Does dispositional mindfulness mediate the relationship between anxiety and exam performance?

¿El mindfulness *disposicional* media la relación entre ansiedad y rendimiento en un examen?

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Abstract

Anxiety affects students' performance in exams. Dispositional mindfulness (DM), the ability to be aware of one's own feelings and thoughts while not react to them, is associated with better cognitive performance under anxiety conditions. However, none study has addressed if DM mediates between anxiety and students' performance in test taking. The aim was to study DM as a mediator of the effect of anxiety over exam performance in a college sample.

240 students driven from the same course and subject participated. Data was gathered before exam started. Measures entailed a sociodemographic questionnaire; the State-Trait Anxiety Inventory (STAI); the Five-Facets Mindfulness Questionnaire (FFMQ); and final marks from the exam. Mediational analyses were performed for each STAI dimension, setting each FFMQ factor as mediator, and marks from the final exam as outcome.

Twenty-nine participants were excluded due to prior experience in meditation. Direct effect model showed that final exam score was significantly predicted by STAI-State (R^2=,145, p<,001, b=-,536, 95% CI [-,719, -353]). A significant indirect effect was detected (t=-3,937, p<,001) for STAI-State through FFMQ-Non-Reactivity (b=-,06, 95% CI [-,095, -,032]).

Data suggest that anxiety negatively affects performance in final exams, but this effect is ameliorated by DM.

Key Words

Dispositional Mindfulness, Exam Marking, Anxiety, Mediation Analysis

Resumen

La ansiedad afecta al rendimiento de los estudiantes en los exámenes. El Mindfulnes Disposicional (MD) está relacionado con un mejor rendimiento cognitivo bajo condiciones de ansiedad. Sin embargo, ningún estudio ha investigado si el MD media el efecto de la ansiedad sobre el rendimiento en exámenes en estudiantes de universidad. El objetivo del estudio fue estudiar este posible papel mediador del MD. 240 estudiantes del mismo curso y materia participaron. Las medidas fueron un

cuestionario sociodemográfico, el Inventario de Ansiedad Estado-Rasgo (STAI); el cuestionario Five-Facets Mindfulness Questionnaire (FFMQ), y la nota del examen final. Se realizaron análisis mediacionales para cada dimensión del STAI, con cada factor de la FFMQ como mediador, y la nota del examen como resultado.

Veintinueve estudiantes fueron excluidos de los análisis por tener experiencia previa con meditación. La nota final era predicha por STAI-Estado (R^2=,145, p<,001, b=-,536, 95% CI [-,719, -353]). Se encontró un efecto indirecto significativo (t=-3,937, p<,001) para la relación STAI-Estado a través de las puntuaciones de FFMQ-Non-Reactivity (b=-,06, 95% CI [-,095, -,032]).

Los datos sugieren que la ansiedad afecta negativamente a la ejecución en el examen final, pero que este efecto es reducido por el MD.

Palabras clave

Mindfulness *Disposicional*, Examen Final, Ansiedad, Análisis *Mediacional*

1. INTRODUCTION

Prior works have showed that exam performance in college students is affected by anxiety and 20% of college students communicate severe anxiety feelings during test taking (Rana & Mahmood, 2010). Although a state of low anxiety can enhance cognitive performance in students, higher levels have a detrimental effect over exam performance (Hooda & Saini, 2017). The examination environment is described as a stressful situation were cognitive processes related with exam performance are affected. For instance, anxiety has been related with poor working memory performance (Shi, Gao & Zhou, 2014), a cognitive process that is fundamental for content recall and deductive processes (Chipman, 2017). On the other hand, according to the cognitive model of Eysenck & Calvo (1992), people with high levels of anxiety during test taking situation experience worries and rumination thoughts which impaired their performance at the exam. It is important to point out that anxiety during test taking is not a disorder, but an adjusted response to a demanding situation. Therefore, personal traits and variables can increase or lessen the effect of anxiety. In this regard, Dispositional Mindfulness (DM) is a modern and promising construct that may help to explain differences between students in how anxiety affects performance.

DM is defined as the tendency to experience a present-centered awareness with a non-judgmental attitude to the events from the environment and the contents that arise to the mind (Baer, 2003). DM is related with a wide range of psychological health benefits in general and clinical population (Tomlinson, Yousaf, Vittersø & Jones, 2018), as well how DM affects people experience of the present moment at a sensory level (Takahashi, Kawashima, Nitta & Kumano, 2020) –which may increase or lessen the anxiety feelings –. The protective effects over general psychological health of DM goes beyond and also affects people's beliefs about anxiety and sadness (Sherwood, Carydias, Whelan & Emerson, 2020). In a more experimental and basic level, DM is associated with enhanced cognitive processing, which is a key point in students' exam performance and learning. The efficiency of attentional networks is positively related with DM as showed by Sørensen et al. (2018). DM is also associated with better executive functioning (Gallant, 2016), both cognitive flexibility – the ability to switch between mental sets – and the inhibition of irrelevant information for a particular task covariate with the DM construct. Recent research also has shown that DM is related

with critical thinking. As pointed by Noone and Hogan (2018), mindfulness trait is associated with better performance in tasks related with critical thinking. However, this relationship may be mediated by executive functioning processes which suggests a more complex process mediating the effect of DM over critical thinking (Noone, Bunting & Hogan, 2016).

Studies addressing DM and exam performance in college students are sparse compared with other samples. Also, research has focused in health domains rather than exam marking. In this regard, DM predicts the adjustment to college (Kingery, Bodenlos & Lathrop, 2020) and mediates the relationship between adaptation to university and maladjustment behaviors like aggression or stress (Yu, Zhang, Zhou, Shi & Xu, 2020). The notion of DM as a protective factor for adjustment to university is strengthened by its relationship with lower rates of psychopathological problems in medical students (van Dijk, Lucassen, van Weel & Speckens, 2017). In spite of these suggestive findings, only one study focused in the relationship between overall performance in qualification marking in college students (Chiang & Sumell, 2019). The study found a positive relationship between DM and overall performance in college education. However, to our best knowledge, none study has addressed the specific effect mediator role of DM in the close relationship between anxiety and exam marking. Thus, the aim of our study was to assess if DM may mediate the effect of anxiety over exam marking in a sample of college students from the first course of the grade of Psychology.

2. METHOD

2.1. Procedure

Two hundred and forty students from the first course of Psychology were invited to participate. Students were driven from an introductory subject about the principles and basic foundations of scientific Psychology. The teacher informed at the start of the subject and during the last class what participation would entail. Also, during the semester information was available in the online platform, and a member of the research staff answered questions about the study. There was no reward by participate in the study.

Data was gathered before starting final exam of the subject at the end of the semester. Students sat in separate tables and started filling the questionnaires before proceeding to answer the exam. Once all the students completed the questionnaires, the exam started.

2.2. Measures

The instruments were selected to comprise a maximum of 20 minutes before starting the exam. Instruments used were:

- A record form to collect age, sex and prior experience with meditation. Participants who had previous experience in meditation were invited to indicate for how many months they practiced.

- The Spanish adaptation of State-Trait Anxiety Inventory (STAI) (Buela-Casal, Guillén-Riquelme & Seisdedos, 2011) was used to assess anxiety. STAI taps two types of anxiety: state anxiety (STAI-S), or anxiety about an event in the current time; and trait anxiety (STAI-T), conceptualized as a personal tendency to experience anxiety. STAI comprises 40 questions on a self-report basis, scored on a 4-point Likert scale . Higher scores are positively correlated with higher levels of anxiety. Spanish adaptation has shown adequate psychometric properties (Guillén & Buela-Casal, 2015).

- Daily life mindfulness was assessed through the Spanish adaptation of the Five Facets of Mindfulness Questionnaire (FFMQ) (Cebolla et al., 2012). FFMQ consists of 39 items measuring mindfulness on 5-point Likert scales from 1 (Never or Very Rarely True) to 5 (Very Often or Always True). FFMQ assesses trait mindfulness across five dimensions: *non-reactivity* to inner experience, *observe* (or notice) sensations, perceptions, thoughts, and feelings in the present moment, acting with *awareness*, *describe* with words emotional or affective experiences in the present moment, and *non- judging* of internal experience in the present. The FFMQ demonstrates acceptable internal consistency and acceptable convergent and discriminant validity as well (Cebolla et al., 2012).

- To assess exam performance, a questionnaire was designed were participants have to answer five open questions about the contents of the subject. The research team designed the rubric system to assess how students understood the subject rather than rely in memory-related processes. Exam mark ranged from 0 to 10.

2.3. Data analysis

Descriptive statistics were generated for the demographic features of the sample. Due the effect of meditation practice over daily-life mindfulness, participants with previous experience in meditation techniques were deleted from the final database. Parametric assumptions were assessed prior any manipulation check. As the aim of the study of research how the relationship between anxiety and exam performance may be explained by DM, two mediation analyses were performed one for each anxiety index. Thus STAI-T and STAI-S were set as predictors, while exam marks were selected as outcomes, and the five dimensions of FFMQ were introduced separately as mediators. Mediation analysis bootstrapped at 5000 iterations the confidence intervals. IBM SPSS v23 and the macro PROCESS (Hayes & Rockwood, 2020) were used for the data analysis. Statistical significance was set at 5%.

3. RESULTS

From the initial pool of 240 participants, 29 were excluded due prior experience with meditation techniques. Mean age of the sample was 18,63 years ($SD = 1,23$), while women were the most frequent sex (73,9%). Mean sample score in exam mark was 6,20 ($SD = 2,27$). Detailed data about STAI-T, STAI-S, and FFMQ is shown in Table 1.

	Mean	Standard deviation
STAI – State	43,55	4,49
STAI - Trait	46,71	5,66
FFMQ – Non-judging	23,96	6,31
FFMQ – Observation	23,61	5,98
FFMQ – Awareness	24,01	5,83
FFMQ – Describe	24,45	3,02
FFMQ – Non-reactivity	19,81	4,02

Table 1. Descriptive statistics of the predictors and mediators

Regression model showed that the optimum model for STAI scores as predictors and exam marking as outcome were significant (R^2 = ,33, F = 3,34, p = ,038) for STAI-State (b = -,153, t = -2,18, p = ,031). Mediational regression models using STAI-State as predictor and Exam mark as outcome were significant in FFMQ- Non reactivity (R^2 = ,04, p = ,038, b = -,08, p = ,022), and FFMQ – Non judging (R^2 = ,14, p < ,001, b = -,17, p = ,031). Regression models setting STAI-Trait as predictor revealed that significant predict Exam mark in the model including FFMQ – Non judging (R^2 = ,14, p < ,00, b = -,01, p = ,836). Sobel test for STAI-Trait scores showed a marginal signification for FFMQ–Non judging (t = 1,67, p = ,095) but not for the rest of the subscales. Contrary, the STAI-State scores were mediated by FFMQ–Non judging scores (t = -3,11, p = ,001) associated to a medium effect size (b=-,06, 95% CI [-,095, -,032]). Table 2 shows detailed data about Sobel test, while Figure 1 displays the significant mediation model in STAI-State.

	STAI - State	STAI - Trait
FFMQ – Non-judging	t = -3,11, p = ,001	t = 1,67, p = ,095
FFMQ – Observation	t = -0,32, p = ,746	t = -,63, p = ,524
FFMQ – Awareness	t =, 44, p = ,627	t = ,66, p = ,509
FFMQ – Describe	t = ,13, p = ,893	t = -,19, p = ,844
FFMQ – Non-reactivity	t = ,89, p = ,37	t = -,98, p = ,324

Table 2. Sobel test results for each of the predictors and mediators
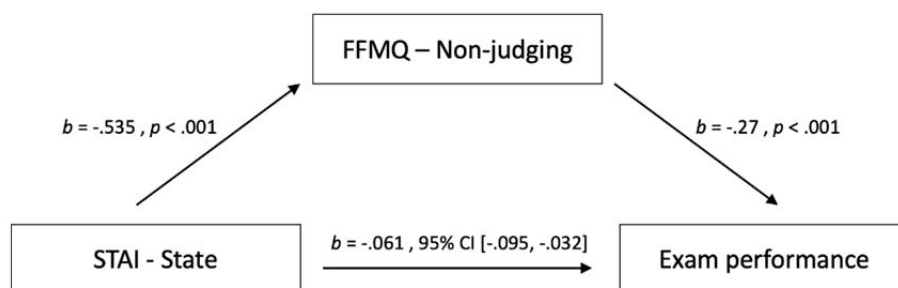

Figure 1. Mediation model including STAI – State as predictor, Exam mark as outcome, and the mediator FFMQ – Non-judging

4. DISCUSSION

The main finding of the study is that a state of anxiety reduces the execution in test taking, but that this negative effect is mediated by DM. According to our data STAI-State scores predict the 15% of the final scoring, but this relationship is lessened in a 6% by high scores in the DM dimension of non-judge the experience. Also, the tendency to experience states of high anxiety is not related with poor exam execution.

Prior research showed that mindfulness practice is related with less anxiety in test taking (Cho et al., 2016), which is congruent with our results as DM increases as a consequence of mindfulness training. Findings presented in the current study are in line with prior works attesting the benefits of mindfulness in cognitive performance. According to Jaiswal, Liang & Muggleton, (2018) people with low anxiety and high DM are more efficient in their attentional network when reorienting attention. Also, people with high DM and low anxiety are more prone to resist the effect of distractors in the presence of a competing stimuli. Therefore, the suggestive findings of prior work and the data presented in our study, point to an important role of DM in cognitive performance under anxiety conditions.

However, in spite of the evidence reported, it remains unclear how DM could help to enhance cognitive performance in test taking and other similar situations. Emotion regulation is proposed as the underlying mechanism through DM exerts its beneficial effects (Huang et al., 2019). Research suggests that emotion regulation moderates the effect of DM in college students when reducing negative thoughts and increasing well-being (MacDonald & Baxter, 2017). Thus, the mediator effect of DM over anxiety in test taking might be partially accounted for emotion regulation and resistance to automatic negative thoughts, however, test this hypothesis is beyond the experimental design used in our study.

The present study has strengths and limitations that deserve mention. Limitations are the use of students from the same university and not recruit the sample in a multicentrically design. Additionally, the study only taps the variables in one moment which prevents to analyze the data in a longitudinal manner. Also, there is an imbalance of gender distribution which affects the generalization of the results to both genders. On the other hand, the study has been conducted in a robust manner using well-stablished questionnaires. The experimental conditions were the same for all the participants, prior meditation experience has been taken into account, and provides the first data of the mediator effect of DM in the negative effect of anxiety over test taking.

In sum, our study highlights the relevance of student's relationship with their own thoughts. Future research should replicate the findings presented, and study if a mindfulness intervention could be beneficial for deal with anxiety associated to the test taking situation.

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