



# Anxiety and performance during tests: the roles of coping and updating

Luis Rojas-Torres, Luis A. Furlan, Vanessa Smith-Castro & Guaner Rojas-Rojas

**To cite this article:** Luis Rojas-Torres, Luis A. Furlan, Vanessa Smith-Castro & Guaner Rojas-Rojas (2023): Anxiety and performance during tests: the roles of coping and updating, Oxford Review of Education, DOI: [10.1080/03054985.2023.2233901](https://doi.org/10.1080/03054985.2023.2233901)

**To link to this article:** <https://doi.org/10.1080/03054985.2023.2233901>



Published online: 31 Jul 2023.



Submit your article to this journal [↗](#)







View related articles [↗](#)



View Crossmark data [↗](#)



# Anxiety and performance during tests: the roles of coping and updating

Luis Rojas-Torres <sup>a</sup>, Luis A. Furlan <sup>b</sup>, Vanessa Smith-Castro <sup>a</sup> and Guaner Rojas-Rojas <sup>a</sup>

<sup>a</sup>Institute for Psychological Research, University of Costa Rica, San José, Costa Rica; <sup>b</sup>Laboratorio de Evaluación Psicológica y Educativa, National University of Córdoba, Córdoba, Argentina

## ABSTRACT

It is widely known that test anxiety (TA) is associated with a decrease in test scores. The objective of this study is to provide evidence of the existence of two paths through which TA affects test scores: an indirect path that is associated with the mediation of the updating efficiency and a direct path moderated by the putting into perspective coping strategy. The study was conducted with a sample of 184 high school students who took an entrance exam for a university in Costa Rica. The structural equation modelling related to the theoretical approach was well adjusted, which provided evidence in favour of the hypotheses about the previously mentioned paths. Based on the results, the use of the putting into perspective coping strategy can help people with high TA levels reduce the effect of this emotion in test scores.

## KEYWORDS

Test anxiety; coping; putting into perspective; updating efficiency; test scores

## Introduction

Test anxiety (TA) is an aversive emotion which arises from considering tests a threatening event. The emotional responses can also have physiological, psychological, behavioural and/or phenomenological implications. The most common emotional response is the continuous concern about failing the exam (Furlan, 2006). While individuals are experiencing TA, they undergo a subjective discomfort characterised by persistent thoughts about aspects related to failing the exam and a feeling of physiological instability. This issue affects a large portion of students: in several studies it has been observed that between 25% and 40% of high school and post-high school students experience high TA levels (Lowe, 2020; Salend, 2012).

As expected, experiencing TA has consistently proved to be negatively associated with test results (Jerrim, 2022; Putwain, 2008), which has been made evident in the meta analyses from Hembree (1988) and Von der Embse et al. (2018). The results suggest that people with high levels of TA see their performance in tests affected by their emotional state during the test. This is a very concerning situation, since it implies a decrease in the test scores of a significant group of individuals, which brings about negative academic, emotional and job-related consequences. Moreover, underestimating the test scores also implies a validity problem regarding the interpretation of these test scores.

**CONTACT** Luis Rojas-Torres  [luismiguel.rojas@ucr.ac.cr](mailto:luismiguel.rojas@ucr.ac.cr)  Psychological Research Institute, University of Costa Rica, San José 11501-2060, Costa Rica

The goal of this article is to provide evidence of the existence of two paths in which TA affects test scores: an indirect path that is associated with the mediation of the updating efficiency and a direct path moderated by the putting into perspective coping strategy.

### ***The role of updating***

The first approach that was proposed to describe the process through which TA affects performance during tests was the Cognitive Interference Model (CIM) (Sarason, 1984; Wine, 1971). In this model, it is asserted that the negative association between TA and test scores occurs because students cannot fully focus their attention on the exam tasks, since part of their cognitive resources is dedicated to preoccupations that stem from TA (Burcaş & Zeno Creţu, 2020). Therefore, as they cannot focus on the tasks they tend to fail more on resolution stages or to need more time to finish tasks. So, TA negatively affects attention, which in turn provokes a decrease in performance during the test (Shi et al., 2019). This means, according to the CIM, that the relationship in question mediates attentional processes. In the Attentional Control Theory (ACT) (Eysenck et al., 2007), the authors deepen into the effect of anxiety on attention. This is explained through the specific analysis of the attention-related cognitive mechanisms: executive functions. The main executive functions are: updating, which allows individuals to turn the information available into relevant information for the task, inhibition, which helps avoid impulsive responses and shifting between mental operations, which contributes to shifting from one task to another (Miyake et al., 2000; Stolte et al., 2020).

In the ACT it is contended that anxiety triggers a decrease in the efficiency of the three main executive functions (inhibition, shifting and updating) during stressful situations. This situation takes place because individuals are not able to fully focus on executing these functions, which in turn causes them to make more effort to reach a desired outcome. According to this theory, anxiety has a larger effect on the efficiency of the executive functions than on general effectiveness. This means that individuals can reach the goals of the executive functions, but with more effort. However, the effort it takes to reach those goals lowers the efficiency of such functions.

Now, not all executive functions are equally relevant when it comes to completing a test. In empirical studies, the executive function that is correlated the most with performance on exams and academic achievement is updating (Cortes et al., 2019; Friedman et al., 2006; Stolte et al., 2020). This has to do with the fact that exam tasks are closer to updating tasks, since most steps to solve the tasks require transformations of information at a conscious and subconscious level. Therefore, the effect of TA on test scores may be mediated by the updating efficiency.

It is important to indicate that to explain the effect of a variable on another variable through a mediating path, there is also a direct path independent of the mediator variable (Hair et al., 2014). This path may represent the effect of TA on the engagement of the student in completing the exam, which is difficult to maintain during intense TA episodes. This hypothesis is based on the argument of the cognitive restructuring interventions, which indicate that TA affects performance due to a mediation of negative emotional reactions (Chin et al., 2017; Zeidner, 1998). This effect of TA in performance is not much related to the effect mediated by updating efficiency.

## ***The role of coping***

According to the Information Processing Theory (IPT) (Eysenck & Calvo, 1992), when TA is affecting performance in tests, a self-control system is activated in students. This system may react in multiple ways in order to counteract the effect of TA. One of the most effective reactions is the use of coping strategies to reduce subjective discomfort. If the strategies are not applied, the influence of TA may last the whole test, but if these are applied, they may mitigate its negative effect. Therefore, it is asserted in the IPT that coping can have a moderating effect on the influence of TA on test scores.

Since it was previously stated that TA affected test scores through a mediation of the updating efficiency, it needs to be specified if the moderation occurs in the mediating path or in the direct one, isolating the mediator variable (Hair et al., 2014). In Eysenck et al. (2007), it is explained that the emotional regulation elements do not help mitigate the effect on the updating, since this type of regulation requires attentional resources. Therefore, the moderation of coping is in the direct relation, isolating the updating.

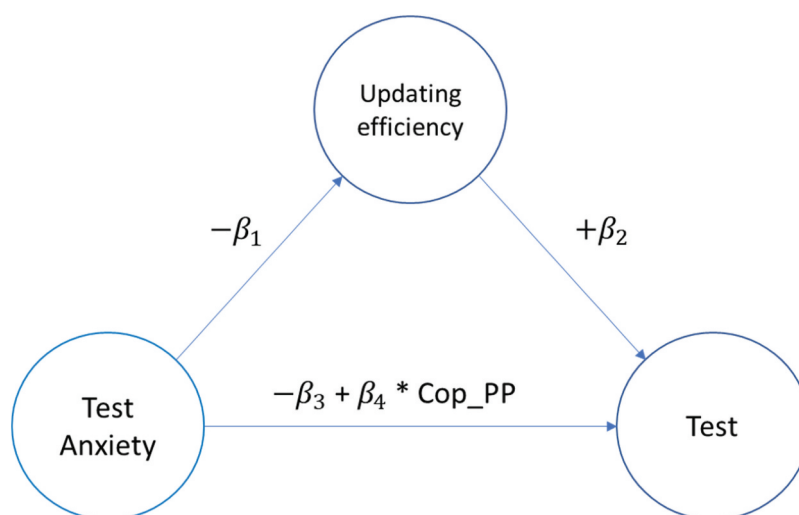
Besides, it is important to mention that there exist multiple coping strategies that can reduce subjective discomfort during an episode of TA such as acceptance, refocus on planning, positive reappraisal and putting into perspective (Garnefski & Kraaij, 2018). One of the most effective strategies is *putting into perspective*, which is defined as the process in which the individual contrasts with objective information the seriousness of a judgement made anxiously (Rojas-Torres et al., 2022). This strategy is the basis of many therapeutic processes made to handle anxiety, since it allows patients to disregard anxious thoughts, which helps patients handle anxiety better during a stressful event (Mashal et al., 2020). Moreover, the putting into perspective strategy is closely related to the cognitive-behavioural techniques used in effective interventions to reduce TA-related subjective discomfort (Zeidner, 1998).

Thus, it can be contended that TA affects performance during tests through a direct path, isolating the updating efficiency, which is moderated through the different coping strategies. In this study in particular, moderation by putting into perspective will be analysed, due to its effectiveness in the handling of TA.

## ***Two-pathway model about the influence of TA on performance during tests***

Based on what was previously stated, the conclusion is that TA affects performance during tests through: a) a mediating path by means of the updating efficiency and b) a direct path, independent of updating efficiency, which is moderated by the coping strategies. In this study, performance during a test will be considered an associated factor score, instead of an observed score; additionally one important TA coping strategy will be analysed: putting into perspective.

In the mediating path, the hypotheses are that the association of TA with updating efficiency is negative and that the association of the mediator variable with test scores is positive. In the moderation path, the hypotheses are that the direct relationship of TA with test scores is negative and that the interaction between TA and coping is associated with test scores positively (coping allows that when the coping level increases, the total effect of TA decreases in the direct path). In [Figure 1](#), the hypotheses of the model mentioned are shown and the verifiability of the hypotheses is analysed with the data.



**Figure 1.** Hypothesis about the regression coefficients of the two-pathway model about the effect of TA on performance during tests.

*Note:* Beta scores represent positive numbers. Cop\_PP: Putting into perspective coping.

## Method

### Participants

A convenience sample was used, which was made up of a group of 184 teenagers who took a standardised test to enter a public university in Costa Rica. Owing to the relevance of this exam, it was possible that the ways in which TA could affect test scores might be appreciated. The sample was made up of 101 women, 82 men and one person who did not identify themselves with these categories. The average age of the participants was 17.27 (.70).

### Instruments

#### *German test anxiety inventory adapted to Costa Rica (GTAI-CR, Rojas, 2021)*

This scale was used to measure the levels of state test anxiety experienced by the students during the exam. The scale consists of 28 items with three options to respond, divided into four dimensions: concern, (9 items,  $\alpha=.90$ ), emotionality (7 items,  $\alpha=.83$ ), lack of self-confidence (6 items,  $\alpha=.87$ ) and interference (6 items,  $\alpha=.83$ ). The average scores of each dimension were used as TA indicators.

#### *Putting into perspective coping strategy subscale of the test anxiety coping scale (Rojas-Torres et al., 2022)*

This subscale was used to measure the use of the putting into perspective coping strategy during the moments in which the participants felt concerned during the exam. The subscale contains four three-level Likert items and its Cronbach's alpha was .86. The scores from each item were used as indicators of the variable called putting into perspective coping strategy.

### ***Working memory updating test (WMUT) (Rodríguez-Villagra, 2015)***

This test was applied to obtain a measure of the updating efficiency in environments in which test-related stress takes place. The test consisted of 24 trials in which nine updating processes and three information retrieval processes have to be performed. Each trial begins with the appearance of a  $5 \times 5$  chart with a figure in the central square (triangle, square or circle), followed by the appearance of an arrow indicating that the figure has to be moved to any adjoining square. After that, the subject has to indicate the new position of the figure with the arrow. The updating of the position of this figure has to be made twice more. After that, the same activity has to be performed with two other figures; thus, six other updating processes ought to be performed. At the end of the trial, the final position of the three figures has to be indicated. The three indicators of the updating efficiency were the numbers of correct updates of each figure divided by the amount of time dedicated to these updates, which is the number of correct updates of a certain figure per second. The correlations among the three indicators were over .80.

### ***Academic aptitude test (PPPAA, 2014)***

The variable through which the influence of TA was studied was the factor score of the construct evaluated in this test.

In this test, the testing of general reasoning abilities in verbal and mathematical contexts is made and its scores are used to select the students who will enter a public university in Costa Rica (Rojas et al., 2018). The test consisted of 60 items grouped in nine reasoning categories: generalisation (5 items), inquiry (7 items), opposing (3 items), paraphrasing (9 items), presupposing (9 items), reduction (10 items), representation (7 items), supposing (3 items) and verification (7 items). Three hours were allotted to complete this exam, and it took place in a standardised facility. The proportion of correct answers in each reasoning category was used as an indicator of the construct evaluated in this test. Therefore, when the test scores are mentioned, it means that reference is being made to factor scores.

### ***Procedure***

Two months prior to the entry test, participants were informed about the objectives and procedures of the study. After that, they were asked to give their informed consent, which was approved by the Ethical and Scientific Committee of the university in question.

A month before the test, WMUT was implemented with the participants. In order to get an approximation of the students' level of updating during the test, this variable was measured in an environment similar to that of the entry test. This was made in a laboratory with computers sufficiently separated from each other and with the same standardisation protocols that would be used in the entry test. Furthermore, so as to replicate the environment in which they would be tested at university, the students were reminded before the beginning of this test that their level of updating would be measured.

On the other hand, there was a factor that would help replicate the environment of the entry test: the students were aware of the fact that this test was highly related to the entry test.

The next stage was the official entry test. Once it was over, the TA and putting into perspective questionnaires were taken. In these questionnaires, participants were asked to remember the behaviours and thoughts they had during the test in order to obtain the value of the variables of interest during the entry test.

### **Data analysis**

So as to analyse whether the data obtained actually confirmed the hypotheses about the paths through which TA affects test scores, a structural equation modelling with three main latent variables was used: TA, updating efficiency and test construct. The indicators of these variables were those mentioned in the Instruments section. The model was composed of two paths of interest: a) from TA to updating efficiency and from updating efficiency to the test construct, and b) from TA to the test construct.

To include the moderation of the putting into perspective coping strategy, the product indicator approach was used. In this proposal, moderation can be included through a regression of the predicted variable on the latent interaction variables and the moderating variables. The interaction variable represents the multiplication of the predictor variable by the moderating variable. In this variable, indicators that are a multiplication of the multiplied variables are used (Hair et al., 2014). Consequently, in the structural equation model in question, two additional test construct predictors were added: the putting into perspective coping strategy and the interaction variable. The indicators of the interaction of this model were the three combinations of multiplications between TA and the putting into perspective coping strategy, which provided the best adjustment of the measuring model.

In order to analyse the adjustment of the structural equation model, it was established that a good adjustment would be determined by factor loadings of the indicators that are over .30 (Cea, 2002) and the following values of the adjustment indexes: SRMR < .08, RMSEA < .06 and CFI > .95 (Hu & Bentler, 1998). The estimation of the model was made with the maximum likelihood estimation through the Lavaan package 0.6–11 (Rosseel, 2012) of the R software in its 3.6.1 version (R Core Team, 2016).

### **Results**

In Table 1, the descriptive statistics of the indicators of the model are shown. It was observed that the pairs of indicators of each latent variable showed correlations higher than .30 between each other. On the other hand, there were no correlations higher than .30 between each other when it came to different latent variables, except the updating efficiency indicators and three indicators of the test: inquiry, representation and verification.

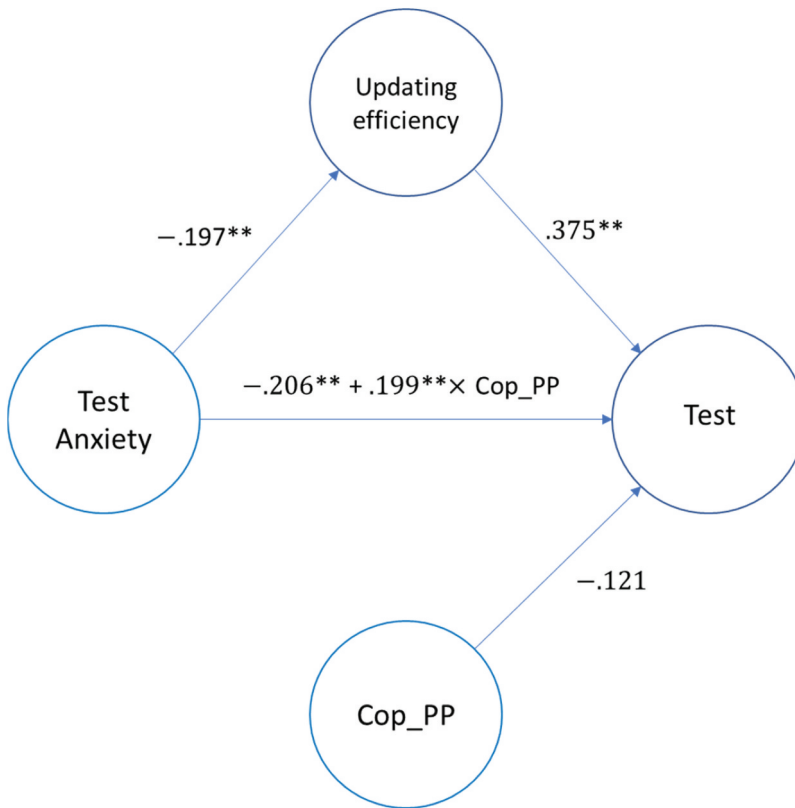
As regards the structural equation model, all indicators used in the estimated model had factor loadings over .35 in the corresponding latent variables. The factor loadings of the TA indicators were between .519 and .787, those of the test between .430 and .833, those of the updating efficiency between .906 and .982, those corresponding to the putting into perspective coping strategy between .394 and .885 and those corresponding to interaction were between .388 and .932.

**Table 1.** Descriptive statistics about the indicators of the model of study.

Indicator	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
1. Worry	2.38	0.52																							
2. Emotionality	1.74	0.56	<b>.62</b>																						
3. Inference	1.80	0.57	<b>.35</b>	<b>.38</b>																					
4. Lack of confidence	2.58	0.44	<b>.43</b>	<b>.49</b>	<b>.45</b>																				
5. Updating Fig. 1	0.85	0.16	-.11	-.06	-.12	-.14																			
6. Updating Fig. 2	0.80	0.15	-.18	-.14	-.12	-.16	<b>.89</b>																		
7. Updating Fig. 3	0.76	0.15	-.14	-.08	-.11	-.11	<b>.83</b>	<b>.89</b>																	
8. PP1	1.63	0.77	-.20	-.09	-.01	-.15	-.07	-.06	-.10																
9. PP2	1.81	0.77	-.19	-.10	-.15	-.17	-.07	-.09	-.10	<b>.71</b>															
10. PP3	1.77	0.80	-.21	-.19	-.12	-.23	-.03	0.3	0.2	<b>.66</b>	<b>.64</b>														
11. PP4	1.60	0.67	.04	.05	.09	-.02	-.06	-.07	-.12	<b>.37</b>	<b>.30</b>	<b>.31</b>													
12. Generalisation	0.51	0.22	-.06	-.01	-.10	-.03	.24	.27	.30	-.09	-.14	-.07	0.7												
13. Inquiry	0.52	0.23	-.01	-.05	-.11	-.10	<b>.33</b>	<b>.34</b>	<b>.31</b>	-.08	-.06	.05	.00	<b>.50</b>											
14. Opposing	0.67	0.32	-.08	-.07	-.09	-.13	.19	.21	.14	-.03	0.3	0.6	-.03	.18	<b>.31</b>										
15. Paraphrasing	0.44	0.22	-.08	-.19	-.16	-.22	.22	.26	.16	-.15	-.10	.07	-.08	<b>.36</b>	<b>.56</b>	<b>.44</b>									
16. Presupposing	0.39	0.20	-.08	-.15	-.06	.00	.14	.20	.15	-.18	-.11	.01	-.12	.28	<b>.40</b>	<b>.46</b>	<b>.52</b>								
17. Reduction	0.52	0.20	-.02	-.07	-.16	-.04	.21	.27	.21	-.11	-.07	.04	-.07	<b>.37</b>	<b>.49</b>	<b>.46</b>	<b>.65</b>	<b>.46</b>							
18. Representation	0.46	0.25	-.08	-.16	-.06	-.21	<b>.37</b>	<b>.43</b>	<b>.32</b>	-.14	-.12	0.3	-.09	<b>.37</b>	<b>.58</b>	<b>.27</b>	<b>.55</b>	<b>.41</b>	<b>.46</b>						
19. Supposing	0.32	0.25	-.08	-.08	-.10	-.11	.24	<b>.31</b>	.26	-.10	-.03	-.03	-.11	.21	.24	.27	<b>.32</b>	<b>.33</b>	<b>.34</b>	<b>.37</b>					
20. Verification	0.45	0.24	-.09	-.14	-.10	-.17	<b>.30</b>	<b>.33</b>	.24	-.13	-.09	.00	-.06	<b>.33</b>	<b>.45</b>	<b>.33</b>	<b>.61</b>	<b>.36</b>	<b>.52</b>	<b>.46</b>	.24				
21. Ind 1*Ind 9	-.020	1.14	.16	.13	.06	.13	-.08	-.07	-.08	-.24	-.16	-.11	-.06	.12	.07	-.02	.17	.01	.14	.05	-.02	.15			
22. Ind 2*Ind 11	-.019	1.01	.11	.00	-.11	.06	-.07	-.01	-.01	-.03	.04	-.11	.03	.11	-.03	-.03	.02	-.09	.04	-.02	-.01	-.01	<b>.38</b>		
23. Ind 4*Ind 10	-.017	0.96	.13	.06	.04	-.06	-.17	-.14	-.22	-.11	-.04	-.04	-.12	-.06	-.07	.09	.08	.04	.07	-.04	-.10	.09	<b>.36</b>	.24	

Note: The indicators are ordered according to the latent variable: TA, Updating efficiency, Putting into perspective (PP), Test and Interaction. Ind n=Indicator n in this table. The correlations that are equal or higher than .30 are highlighted.





**Figure 2.** Standardised coefficients of the proposed model of influence of TA in the test construct. *Note:* The latent interaction variable was not depicted as a circle, since this would not allow us to show its role as a moderator. Instead, the regression coefficient of this variable is shown in the regression equation of the test, over TA.

Figure 2 shows the latent model, composed of the proposed paths through which TA affects the test, together with the standardised regression coefficients obtained in the model estimation. The values of the main adjustment indexes of the model were CFI = .956; RMSEA = .041 and SRMR = .060, which complied with the previously established conditions. Therefore, it can be concluded that the model adjusted properly to the data.

Regarding the mediating path, the regression coefficients of the two regressions that defined it were 5% statistically significant. The TA coefficient towards updating efficiency was  $-.197$ , whereas the one from updating efficiency towards the test was  $.375$ . The signs of both coefficients proved the hypotheses made in the theoretical model. The global regression coefficient through this path was  $-.074$  (the multiplication of the coefficients of the two regressions involved).

As regards the direct path, the regression coefficient of TA towards the test was 5% statistically significant and its value was  $-.206$ . As in the first path, the sign of the coefficient matched what was expected in the theoretical model. Furthermore, the interaction variable in this model was also 5% statistically significant and its value was  $.199$ . Therefore, this path is moderated by such interaction (Hair et al., 2014).

Now, the direct effect of TA is moderated through the interaction of TA and the putting into perspective coping strategy (PP). This means that the global coefficient of this path can be modelled as  $-206+.199 PP$ . This coefficient indicates that if the PP level is low, the direct effect is potentiated (the negative magnitude increases). For example, if  $PP = -1$ , then the global direct coefficient is  $-.405$ . On the other hand, if the PP level is high, the direct effect of TA is neutralised. For example, if  $PP = 1$ , the global coefficient of this path would be  $-.007$ . Moderation in the direct global coefficient made by PP was in consonance with the hypothesis made: the lower the level of adaptive coping, the higher the influence of TA, and vice versa: the higher the level of adaptive coping, the lower the influence of TA.

In the same way, it can be observed that the total effect of TA on the test is also neutralised as the values of PP increase. When the values of PP were  $-1$ ,  $0$  and  $1$ , the values of the total effect of TA on the test were  $-.479$ ,  $-.280$  and  $-.081$  respectively (the total effect is the sum of the direct effect plus the effect of mediation, whose value was  $-.074$ ). This shows that the role of the mediating path is much greater for high PP levels. When the PP values were  $-1$ ,  $0$  and  $1$ , the proportions of the total effect that were owing to mediation were:  $15.5\%$ ,  $26.4\%$  and  $91.3\%$  respectively. According to Hair et al. (2014), there was no mediation in the first case; in the second one there was partial mediation; and in the third one mediation was full.

## Discussion

The results obtained in the model estimation showed evidence in favour of the initial hypotheses. TA affects the factor scores of the test construct through an indirect path, mediated by the updating efficiency and also through a direct path, moderated by the putting into perspective coping strategy.

The first component of the indirect path indicated that TA affects updating efficiency. Based on what Eysenck et al. (2007) mentioned, anxious thoughts do not let individuals devote all their cognitive resources to the updating tasks required. Consequently, they have to make an additional effort to perform them, which causes the updating efficiency to decrease. As for the other component of the indirect relation, Friedman et al. (2006) indicated that updating is associated with test scores since the characteristics that define this function play a key role during tests: keeping focus on relevant information, discarding irrelevant information and replacing it by more pertinent information. When this function performs inefficiently, it will take longer for individuals to complete updating tasks and, thus, it will take longer for them to complete the test, and they will get lower results in tests with a time limit.

An instance of this indirect relation may be appreciated when individuals experience problems focusing during a test owing to their anxious thoughts, which makes them read an exercise many times to identify relevant pieces of information. This also leads to an increase in the difficulty of the task from the moment the subject tries to grasp it. Besides, this process might be repeated while the task is being solved or checked, which would mean an increase in the difficulty of the task for persons with higher TA levels.

Additionally, it was found that the direct path was statistically significant. This implies that TA affects the test construct through a path independent of updating efficiency.

Previously, it had been proposed that this path could represent the decrease in the engagement to work on the task that some anxious individuals experience.

To prove this hypothesis of mediation, a variable associated with the engagement with the task during the exam should be added. Regarding this mediation, it was observed in Vanstone and Hicks (2019) that TA was positively associated with avoidance behaviour, which includes behavioural disengagement.

Now, regarding the moderation of the direct path, it can be concluded that an appropriate coping strategy can mitigate the effect of TA in the factor scores of the test. It was observed in this study that high PP levels (around 1) are associated with a virtually null direct effect of TA. This occurs because this coping strategy helps individuals to disregard anxious thoughts and to work on the test again. In opposition, when this coping strategy is at low levels (around  $-1$ ), the influence of the direct effect increases considerably. Subjects with such low values validate anxious thoughts, so a snowball effect is provoked, in which catastrophic and ruminating thoughts appear. These thoughts make individuals stop working on the test to just focus on these sequences of thoughts.

On the other hand, updating efficiency mediation was observed in cases with medium (around 0) or high PP levels. In these cases, TA still affects the test construct through the mediating path, regardless of PP levels. This may occur owing to the fact that anxious individuals constantly bear with anxious stimuli, since hypervigilance leads them to find TA triggers. Consequently, the attention paid to these stimuli provokes a decrease in updating efficiency. It is important to clarify here that the effect of TA through the mediating path is relatively low ( $-.074$ ) in comparison to the direct effect it has when there are low PP levels ( $-.405$ ).

The data collected also indicated that the mediation of the updating efficiency was not plausible when PP levels were low. It seems that this occurs because the direct effect is so large that the mediating path becomes insignificant. Therefore, anxious individuals with low PP levels have issues resorting to updating efficiently, but their biggest struggle is in situations related to the direct effect, which could mean engagement with task completion.

The research results may be used to support people affected by TA. The immediate recommendation is to help these people resort to the putting into perspective coping strategy, since it is associated with a decrease in the influence of the direct effect, which is the most relevant one. It is also important to keep in mind that in therapies aiming for the healthy coexistence with an emotion, the coping strategy must be used when completing the test, since a therapeutic strategy can be unhelpful to mitigate the total effect and unfocus the student from the main task (Zeidner, 1998).

Additionally, to reduce the effect of the mediating path, efforts should be made for anxious individuals to reduce hypervigilance and therefore avoid unfocused minds during tests.

Regarding future research, it should be studied whether the direct effect means less effort during the completion of an exam. It is also necessary to study whether interventions based on PP or on the treatment of hypervigilance mean a decrease in the mentioned effects.

On the other hand, the main constraint of the study was that the measurement of the updating efficiency was made in an environment that mirrored that of a standardised test,

but it cannot be assured this measurement can replicate the updating levels during the completion of the exam in question. However, it is unlikely that this constraint can be overcome, since a trial cannot be made in a real test situation.

To conclude, the data obtained showed evidence about the settings of the paths made to explain the influence of TA on test scores: the mediation of the updating and the path independent of the updating, moderated by the putting into perspective coping strategy. It is expected that the results obtained will be used to develop interventions that help individuals with high TA levels get higher scores on their tests.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Notes on contributors

*Luis Rojas-Torres* has a Ph.D. in Education, a master's in Statistics and a bachelor's degree in mathematics teaching. He works at the School of Mathematics and the Institute for Psychological Research, of the University of Costa Rica (UCR). He has several articles and research on the topics of educational evaluation; construction and validation of psychological and educational measurement instruments; measurement models and factors associated with academic performance, especially test anxiety, emotional regulation, and reasoning in mathematical context. He teaches courses in quantitative research, measurement models, evaluation, statistics, and probability.

*Luis Alberto Furlan* has a Ph.D. in Psychology from National University of Cordoba, Argentina. He is Assistant Professor of Research Methods in Psychology and postgraduate courses of "emotion regulation strategies in test situations" and "theory, assessment and treatment of procrastination". Also, he is director of the research team in emotion regulation on learning and testing settings. His research interests are evidence based interventions, psychological assessment, cognitive and contextual approaches in psychotherapy to cope with test anxiety, and academic procrastination.

*Vanessa Smith* earned her Licenciatura degree in Psychology from the University of Costa Rica and her Ph.D. in Social Psychology from Philipps-Universität Marburg (Germany). She is professor at the Institute for Psychological Research of the University of Costa Rica. Her research interests are social cognition, quantitative research methods, and psychometrics.

*Guaner Rojas-Rojas* has a Ph.D. in Methodology of Behavioral Sciences and Health from the Universidad Autónoma de Madrid. He is a professor and researcher at the Institute for Psychological Research and the School of Statistics of the University of Costa Rica. His research focuses on the development of methodology and applications in measurement and statistics with latent variables.

## ORCID

Luis Rojas-Torres  <http://orcid.org/0000-0002-9085-2703>

Luis A. Furlan  <http://orcid.org/0000-0002-8415-0596>

Vanessa Smith-Castro  <http://orcid.org/0000-0001-6348-4223>

Guaner Rojas-Rojas  <http://orcid.org/0000-0002-3064-9631>

## References

- Burcaş, S., & Zeno Crețu, R. (2020). Multidimensional perfectionism and test anxiety: A meta-analytic review of two decades of research. *Educational Psychology Review*, 33(1), 249–273. <https://doi.org/10.1007/s10648-020-09531-3>
- Cea, M. A. (2002). *Análisis multivariable: Teoría y práctica en la investigación social*. Síntesis.
- Chin, E., Williams, M. H., Taylor, J. E., & Harvey, S. H. (2017). The influence of negative affect on test anxiety and academic performance: An examination of the tripartite model of emotions. *Learning and Individual Differences*, 54, 1–8. <https://doi.org/10.1016/j.lindif.2017.01.002>
- Cortes, A., Moyan, N., & Quílez, A. (2019). The relationship between executive functions and academic performance in primary education: Review and meta-analysis. *Frontiers in Psychology*, 10, 1582. <https://doi.org/10.3389/fpsyg.2019.01582>
- , M., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition & Emotion*, 6(6), 409–434. <https://doi.org/10.1080/02699939208409696>
- Eysenck, M., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion*, 7(2), 336–353. <https://doi.org/10.1037/1528-3542.7.2.336>
- Friedman, N. P., Miyake, A., Corley, R. P., Young, S. E., DeFries, J. C., & Hewitt, J. K. (2006). Not all executive functions are related to intelligence. *Psychological Science*, 17(2), 172–179. <https://doi.org/10.1111/j.1467-9280.2006.01681.x>
- Furlan, L. (2006). Ansiedad ante los exámenes. ¿Qué se evalúa y cómo? *Revista Evaluar*, 6(1), 32–51. <https://doi.org/10.35670/1667-4545.v6.n1.533>
- Garnefski, N., & Kraaij, V. (2018). Specificity of relations between adolescents' cognitive emotion regulation strategies and symptoms of depression and anxiety. *Cognition and Emotion*, 32(7), 1401–1408. <https://doi.org/10.1080/02699931.2016.1232698>
- Hair, J. F., Hult, G. T., Ringle, C. M., & Sarstedt, M. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM)*. SAGE Publications.
- Hembree, R. (1988). Correlates, causes, effects, and treatment of test anxiety. *Review of Educational Research*, 58(1), 47–77. <https://doi.org/10.3102/00346543058001047>
- Hu, L. T., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods*, 3(4), 424–453. <https://doi.org/10.1037/1082-989X.3.4.424>
- Jerrim, J. (2022). Test anxiety: Is it associated with performance in high-stakes examinations? *Oxford Review of Education*, 49(3), 329–341. <https://doi.org/10.1080/03054985.2022.2079616>
- Lowe, P. A. (2020). The test anxiety measure for college students-short form: Development and examination of its psychometric properties. *Journal of Psychoeducational Assessment*, 39(2), 139–152. <https://doi.org/10.1177/0734282920962947>
- Mashal, N. M., Beaudreau, S. A., Hernández, M. A., Cackler, R., Romaniak, H., Eun Shin, K., Paller, K. A., & Zinbarg, R. E. (2020). A brief worry reappraisal paradigm (REAP) increases coping with worries. *Cognitive Therapy and Research*, 44(1), 216–228. <https://doi.org/10.1007/s10608-019-10053-8>
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive Psychology*, 41(1), 49–100. <https://doi.org/10.1006/cogp.1999.0734>
- PPPAA. (2014). La Prueba de Aptitud Académica. In Smith, V. (Ed.), *Compendio de Instrumentos de Medición del IIP* (pp. 286–293). Publicaciones del IIP-UCR. <https://www.iip.ucr.ac.cr/sites/default/files/contenido/cuamet6.PDF>
- Putwain, D. W. (2008). Test anxiety and GCSE performance: The effect of gender and socio-economic background. *Educational Psychology in Practice*, 24(4), 319–334. <https://doi.org/10.1080/02667360802488765>
- R Core Team. (2016). *R: A language and environment for statistical computing* (3.3.2) [Computer software]. R Foundation for Statistical Computing. <https://www.R-project.org/>

- Rodríguez-Villagra, O. A. (2015). Modelos de variables latentes, modelación cognitiva y memoria de trabajo: un punto de encuentro. *Actualidades en Psicología*, 29(119), 43–62. <https://doi.org/10.15517/ap.v29i119.18850>
- Rojas, L. (2021). *Mecanismos subyacentes a la asociación de la ansiedad ante los exámenes con el rendimiento en pruebas* [Tesis para optar por el grado de Doctorado en Educación]. Universidad de Costa Rica.
- Rojas, L., Rojas, G., & Brizuela, A. (2018). The use of measurement invariance with dichotomous variables as evidence of validity. *Revista Evaluar*, 18(2). <https://doi.org/10.35670/1667-4545.v18.n2.20807>
- Rojas-Torres, L., Furlan, L., Sánchez-Rosas, J., & Rojas-Rojas, G. (2022). Construcción y validación de la Escala de Afrontamiento de la Ansiedad durante los Exámenes. *Ansiedad y Estrés*, 28(2), 81–90. <https://doi.org/10.5093/anyes2022a9>
- Rosseel, Y. (2012). *Lavaan: An R package for structural equation modeling*. <http://www.jstatsoft.org/v48/i02/>
- Salend, S. J. (2012). Teaching students not to sweat the test. *PDK International*, 93(6), 20–25. <https://doi.org/10.1177/003172171209300605>
- Sarason, I. G. (1984). Stress, anxiety, and cognitive interference: Reactions to tests. *Journal of Personality and Social Psychology*, 46(4), 929–938. <https://doi.org/10.1037/0022-3514.46.4.929>
- Shi, R., Sharpe, L., & Aboot, M. (2019). A meta-analysis of the relationship between anxiety and attentional control. *Clinical Psychology Review*, 72(101754), 101754. <https://doi.org/10.1016/j.cpr.2019.101754>
- Stolte, M., García, T., Van Luit, J., Orange, J., & Kroesbergen, E. H. (2020). The contribution of executive functions in predicting mathematical creativity in typical elementary school classes: A twofold role for updating. *Journal of Intelligence*, 8(2), 26. <https://doi.org/10.3390/jintelligence8020026>
- Vanstone, D. M., & Hicks, R. E. (2019). Transitioning to university: Coping styles as mediators between adaptive-maladaptive perfectionism and test anxiety. *Personality and Individual Differences*, 141, 68–75. <https://doi.org/10.1016/j.paid.2018.12.026>
- 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>
- Wine, J. (1971). Test anxiety and direction of attention. *Psychological Bulletin*, 76(2), 92–104. <https://doi.org/10.1037/h0031332>
- Zeidner, M. (1998). *Test anxiety: The state of art*. Kluwer Academic Publishers.