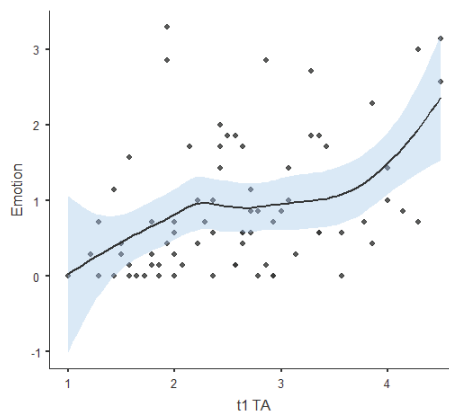


Figure 3. Scatterplot of the correlation between t1 TA and emotion-focused coping.

There is an indication of non-linearity in TA~task-focused coping relationship. Initially, an increase in t1 TA values is followed by an increase in task-focused coping; however, as the TA starts to approach moderately high values, task-focused coping starts to decline (Figure 2). On the other hand, an increase in t1 TA values is followed by an increase in emotion-focused coping, which appears to become sharper once the TA approaches moderately higher values (Figure 3).

Discussion

In line with previous studies (Bolger, 1990; Lotz & Sparfeldt, 2017; Raffety, Smith, & Ptacek, 1997), our results show that students had the highest TA levels right before the midterm exam (t1). The levels reported right after the exam, referring to “what they actually experienced during the exam” (t2) were substantially lower. A week later (t3), students tended to remember even slightly lower TA levels compared to the TA experienced during and reported after the exam (t2). In other words, symptoms of anxiety were the most pronounced immediately prior to testing situation, they were reduced once the test started and completed, and they were later remembered as even lower than that.

Consistent with the findings of Stöber (2004), the TA levels prior to test were positively correlated with both task-focused and emotion-focused coping (however, with no particular association with the avoidance in our case). While Stöber (2004) obtained these effects for the Worry TA dimension specifically, and here the effects manifested for the TA as a whole, still applicable on our results is his general notion that certain aspects of TA, at specific levels, can arguably boost motivation and stimulate preparation for analytical thinking. Therefore, not too highly elevated TA levels before the testing situation can elicit problem solving (i.e., task-focused coping), while simultaneously elevating the focus on emotions. Our data suggests that this is not necessarily linear, i.e., it is true for the TA up to moderately high levels, after which the task-focused coping declines, but the emotion-focused coping increases further. It is unclear whether or not the initial, smaller rise in the emotion-focused coping, serves an adaptive function, or is it negative from the get-go. Perhaps combined with the increase in the task-focus, smaller levels of increase in emotion-focus could help to fortify the sense of presence

and active responsibility in the testing situation. However, it stands to reason that any substantial increase in the emotion-focused coping is not optimal. Our results show that higher pre-test TA predicts higher TA during the actual test partially through the emotional coping. Thus, if having high TA prior to an exam is combined with pronounced focus on one's own emotions during the exam, that will lead to elevated TA levels all throughout the actual exam. This is potentially negative, as higher TA has been shown to lead to lower test achievement precisely through the higher emotion-focused coping (Genc, 2017).

Our results provide another line of evidence showing how emotion-focused coping could have negative implications. Specifically, while the increased TA levels prior to exam are related to both task-focused and emotion-focused coping, those TA levels will tend to drop when the testing situation starts, and students will even remember slightly lower TA levels than actually experienced during the exam. But if the TA levels remain elevated, the only relevant coping dimension to facilitate that elevation persistence is the emotion-focus. Out of all the examined coping dimensions, only emotion-focus correlates with all three point-measures of TA, in roughly similar, moderate to high intensity range. The best predictor of post-test TA level (t2) and post-test TA level recalled a week later (t3) is the pre-test TA level. However, 15-20% of that predictive effect is achieved through the emotion-focused coping. Therefore, students who excessively rely on the emotion-focused coping will tend to have higher levels of TA during the testing situation and will tend to remember higher TA levels. This might put them in the "infinite loop" of constantly elevated TA levels in upcoming testing situations, which, both directly (von der Embse et al., 2018) and indirectly, through the emotion-focused coping (Genc, 2017), could impede their achievement.

Appendix: Test Anxiety Questionnaire (TAQ) EFA results

No.	Items	Factor loadings (Λ)		
		t1	t2	t3
1	... my palms are sweating.	.340	.493	.459
2	... I'm afraid I'll forget what I know.	.798	.758	.592
3	... I feel anxious.	.872	.862	.820
4	... I doubt my knowledge.	.446	.642	.555

5	... I worry what parents and/or friends will tell me if I fail.	.376	.640	.457
6	... I feel I will panic.	.864	.763	.782
7	... I'm afraid I will not pass the test.	.368	.683	.592
8	... I have the impression that I'll get all the questions that I don't know the answers to.	.514	.544	.615
9	... my heart is pounding rapidly.	.831	.798	.780
10	... I have stomach problems.	.653	.734	.347
11	... I feel tense.	.823	.804	.715
12	... I'm afraid my mind will go "blank".	.913	.783	.701
13	... I'm not nervous.	-.720	-.586	-.680
14	... it's hard for me to concentrate.	.384	.694	.717
Eigenvalues		6.29	6.99	5.80
Percentage of explained variance		47.83	53.23	45.18
Cronbach's α		.904	.930	.901
McDonald's ω		.909	.932	.905
Tucker's congruence coefficient (Φ): t1-t2		.973		
Tucker's congruence coefficient (Φ): t1-t3		.967		
Tucker's congruence coefficient (Φ): t2-t3		.984		

Notes: Items are abbreviated translations of Serbian originals. All the items and instructions were modified to be appropriate for administration prior to test (t1: "Before this exam..."), right after the test (t2: "During the previous exam..."), and a week later, when the recollections of TA levels during the test were made (t3: "During the last week's exam..."). Items are given on a 5-point Likert format (1="Not at all true" to 5="Very much true"). Exploratory factor analysis (EFA) was based on the RDWLS estimator and polychoric correlation matrix (Lorenzo-Seva & Ferrando, 2013). All the commonly recommended procedures (Subotić, 2013) suggested that a single factor solution should be retained in all three measurement points. Initial item pool comprised 20 items, but six items were removed due to low loadings (in either time point) and/or non-congruence between the measurements. The final 14-item solution was highly congruent between all three time points, as judged by the Tucker's Φ larger than .95.

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POVEZANOST KOPING STRATEGIJA I TESTNE ANKSIOZNOSTI (SJEĆANJA NA ANKSIOZNOST)

Sažetak: Testna anksioznost (TA) ima tendenciju da se mijenja u zavisnosti od blizine testa. Prilikom pokušaja prevazilaženja TA, studenti mogu da koriste različite koping strategije. U radu je ispitana povezanost koping strategija i testne anksioznosti mjerene u tri vremenska trenutka: 1) TA prije polusemestralnog ispita (t_1), 2) TA za vrijeme polusemestralnog ispita, mjerena neposredno nakon njega (t_2) i 3) sjećanje na nivo TA tokom polusemestralnog ispita, procijenjeno sedam dana kasnije (t_3). Nivoi TA su izmjereni na 76 (80.3% žene) studenata u t_1 i t_2 ; 68/76 studenata je bilo dostupno za mjerenje u t_3 . Nivo TA je bio najviši u t_1 , onda je opadao u t_2 i t_3 . Sva tri TA nivoa su se značajno razlikovala između sebe ($t_1 > t_2$: $g=0.84$; $t_1 > t_3$: $g=1.12$; $t_2 > t_3$: $g=0.31$). Koping strategije usmjerenosti na zadatak ($r=.38$) i usmjerenost na emocije ($r=.40$) korelirale su sa TA nivoima iz t_1 . Samo je usmjerenost na emocije korelirala sa TA iz t_2 ($r=.64$) i t_3 ($r=.57$). Rezultati pokazuju da TA prije ispita može biti povišena i u funkciji usmjerenosti na zadatak i usmjerenosti na emocije. Premda će se studenti kasnije sjećati nižih TA nivoa nego što su bili prisutni tokom ispita, trend pada TA i nivo TA kojeg se prisjećaju biće povezani sa nivoima emocionalnog kopinga. Stoga, studenti koji se pojačano oslanjaju na regulaciju svojih emocija kao koping strategiju, imaće više nivo TA prije i za vrijeme testne situacije, što potencijalno može da umanju njihovo postignuće.

Ključne riječi: testna anksioznost, sjećanje na anksioznost, koping strategije.