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Anxiety, depression, stress, executive functions, and academic performance: a post-COVID-19 study

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Abstract

Objective: *Low academic performance (LAP) is a concerning phenomenon in Mexico. Neuropsychology has emerged as a discipline to address this issue through executive functions. This study analyzed how anxiety, depression, academic stress, and executive dysfunctions (EDs) influence the academic performance (AP) of adolescents.* **Methods:** *A quantitative, non-experimental approach with correlational and explanatory scope was employed. 147 high school students from the state of Puebla (Mexico) participated.* **Results:** *Depression and coping with academic stress explained AP (R^2 = 0.089, F = 7.013, p ≤ 0.001). Furthermore, better performance in tasks assessing inhibitory control (R^2 = 0.190, F = 16.938, p ≤ 0.001), verbal working memory (R^2 = 0.176, F = 10.185, p ≤ 0.001), phonological and semantic verbal fluency (R^2 = 0.207, F = 12.415, p ≤ 0.001), abstract attitude, and comprehension of figurative meaning (R^2 = 0.179, F = 10.403, p ≤ 0.001) also explained AP.* **Conclusions:** *The importance of considering depression, academic stress, and ED to understand and address LAP is highlighted, which will guide effective educational interventions.*

Keywords: *Anxiety. Depression. Academic stress. Executive functions. Academic performance.*

Ansiedad, depresión, estrés, funciones ejecutivas y rendimiento académico: un estudio post COVID-19

Resumen

Objetivo: *El bajo rendimiento académico (BRA) es un fenómeno preocupante en México. La neuropsicología ha surgido como una disciplina para abordar este problema a través de las funciones ejecutivas (FE). Este estudio analizó cómo la ansiedad, la depresión, el estrés académico y las disfunciones ejecutivas influyen en el rendimiento académico (RA) de los adolescentes.* **Métodos:** *Se empleó un enfoque cuantitativo, no experimental, con un alcance correlacional y explicativo. Participaron 147 estudiantes de secundaria del estado de Puebla (México).* **Resultados:** *La depresión y el afrontamiento al estrés académico explicaron el RA (R^2 = 0.089, F = 7.013, p ≤ 0.001). Además, un mejor desempeño en tareas que evalúan el control inhibitorio (R^2 = 0.190, F = 16.938, p ≤ 0.001), la memoria de trabajo verbal (R^2 = 0.176, F = 10.185, p ≤ 0.001), la fluidez verbal fonológica y semántica (R^2 = 0.207, F = 12.415, p ≤ 0.001), la actitud abstracta y la comprensión del sentido figurado (R^2 = 0.179, F = 10.403, p ≤ 0.001) también explicaron el RA.* **Conclusiones:** *Se destaca la importancia de considerar la depresión, el estrés académico y las disfunciones ejecutivas para comprender y abordar el BRA, lo que guiará intervenciones educativas efectivas.*

Palabras clave: *Ansiedad. Depresión. Estrés académico. Funciones ejecutivas. Rendimiento académico.*

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Introduction

Academic performance (AP) is often reflected in numerical terms or grades, representing students' level of learning, effort, and success in an educational. When students fail to meet the objectives and competencies set by teachers, they are identified as cases of low AP (LAP)[1]. In Mexico, LAP is a significant concern, evidenced by the PISA 2022 results showing a marked decline in Mathematics and Science performance compared to 2018. Mexico ranked third worst in Mathematics and reading comprehension and had the lowest score in Science[2].

This decline is largely attributed to the COVID-19 pandemic lockdowns, as online classes significantly impacted learning. Parents and caregivers reported a deterioration in AP, with teachers noting greater difficulties in subjects such as Reading and Mathematics[3]. LAP's adverse consequences include school dropout, which exposes adolescents to risks like joining criminal gangs or adopting antisocial behaviors, and developing issues such as alcoholism or drug addiction. In addition, psychological consequences have been identified in adolescents with LAP, including suicidal behavior, depression, and low self-esteem due to frustration at not achieving academic success.

During the COVID-19 pandemic, there was a significant increase in these symptoms. In regions like North America, psychological impacts such as anxiety, stress, and depression were reported[4], negatively affecting students' concentration and mood, especially during the transition from distance to in-person education, resulting in a sense of disconnection impacting AP[5]. In addition, executive functions (EF), including inhibitory control, working memory, and cognitive flexibility, essential for managing academic tasks, were also negatively affected.

This study aims to evaluate anxiety, depression, academic stress, and executive dysfunction in secondary school students and their relationship with AP post-pandemic.

Materials and methods

A quantitative, non-experimental, cross-sectional study with correlational and explanatory scope was conducted.

A total of 162 adolescents from a secondary school in the state of Puebla (Mexico) participated, of which 147 (51.7% male and 48.2% female) met the inclusion criteria: (1) adolescents without learning difficulties, (2) without physical or sensory limitations, (3) active and enrolled in the educational institution where the research was conducted, (4) voluntary participation with parental or guardian consent. Table 1 describes the sample characteristics.

Although the sample is not representative of the entire state of Puebla, it is representative of the secondary school where the study took place, which had a total of 232 students at the time of the evaluation. The representativeness of the sample was determined by calculating a margin of error of 5% and a confidence level of 95%, resulting in a required sample size of approximately 146 students. However, the sample was selected through convenience sampling, meaning that participation was voluntary and limited to those who were willing to participate.

To assess anxiety, the Spanish version of the "Generalized Anxiety Disorder 7-item scale" was used. This screening tool evaluates the frequency of generalized anxiety symptoms through seven Likert-type questions ranging from 0 (never) to 3 (almost every day). A score ≥ 10 could indicate the presence of moderate-to-severe generalized anxiety disorder. The instrument's reliability in Mexican population was 0.93[6]. For this study, Cronbach's α reliability was 0.80.

To assess depression, "The Patient Health Questionnaire (PHQ-9)" was used. This screening tool evaluates the frequency of depressive symptoms through nine items with responses ranging from 0 (None) to 3 (Almost every day). A score ≥ 10 could indicate the presence of moderate-to-severe depressive disorder. The reliability in Mexican population was 0.81[7]. For this study, it was 0.80.

To assess academic stress, the Systemic Cognitive Inventory (SV-21) was used[8]. It consists of 23 items, a dichotomous first filter with yes and no options to determine if the participant is a candidate for evaluation, and a second item that evaluates the intensity of academic stress with responses from 1 = little to 5 = a lot. The remaining 21 items are grouped into three dimensions with seven items each: (1) stressors, (2) symptoms or reactions to stressors, and (3) coping strategies. Each factor includes response anchors from 0 = never to 5 = always. A mean of 0 to 2.38 indicates a low level of academic stress, 2.39-3.0 a moderate level, and 3.1-5.0 a severe level. The reliability was 0.83 for the stressor's subscale, 0.87 for symptoms, and 0.85 for coping strategies. In this study, it was 0.78 for stressors, 0.86 for symptoms, and 0.85 for coping strategies.

The overall average for the school year (2022-2023) was considered. AP was classified into low, medium, and high categories based on the following criteria:

Table 1. Sample characteristics (n = 147)

Variable	F (%)
Sex	
Male	76 (51.7)
Female	71 (48.2)
Age	
12	51 (34.6)
13	51 (34.6)
14	35 (23.8)
15	10 (6.8)
School grade	
1st year	70 (47.6)
2st year	77 (52.4)
Schooling	
7 years	64 (43.5)
8 years	77 (52.3)
9 years	6 (4.0)
Handedness	
Right-handed	135 (91.8)
Left-handed	11 (7.5)
Ambidextrous	1 (0.7)
Academic performance	
Low	93 (63.2)
Medium	48 (32.6)
High	6 (4.0)

a score below 7 indicates LAP, 8 indicates medium AP, and between 9 and 10 indicates high AP.

The Neuropsychological Battery of EFs and Frontal Lobes-3 was applied[9]. This instrument, validated for the Mexican population, consists of 15 tests for ages 6-90. The battery evaluates functions corresponding to the orbitofrontal, medial, dorsolateral, and anterior prefrontal cortex. It includes tasks to assess: inhibitory control, rule-following, risk-benefit processing, visual self-directed working memory, verbal-serial working memory, sequential visuospatial working memory, verbal fluency, productivity, mental flexibility, visuospatial planning, sequential planning, reverse sequencing, coding control, metamemory, comprehension of figurative meaning, and abstract attitude. The normalized scores classify performance as high normal (> 116), normal (85-115), mild-moderate impairment (70-84), and severe impairment (< 69).

The battery has shown adequate psychometric properties, with inter-rater reliability reported at 0.80, ensuring consistent scoring between examiners.

A meeting was held with the school principal to obtain permission for the study, explaining the objectives and purpose of the research. Upon consent, a meeting with parents or guardians was conducted to request permission, and those who provided consent signed the informed consent. Their children were then contacted to request informed assent, explicitly detailing confidentiality, anonymity, and voluntary participation guarantees[10].

Before its implementation, the project was reviewed in its methodological and ethical aspects by a committee of researchers designated by the Subdirectorate of Graduate Studies at the Faculty of Psychology of the *Universidad Autónoma de Nuevo León*.

The neuropsychological battery and questionnaires were administered 5 months after resuming in-person classes post-COVID-19 lockdown, from December 2022 to April 2023. The evaluation was conducted individually in a designated, interference-free space provided by the educational institution. The evaluation time was 60-90 min.

The Jeffrey's Amazing Statistics Program was used. First, descriptive statistics such as mean and standard deviation (SD) were obtained for each variable. Then, Spearman's rho non-parametric correlations were conducted, interpreting correlation strength using the following criteria: 0.1-0.3 = weak, 0.4-0.6 = moderate, 0.7-0.9 = strong.

A stepwise multiple regression analysis was also conducted to select a subset of AP predictor variables. This analysis was performed in separate models, considering psychological variables and cognitive function variables related to orbitofrontal, anterior prefrontal, and dorsolateral regions. This strategy aimed to reduce model overfitting risk and simplify result interpretation. For supplementary analyses comparing anxiety symptoms among students with low, medium, and high AP, the Kruskal–Wallis H test was used.

Results

More than half of the participants were male, with an average age of 13.02 (SD = 0.929) and schooling of 7.60 (SD = 0.568). The average AP was 7.68 (SD = 0.743), and over 60% had low AP (Table 1).

The average levels of anxiety, depression, and academic stress symptoms in the sample were mild. Weak and negative correlations were found between AP and both depression and academic stress symptoms. In addition, both positive and negative correlations were observed in the Stroop A and B indicators. Negative correlations were also found with verbal working memory tasks, with the most notable being with alphabetical ordering (trial number 2). Finally, phonological verbal fluency was one of the main variables associated with AP (Table 2).

Table 2. Descriptive statistics and correlations with academic performance

Psychological and neuropsychological variables	$\bar{X}$	SD	Rho
Psychological variables			
Anxiety	8.06	4.950	–0.058
Depression	7.75	5.512	–0.235**
Stressors	1.70	0.738	–0.110
Academic stress symptoms	1.47	0.846	–0.176*
Academic stress coping	1.83	0.832	0.070
Orbitofrontal region			
Mazes (crossing)	0.476	0.960	0.005
Cards (risk percentage)	35.9	8.732	0.017
Card game (total score)	17.5	12.29	0.058
Stroop A (stroop errors)	3.14	4.589	–0.339***
Stroop A (time)	116.9	37.70	–0.401***
Stroop A (correct)	79.0	6.323	0.357***
Stroop B (Stroop errors)	2.95	5.229	–0.353***
Stroop B (time)	95.8	32.52	–0.463***
Stroop B (correct)	80.9	5.255	0.334***
Classification (errors)	0.918	0.955	0.119
Total (natural)	186.5	13.42	0.436***
Anterior prefrontal region			
Semantic classification (abstracts)	1.53	1.406	0.164*
Proverbs (time)	128.6	50.95	–0.283***
Proverbs (correct)	3.27	0.965	0.275***
Metamemory (negative errors)	3.18	2.867	0.085
Metamemory (positive errors)	3.14	2.674	–0.068
Total (natural)	14.14	2.700	0.265**
Dorsolateral region - working memory			
Self-directed pointing (perseverations)	2.96	3.001	–0.070
Self-directed pointing (time)	74.7	48.74	–0.157
Self-directed pointing (correct)	18.1	3.844	0.122
Subtracting 40-3 (time)	68.5	44.32	–0.202*
Subtracting 40-3 (correct)	9.57	3.103	0.157
Subtracting 100-7 (time)	156.9	82.10	–0.216**
Subtracting 100-7 (correct)	7.42	4.409	0.209*
Adding (time)	67.8	40.61	–0.158
Adding (correct)	17.65	4.001	0.196*
Alphabetical order (Trial 1)	3.21	1.602	–0.252**
Alphabetical order (Trial 2)	5.59	0.881	–0.323***
Alphabetical order (Trial 3)	5.69	0.816	–0.281***
Visuospatial memory (max level)	2.51	0.982	–0.022
Visuospatial memory (perseverations)	0.279	0.649	0.144
Visuospatial memory (order errors)	3.00	2.348	–0.046
Dorsolateral region - executive function			
Mazes (planning - dead end)	0.646	0.985	–0.114
Mazes (time)	36.3	14.03	–0.178*
Card sorting (correct)	36.7	10.45	0.203*
Card sorting (perseverations)	7.85	5.451	–0.172*
Card sorting (delayed perseverations)	7.72	4.456	–0.136
Card sorting (time)	350.8	104.3	–0.099
Semantic classification (categories)	3.32	1.277	0.218**
Semantic classification (animal average)	6.57	2.078	0.075
Semantic classification (total score)	7.88	3.618	0.207*
Verbal fluency (correct)	9.84	3.878	0.360***
Verbal fluency (perseverations)	0.701	0.925	0.014
Tower of Hanoi (3 discs - moves)	10.74	5.657	0.127
Tower of Hanoi (3 discs - time)	128.6	50.95	0.106
Tower of Hanoi (4 discs - moves)	26.63	13.07	0.139
Tower of Hanoi (4 discs - time)	106.5	65.26	0.047
Total (natural)	166.7	23.17	0.321***

*p < 0.05; **p < 0.01; ***p < 0.001. $\bar{X}$: mean; SD: standard deviation; Rho: correlation coefficient.

Table 3. Multiple regression between anxiety, depression, academic stress, and academic performance

Predictor variables	β	t	p	Collinearity	
				Tolerance	VIF
Model with anxiety variable					
(Intercept)		49.596	< 0.001		
Depression	–0.481	–3.917	< 0.001	0.411	2.434
Coping strategies	0.207	2.430	0.016	0.855	1.170
Anxiety	0.250	2.066	0.041	0.423	2.365
Model without anxiety variable					
(Intercept)		51.521	< 0.001		
Depression	–0.361	–3.469	< 0.001	0.862	1.160
Coping strategies	0.199	2.600	0.010	0.862	1.160

β: regression coefficient; t: student's t; p: statistical significance; VIF: variance inflation factor.

A relationship was found between psychological variables and AP (R^2 = 0.115, F = 6.204, p ≤ 0.001); specifically, depression (β = –0.481), coping with academic stress (β = 0.207), and anxiety (β = 0.250). To obtain a more precise model of the psychological variables explaining AP, anxiety was excluded from the analysis as it did not show a significant correlation with AP (Table 2). The result of the final model indicated a statistical relationship (R^2 = 0.089, F = 7.013, p ≤ 0.001); with the variables of depression (β = –0.361) and coping with academic stress (β = 0.199) (Table 3).

In addition, to analyze the role of anxiety in AP, the Kruskal–Wallis test revealed no significant differences (χ^2 = 1.032; p = 0.597) (Fig. 1), between the low AP group (8.32 ± 4.762), medium AP group (7.75 ± 5.261), and high AP group (6.66 ± 5.785), although a trend in the mean can be observed, where the low AP group exhibits the highest levels of anxiety.

Tasks related to the orbitofrontal region showed an association with inhibitory control tasks (R^2 = 0.190, F = 16.938, p ≤ 0.001), specifically in time (β = –0.352) and the number of errors in Stroop B (β = –0.173). Tasks related to the anterior prefrontal region also showed a statistical relationship, especially those related to abstract attitude and understanding figurative meaning (R^2 = 0.179, F = 10.403, p ≤ 0.001); such as time (β = –0.255) and the number of correct responses in the proverbs test (β = 0.201). In addition, the number of abstract categories generated by participants during the semantic classification task (e.g., categories like 'marine animals' or 'carnivores') showed a positive association (β = 0.161).

An association was also identified in working memory tasks (R^2 = 0.176, F = 10.185, p ≤ 0.001), specifically in verbal working memory tasks, such as the number of trials in list three (β = –0.231) and two (β = –0.190), as well as

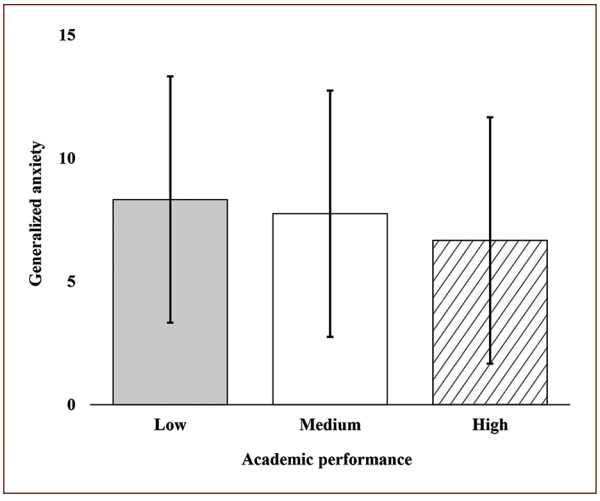

Figure 1. Comparison of generalized anxiety among groups.

the time in the consecutive subtraction 100-7 (β = –0.183). Finally, in EF tasks, a relationship with AP was found (R^2 = 0.207, F = 12.415, p ≤ 0.001), especially with tasks of phonological verbal fluency, in the number of correct responses (β = 0.373) and semantic fluency, in the total number of categories (β = 0.183); and finally, the time to solve the three-disc Tower of Hanoi (β = 0.166) (Table 4).

A statistical association was also found in the natural scores of each region (R^2 = 0.202, F = 18.173, p ≤ 0.001), especially the total score of the orbitofrontal region (β = 0.018) and the anterior prefrontal region (β = 0.062) (Table 5).

Discussion

The aim of the study was to evaluate the psychological variables of anxiety, depression, and academic

Table 4. Multiple regression between the functions of each region evaluated by BANFE-3 and academic performance

Neuropsychological tests by region	β	t	p	Collinearity	
				Tolerance	VIF
Orbitofrontal					
(Intercept)		48.925	< 0.001		
Stroop B (time)	−0.352	−4.484	< 0.001	0.910	1.098
Stroop B (stroop errors)	−0.173	−2.198	0.030	0.910	1.098
Prefrontal anterior					
(Intercept)		27.067	< 0.001		
Proverbs (time)	−0.255	−3.271	0.001	0.943	1.061
Proverbs (correct)	0.201	2.523	0.013	0.903	1.107
Abstract categories	0.161	2.058	0.041	0.943	1.060
Dorsolateral. Working memory					
(Intercept)		21.822	< 0.001		
List 3 (trials)	−0.231	−2.830	0.005	0.861	1.161
Subtracting 100-7 (time)	−0.183	−2.377	0.019	0.970	1.031
List 2 (trials)	−0.190	−2.300	0.023	0.845	1.184
Dorsolateral. Executive function					
(Intercept)		30.917	< 0.001		
Verbal fluency (correct)	0.373	4.879	< 0.001	0.948	1.055
Semantic (categories)	0.183	2.403	0.018	0.955	1.047
Tower of Hanoi (3 discs-time)	0.166	2.201	0.029	0.979	1.021

β: regression coefficient; t: student's t; p: statistical significance; VIF: variance inflation factor; BANFE-3: battery of EF and frontal lobes.

Table 5. Multiple regression between the total scores of each region and academic performance

Total scores by prefrontal cortex region	β	t	p	Collinearity	
				Tolerance	VIF
(Intercept)	3.382	4.362	< 0.001		
Orbitofrontal	0.018	4.290	< 0.001	0.925	1.081
Prefrontal anterior	0.062	2.898	0.004	0.925	1.081

β: regression coefficient; t: student's t; p: statistical significance; VIF: variance inflation factor.

stress and the executive dysfunction that explains AP after the pandemic. In the first model of psychological variables, anxiety was identified to have a positive effect on AP, contradicting the direction of the direct correlation found, which was not significant. Considering this and the absence of significant differences in the comparison between AP groups, the variable was excluded and a second model was presented where the results showed that lower frequency of depressive symptoms and higher frequency of coping strategies for academic stress explained AP.

The negative relationship between depression and AP contrasts with previous studies that found no significant relationship[11]. However, these data align with other research[12,13], which can be explained by the effects that depression can have on adolescents, such as lack of concentration, constant fatigue, sleep disorders, and loss of appetite, which affect school performance[14]. It is important to highlight that the evaluation was carried out 5 months after the return to face-to-face classes due to the COVID-19 confinement. Meta-analytic reviews have shown that mental health problems, including depressive symptoms, persisted in children and adolescents after the pandemic[15].

The positive relationship between coping strategies for academic stress and AP has been supported by other research. Even during the COVID-19 pandemic, it was found that having adequate coping strategies could help adolescents reduce their stress levels, make clear and rational decisions, increase resilience, and

emotional well-being, which would benefit AP[16,17]. On the other hand, regarding EFs and AP, it was found that better performance in inhibitory control indicators is related to better AP. This is because inhibitory control is responsible for regulating automatic and impulsive responses, both at the level of attention and behavior. Students with difficulties in inhibitory control tend to be easily distracted by external stimuli and exhibit excessive motor restlessness[18,19]. This cognitive function gained special relevance after the COVID-19 pandemic, as negative effects of prolonged time in front of electronic devices on students were reported[20]. It was also found that better performance in tasks evaluating verbal working memory, such as the number of trials in the second and third-word list, can predict AP. These findings are in line with other research highlighting the importance of verbal working memory, especially in subjects such as Reading and Mathematics[21-23]. It has been explained that verbal working memory has important implications in language comprehension and production, as well as in long-term retention of information. Therefore, better performance could provide significant advantages in the ability to understand and remember concepts presented in class, as well as to express ideas clearly and coherently[24].

The model revealed that performance in phonological and semantic verbal fluency is related to better AP. These results are consistent with research in university students and adolescents that identified lower performance in these two functions in students with LAP[25-27]. In the case of semantic verbal fluency, neuroimaging studies have shown greater activation in the left temporal cortex, which is mainly associated with language processing and semantic memory, including the comprehension and production of word meanings and the knowledge of concepts[28]. This function facilitates effective communication, critical thinking, and the assimilation of new knowledge, fundamental aspects for achieving better AP[29].

On the other hand, phonological verbal fluency involves linguistic mechanisms associated with fronto-temporal regions, essential for communication[30]. The application of this test involves evoking as many verbs in the infinitive as possible in 1 min, which also requires other skills such as strategy searching, sustained attention, anticipation ability before a task, goal setting and achievement, time planning and organization, essential aspects for academic success[1,31,32]. Even the assessments of semantic and phonological verbal fluency have been proposed as effective tools to detect academic difficulties in students[25].

Within the model, it was also observed that longer time in solving the three-disc Tower of Hanoi was associated with better AP. This test evaluates planning and problem-solving ability. Although no similar studies were found that could explain these results, they could be attributed to the fact that students require more time because they use a more methodical and reflective approach to solve it. However, caution is suggested when interpreting these results, as the main indicator of the Tower of Hanoi (number of moves) did not show a significant relationship. In addition, during its application, it was observed that not all students solved it with the correct number of moves and without making errors (moving two discs at a time and without placing a smaller disc under a larger one). It has been reported that the temporal parameters of this test do not show stability when measured and related to other variables due to various factors, both individual and related to the nature of the test[33]. This suggests that the resolution time alone may not be a completely reliable indicator of cognitive performance.

On the other hand, it was found that better performance in the proverb test, which evaluates the ability to understand figurative meaning, explains AR. These results differ from those obtained in university students, where no significant associations were found[34]. However, they may align with other findings, which showed that students with learning difficulties perform worse in tests of figurative understanding compared to students without learning difficulties[35]. This is explained by the fact that the academic context often involves the use of figurative language, which requires students to go beyond the literal meaning of words. This approach fosters critical thinking and the ability to analyze problems from different perspectives, essential skills in various academic disciplines. It was also found that a higher number of abstract categories explains AP, results that resonate with other studies conducted on university students[36]. This can be explained by the fact that the ability to think abstractly allows for identifying patterns, formulating hypotheses, and solving problems effectively. Furthermore, an abstract attitude facilitates the development of original and creative ideas, which is essential for solving problems in the educational field[37].

Finally, it was revealed that the raw scores of the orbitofrontal and anterior prefrontal regions are the best predictors of AP. This aligns with research suggesting that the orbitofrontal region plays an important role in behavior control, decision-making, and emotional

processing[38]. Deficits in this area can influence behavioral problems that affect learning[39]. It has been suggested that stimulating cognitive processes in this region allows for academic success[40]. On the other hand, the anterior prefrontal region houses "metafunctions," which are higher-order cognitive processes, such as metamemory, understanding figurative meaning, and abstract attitude which are essential for tackling academic problems creatively and unconventionally[9].

The study presents some limitations. First, the sample was not representative of the entire state of Puebla, making it difficult to generalize the results; however, the sample size is adequate for the conclusions reached, and the study has adequate internal validity. The GAD-7 and PHQ-9 instruments are screening tools for initial assessment and cannot replace a complete clinical diagnosis. In addition, being self-report questionnaires, there is the possibility of social desirability bias. In the statistical analysis of EFs, only quantitative measures were used, which might not fully capture the complexity of cognitive processes.

Conclusion

The study evaluated anxiety, depression, academic stress, executive dysfunctions, and their relationship with AP post-pandemic. It was found that a lower frequency of depression symptoms and better management of academic stress were associated with higher AP. In addition, better performance in inhibitory control, verbal working memory, verbal fluency, understanding figurative meaning, and abstract attitude were related to better AP. These findings highlight the importance of addressing both psychological and cognitive aspects to understand AP post-pandemic.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of humans and animals. The authors declare that the procedures followed complied with the ethical standards of the responsible human experimentation committee and adhered to the World Medical Association and the Declaration of Helsinki. The procedures were approved by the institutional Ethics Committee.

Confidentiality, informed consent, and ethical approval. The authors have followed their institution's confidentiality protocols, obtained informed consent from patients, and received approval from the Ethics Committee. The SAGER guidelines were followed according to the nature of the study.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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