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The Effects of Stress and Anxiety on the Academic Performance of Students: A Cross-Sectional Experimental Study

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Abstract

Research in education often explores factors impacting students' academic performance While numerous studies have sought to explore the influence of anxiety on working memory, a noteworthy gap exists in the investigation of this relationship within the context of Algerian EFL undergraduates. This study aims to redress this imbalance by probing the impact of anxiety on working memory and assessing the degree to which anxiety can debilitate this cognitive function. Adopting a cross-sectional experimental research design, the study utilises Spielberger's Trait-State Anxiety Inventory (STAI) for measuring anxiety levels, visual observation methods to gauge stress, and the forward and backward subtest of the Wechsler Working Memory Scale (WWMS) for measuring working memory capacity. The participant cohort comprised 45 first-year EFL undergraduates from the English department. Participants' anxiety levels were first quantified using STAI, after which they were tasked with a challenging dual-task activity involving concurrent reading comprehension and information retention. The WWMS was administered in the form of a text discussing the societal impacts of social media, with stress visually monitored throughout the process. The findings highlight the detrimental effect of anxiety on working memory, as exemplified by the superior performance of non-anxious participants compared to their anxious counterparts.

Keywords: Stress, Anxiety, Working Memory Capacity, Algerian EFL Undergraduates, Spielberger's Trait-State Anxiety Inventory (STAI), Wechsler Working Memory Scale (WWMS)

1. Introduction

In recent decades, researchers have focused their efforts on understanding the myriad factors that influence learners' academic performance. Among these, psychological aspects, such as stress and anxiety, have received significant attention. A range of theories have been proposed to unpack the relationship between these psychological factors and academic performance, placing cognition as a critical intermediary (Stornes & Bru, 2011; Ashcraft, n.d.; Aronen et al., 2005; Owens et al., 2008; Khan et al., 2022).

Of particular interest is the connection between these psychological factors and the functioning of working memory (WM), a cognitive construct that plays a vital role in students' learning efficacy and test performance. Working memory, as a core cognitive resource, facilitates the processing and management of information necessary for complex cognitive tasks. These tasks encompass problem-solving, language comprehension, and long-term learning, amongst others (Atkinson & Shiffrin, 1968).

The function of WM extends beyond simple information storage; it provides an interactive cognitive space for the manipulation of stored information. As such, an understanding of the potential impacts of stress and anxiety on WM is crucial, given its foundational role in various aspects of academic performance. There is a considerable number of works in the literature on the impact of stress and anxiety on working memory capacity (WMC) (Luethi et al., 2008; Lukasik et al., 2019; Moran, 2016). However, there is a noticeable gap on how stress and anxiety can impact the working

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memory in the context of EFL in Algeria. For that, this study aims to shed light on the nuanced relationship between stress and anxiety and WM performance of first year EFL undergraduates.

2.   Research Questions:

Q1:   How does anxiety, as measured by Spielberger's Trait-State Anxiety Inventory (STAI), influence the working memory capacity of first-year EFL undergraduates in Algeria?

Q2:   To what extent does anxiety impact the performance of EFL undergraduates in high-demand tasks that require concurrent reading comprehension and information retention?

Q3:   How do the performance outcomes on the Wechsler Working Memory Scale (WWMS) differ between anxious and non-anxious first-year EFL undergraduates in Algeria?

3.   Research Hypotheses:

1.   Higher levels of anxiety, as measured by Spielberger's Trait-State Anxiety Inventory (STAI), are associated with lower scores on the Wechsler Working Memory Scale (WWMS), suggesting impaired working memory capacity.

2.   Anxiety can have a detrimental impact on dual-task performance, where tasks require concurrent reading comprehension and information retention, suggesting a potential memory impairment.

3.   Anxious first-year EFL undergraduates in Algeria exhibit lower working memory performance when compared to their non-anxious counterparts, suggesting that anxiety may contribute to memory impairment in this population.

4.   Literature Review:

Understanding the multifaceted influences on academic performance is a central concern for educators and researchers alike. While the pedagogical process has been the subject of extensive scrutiny, there is a growing recognition of the role of psychological factors in determining academic outcomes. In particular, the relationship between psychological stress, anxiety, and cognitive function – particularly Working Memory (WM) – is an area of considerable interest. This literature review seeks to unpack this relationship, providing a comprehensive exploration of the prevailing theories and empirical research. Initially, it contextualises the complexity of cognitive processes, followed by a detailed examination of stress and anxiety. It then delves into the significance of WM in academic performance and the pervasive impact of stress and anxiety on this critical cognitive function. The review will underscore the urgency of understanding these interactions to devise effective interventions to enhance students' academic performance (Khan et al., 2022).

4.1.   The Intricacy of Cognitive Processes: Contextualizing Working Memory and Psychological Factors:

Cognitive processes present a complex challenge to scholars and researchers, particularly in terms of their interplay with various psychological factors. A key cognitive process, Working Memory (WM), is found to be susceptible to a multitude of factors, with psychological traits such as personality disorders having a significant impact (Katsumi et al., 2017). Furthermore, cognitive processes are also influenced by motivational elements, as it is posited that decreased levels of interest and motivation may impair WM (Szatkowska et al., 2008). Interestingly, elements like self-efficacy and personality characteristics are also seen as potential influences on WM (Katsumi et al., 2017; Vasile et al., 2011). Moreover, mood disorders, stress, anxiety, and depression exhibit a high correlation with WM performance. However, due to the scope of the current study, the focus will be on Stress and Anxiety Disorder (SAD). This literature review provides a comprehensive examination of SAD, followed by the theoretical framework of WM.

4.2.   Understanding Stress:

Stress is a multifaceted concept defined by multiple scholars. De Kloet et al. (2005) define stress as a challenge to an individual's internal or external balance, as cited in Wolf (2015). Stress is generally considered a complex, subjective experience. It is understood by Cotton (2014) as a stimulus-response phenomenon, highlighting that what induces stress in one individual might not affect another. The subjectivity of stress arises from various factors, including an individual's background and environmental experiences (Cotton, 2014). Therefore, stress can be succinctly described as a complex internal state, stemming from or related to unsatisfying conditions, which is shaped by individual experiences and backgrounds.

4.3. Anxiety:

The understanding and definition of anxiety differ among psychological researchers. Eysenck et al. (2007, p. 336) posit that anxiety can be comprehended as an aversive emotional and motivational state that transpires in threatening circumstances. On the other hand, Power and Dalgleish (1997, pp. 206-207) view anxiety as a state whereby an individual fails to instigate a coherent behavioural pattern in response to or alteration of the threatening event, object or interpretation challenging an established goal.

4.4. The Intersection of Stress and Anxiety:

Stress and anxiety, often used interchangeably in literature, are interlinked in a manner where one encompasses the other. Studies suggest that individuals who identify as stressed often experience anxiety (Esyanov and Calamari, 2004). Therefore, it's important to consider stress as a component and indicator of anxiety in psychological assessments to avoid potential issues of comorbidity. This review, therefore, expands the anxiety inventory to include observation of stress.

So far this literature review provided an overview of the relationship between stress, anxiety, and Working Memory (WM) in the context of academic performance. The intricate nature of cognitive processes, particularly WM, has been discussed, highlighting the influence of psychological factors such as stress and anxiety. Stress and anxiety were defined. The theoretical frameworks of anxiety and its effects on memory, including processing efficiency theory and attentional control theory were examined. Additionally, the intersection of stress and anxiety was discussed, emphasizing the need to consider stress as a component of anxiety in psychological assessments. Understanding these interactions is crucial for developing effective interventions to enhance students' academic performance. Further research is needed to explore the underlying mechanisms and develop targeted strategies to mitigate the negative effects of stress and anxiety on WM and academic outcomes.

4.5. The Impact of Stress and anxiety on Cognitive Function and Academic Performance:

Stress and anxiety have been found to have a significant impact on cognitive function and academic performance. Chronic stress has been shown to have detrimental effects on cognitive function, including working memory, and can lead to impaired cognition (Luine et al., 2007). Studies have also demonstrated that stress and anxiety are associated with poor academic performance (Greenberg et al., 2001). The consequences of stress include elevated anxiety, depression, and impaired cognitive function, all of which can negatively affect academic performance (Greenberg et al., 2001).

Research has shown that stress and anxiety can disrupt working memory performance (Lukasik et al., 2019). Working memory is a cognitive process that is crucial for learning and academic tasks, such as problem-solving, comprehension, and information retention (Lukasik et al., 2019). When individuals experience stress and anxiety, their working memory capacity may be compromised, leading to difficulties in processing and retaining information, which can ultimately impact academic performance (Lukasik et al., 2019).

Two theories explain how anxiety impair the working memory; processing efficiency theory and attentional control theory.

4.5.1. Processing Efficiency theory:

The processing efficiency theory was introduced by Eysenck and Calvo (1992). This theory elicits the difference between efficiency and effectiveness. Effectiveness refers to the quality of performance or the amount of accuracy while efficiency refers to the relationship between performance effectiveness and the effort or processing resources invested in that performance. This means that high processing efficiency involves high levels of performance effectiveness achieved with the use of few resources. Processing efficiency theory predicts that anxiety affects efficiency (time taken to respond) but not effectiveness. Anxiety generates worry which involves individuals in task-irrelevant thoughts including negative self-evaluation. Involvement in a task- irrelevant process results in increasing time and efforts to attain accurate responses when performing a cognitive task. In this instance, anxious individuals tend of use compensatory strategies and efforts that serve to reduce the negative effects of anxiety on performance effectiveness at the expanse of processing efficiency. (Derakshan & Eysenck, 2009). Overall, anxiety engages people in irrelevant thoughts which might slow the speed of performance and in some cases impact its quality.

4.5.2. Attentional control theory:

The second theory is referred to as attentional control theory. This theory extends the horizon of the previous theory and its more precise about effects of anxiety on the functioning of the central executive component of WM. This theory assumes that anxiety affects attentional processes. It typically reduces attentional focus on the present task unless it involves threatening stimuli. More specifically, anxiety impairs attentional control which is a key function of the central executive. Anxious individuals distribute attentional resources to threat related stimuli, worrisome thoughts which is internal or external threatening task-irrelevant distracters. (Derakshan and Eysenck, 2009)

According to Corbetta and Shulman (2002) there are two attentional systems. Directed attentional system that involves top down control of attention and stimulus-driven attentional system which involves bottom up control of attention. The two systems regularly interact during functioning. However, anxiety disrupts the balance between the two systems in which the influence of the stimulus-driven attentional system is increased over the other system.

Stress and anxiety can also affect other cognitive functions, such as executive functions, including planning, inhibition, and cognitive flexibility (Jaschke et al., 2018). These cognitive processes are essential for academic tasks that require organization, self-regulation, and goal-directed behavior (Jaschke et al., 2018). When individuals are under stress or experiencing anxiety, their executive functions may be impaired, leading to difficulties in planning, organizing, and completing academic tasks effectively (Jaschke et al., 2018).

In addition to the direct impact on cognitive function, stress and anxiety can also indirectly affect academic performance through their effects on mental health. High levels of stress and anxiety have been associated with increased symptoms of depression, which can further impair cognitive function and academic performance (Al-Khani et al., 2019). Moreover, stress and anxiety can disrupt sleep patterns, which can negatively impact cognitive function and academic performance (Al-Khani et al., 2019).

Interventions that target stress and anxiety management have shown promise in improving cognitive function and academic performance. For example, stress inoculation training and anxiety management training have been found to be effective in reducing the negative impact of stress on cognitive function and academic performance (Greenberg et al., 2001). These interventions provide individuals with coping skills to manage stress and anxiety, which can help improve cognitive function and academic outcomes (Greenberg et al., 2001).

Stress and anxiety have a significant impact on cognitive function and academic performance. Chronic stress can impair cognitive function, including working memory, and lead to poor academic performance. Stress and anxiety can also disrupt executive functions and indirectly affect academic performance through their effects on mental health and sleep patterns. Interventions that target stress and anxiety management have shown promise in improving cognitive function and academic performance. Understanding the relationship between stress, anxiety, and cognitive function is crucial for developing effective interventions and support systems to promote academic success.

5. Methodology

This study employed a cross-sectional experimental design to investigate the impact of stress and anxiety on the working memory of EFL undergraduates in Algeria. The decision to use an experimental cross-sectional design was influenced by the need to conduct quantitative measurements of working memory (WM) functions using memory tests, allowing for the collection of valid and objective data.

5.1. Research Instruments

The study utilised a suite of research instruments, including visual observation, Spielberger's State-Trait Anxiety Inventory (STAI) and Wechsler Working Memory Scale (WWMS).

5.1.1. Spielberger's State-Trait Anxiety Inventory (STAI)

The STAI is a psychological inventory specifically designed to assess anxiety levels. It was selected for this study due to its ability to measure both state and trait anxiety. The STAI, proposed by Charles Spielberger, operates on a 4-point Likert scale, comprising 40 self-reported statements. It primarily assesses two forms of anxiety: state anxiety, pertaining to a specific situation, and trait anxiety, which refers to a persistent tendency to perceive situations as threatening.

The STAI questionnaire is subdivided into two sections. The first section collects 'general information' about the participants, such as full name, gender, and age. The second section contains

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'specific questions', Likert-scale statements used by participants to describe their emotional, cognitive, physical, and habitual states. The intensity and degree of these states serve as indicators of the participant's level of anxiety (see appendix 2).

5.1.2. Visual Observation of Stress

Visual observation was employed to identify symptoms of stress, thereby addressing the limitations of the STAI and reducing the potential for comorbidity, given that stress serves as a crucial indicator of anxiety. Stress was observed while participants were undertaking the WM test, with the intent to capture non-verbal expressions of students' feelings during the test. Observation was chosen as the most appropriate tool for stress data collection, as it allows for a focus on participant behaviour rather than subjective perceptions. Stress-related behaviours, such as confusion, hyperactivity, and anger, were observed and recorded. The literature guided the observation of these stress symptoms, with frequency and duration parameters set to ensure that the observed symptoms were indeed indicative of stress and not influenced by other factors (see appendix 4).

5.1.3. Working Memory Test

To explore the influence of Social Anxiety Disorder (SAD) on working memory (WM) We used a test known as the 'loading paradigm' to investigate the impact of Social Anxiety Disorder (SAD) on working memory (WM).

This decision was based on our hypothesis, which was derived from studies by Thompson and Allan (2013) and Eysenck et al. (2007), which proposed that psychological factors primarily impair WM during cognitive dual tasks or attention-demanding tasks.

We opted for the forward-backward word recall, a concurrent memory task, as the testing method of choice, primarily due to its dual nature involving comprehension and retention of specific information simultaneously. The test text centered on the effects of social media on people's lives. Participants were instructed to read and memorise these effects. The text was composed of simple and basic vocabulary to minimise individual differences in reading comprehension. Furthermore, it was presumed that all participants would have prior knowledge about 'social media', thus reducing potential disparities in reading comprehension that might affect the results (see appendix 3).

This test is a subtest of the Wechsler scale battery, a WM assessment tool created by David Wechsler (1945). It is known to test phonological code via immediate forward recalling and visuo-spatial code via backward recalling (Thompson and Allan, 2013). It is considered a complex span measure of WM (Hoshi et al., 2000; Gerton et al., 2004).

5.2. Population and Sampling

The population of interest for this study consisted of first year EFL undergraduate students at the Department of English, University of Blida 2 during the academic year 2018/2019. This population was selected primarily because these students, transitioning from secondary school to university, may experience stress and anxiety due to the novel demands and requirements of higher education. Furthermore, given their specialization in a foreign language, we assert that they are the most suitable population for our study.

The sample consisted of 45 first-year undergraduates from the English Department at the University of Blida2, with a gender distribution of 36 females and 9 males. The participants' average age was 20, ranging from 18 to 22 years. The selection of participants was non-random and was based on convenience sampling due to time constraints and the difficulty of securing teacher agreements to conduct the experiment with their students. Only one teacher accepted our request to facilitate the experiment with her students.

6. Findings:

The findings from the administration of the State-Trait Anxiety Inventory (STAI) are presented here, starting with general demographic data about the participants.

Demographic Data:

A. Gender Distribution:

The distribution of participants based on gender is represented in the following table:

Gender	Number of Participants	Percentage
Male	09	20%
Female	36	80%
Total	45	100%

(Figure 01: Distribution of participants based on gender)
This table indicates that out of the 45 participants in the study, 9 (or 20%) were male and 36 (or 80%) were female.

B.   Age Distribution:
The distribution of participants according to their ages is depicted in the table below:

Age	Number of Participants	Percentage
18	22	48.88%
19	20	44.44%
20	01	2.22%
21	01	2.22%
22	01	2.22%
Average Age	20	-

(Figure 02: Distribution of participants by age)
The table suggests that the majority of participants were either 18 or 19 years old, constituting 48.88% and 44.44% of the sample respectively. There were fewer participants in the age groups of 20, 21, and 22, each making up just 2.22% of the sample. The average age of participants in this study was 20 years old.

C.   Finding from STAI and visual observation:
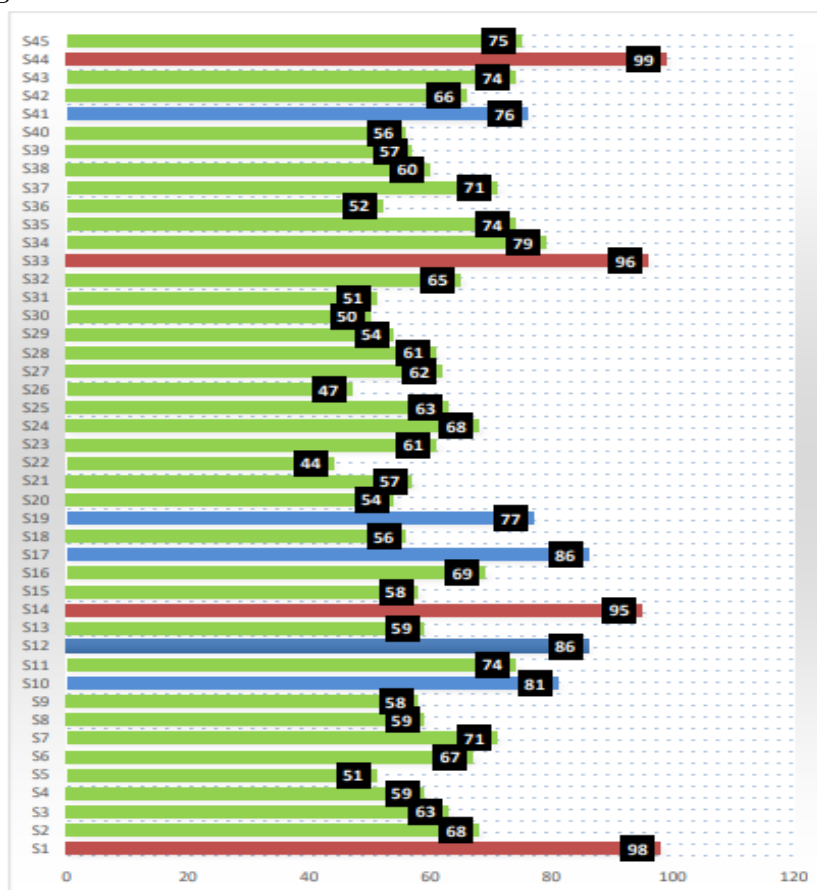

Figure   : Figure 1. Participants' Scores on STAI

S : Student.

Participants with high levels of anxiety.   Participants with no anxiety.

Participants with moderate anxiety levels.

D.   Analysis of Anxiety Scores from STAI:
      The STAI scoring model offered an interpretation of scores; a range from 40 to 75 signifies no anxiety, 76 to 88 suggests moderate anxiety, while 89 to 160 points to high anxiety. From the

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collected data, it was observed that 36 participants exhibited no anxiety, 5 showed signs of moderate anxiety, and 4 demonstrated high anxiety.

Common cognitive symptoms among the moderate and high anxiety group included disturbing thoughts. Emotional symptoms included feelings of upset, while physical states comprised discomfort. Habitual anxiety symptoms were also observed, such as excessive worrying over minor matters. The severity of these symptoms varied from 'somewhat,' to 'moderately,' and 'very much,' which denoted the intensity of the anxiety experienced by participants. In summary, the majority of participants (36) were not anxious, while 9 exhibited some level of anxiety, with 5 demonstrating moderate anxiety and 4 high anxiety.

E.   Observational Analysis of Stress Symptoms:

In addition to the STAI, the research team actively monitored participants for observable signs of stress while they completed the Working Memory (WM) test. Notably, 8 participants exhibited stress symptoms such as hyperactivity, difficulty concentrating, forgetfulness, and confusion. The researcher took note of these symptoms, particularly their duration and frequency of occurrence.

When researcher noticed these symptoms, they approached the affected participants and asked them how they felt. The responses, including expressions of stress, fear, forgetfulness, and difficulty in recall, were then recorded. A list was compiled featuring the names of these stressed participants alongside the stress symptoms they exhibited. However, it's important to note that not all stress symptoms could be recorded since some manifestations, such as accelerated heart rate, are internal and not readily observable.

F.   WM Test Results:

Analysis of WM Scores for Anxious and Non-Anxious Participants:

A comparative analysis was conducted between the WM scores of participants with moderate and high anxiety and those with no anxiety, along with the 8 participants who displayed stress symptoms. The WM scores are tabulated below:

Participants with Moderate and High Anxiety WM Scores Frequency Participants with No Anxiety WM Scores Frequency.

Participants with Moderate and high anxiety WM scores	Frequency	Participants with no anxiety WM scores	Frequency
8	4	3	2
7	2	4	4
6	1	10	5
10	2	6	4
1	3	2	2
2	1	12	1
3	2	1	3
4	1	8	8
Mean:5.12	Total16	Mean: 5.75	Total: 29

Table 6: Comparison of WM Scores between Anxious and Non-Anxious Participants

This table presents the distribution of WM scores for both groups. The group of participants with moderate to high anxiety had a mean WM score of 5.12 (N=16), while the group with no anxiety had a slightly higher mean WM score of 5.75 (N=29). This comparison provided an indication of the possible impact of anxiety levels on WM performance among the study participants.

	Anxious participants	percentage	Non-anxious participants	Percentage
Under the average	07	43,75%	11	37,93%
Above the average	09	56,25%	18	62,02%
	Total 16	Total 100%	Total 29	Total 100%

Table7. Score Rates of under and above the Average of Anxious and Non-Anxious Participants.

G.   Analysis of WM Scores for Anxious and Non-Anxious Participants:

Table 6 illustrates the performance of both anxious and non-anxious participants in terms of WM scores. From the 16 anxious participants, 7 (43.75%) scored below the average, whereas 9 (56.25%) scored above the average. This data suggests that anxiety affects the WM performance of approximately half of the participants. Regarding the non-anxious participants, 11 out of 29 scored below the average, whereas the majority, 18, scored above the average, signifying that a large proportion (62.02%) of these participants successfully performed the WM task. Nevertheless, for those non-anxious individuals who did not achieve the average score, there might be some factors interfering with their performance. A comparison of the performance of non-anxious and anxious participants indicates a poorer performance by anxious participants (56.25% vs. 62.02%). However, the results also suggest the presence of additional factors that might have impacted the performance of non-anxious participants who did not achieve the average score.

7.   Discussion:

The State-Trait Anxiety Inventory (STAI) was used to assess anxiety levels among the participants. This was followed by the administration of a WM test and observations to identify stress symptoms, possibly indicative of anxiety. The findings suggest that anxiety has an influence on working memory performance. Among the 16 anxious participants, 7 performed poorly on the recall task, indicating that the overall performance of non-anxious participants (62.02%) was superior to that of their anxious counterparts (56.25%).

These results underscore that anxiety negatively impacted the WM of certain participants, while others performed well despite experiencing anxiety. This can be interpreted in relation to individual variations in WM, where individuals with high working memory capacity (WMC) might be less affected by anxiety than those with lower WMC (Beilock and Carr, 2005; Johnson and Gronlund, 2009). This aligns with the processing efficiency theory, which posits that anxious individuals may achieve performance effectiveness (quality of performance) at the expense of efficiency (speed) (Eysenck and Calvo, 1992).

Our findings also concur with the literature suggesting that moderate anxiety can facilitate cognitive performance (Fernández-Castillo & Gutierrez-Rojas, 2009). Therefore, we tentatively suggest that anxious participants may have taken more time than non-anxious participants to complete the tasks. However, due to the large size of the participant pool and the non-individual testing format, we were unable to measure task completion speed.

Nevertheless, not all anxious participants scored above average, which lends support to the attentional control theory stating that anxiety can disrupt central executive functions, mainly shifting and inhibition (Eysenck et al., 2007). These findings are also consistent with those of previous research (Darke, 1990; Blashill, 2016; MacLeod and Donnellan, 1993; Derakshan and Eysenck, 1998), which reported similar impacts of anxiety and academic stress on WM performance.

8.   Pedagogical Implications:

The findings underscore the potential for stress and anxiety to impair WMC, emphasising the need for educators to cultivate positive and supportive learning environments. A focus on promoting emotional well-being and reducing stress and anxiety is crucial. The approach to assessment and grading should also be reconsidered, prioritising formative assessment methods, which emphasise feedback over traditional testing and grading structures. Such an approach can help to mitigate stress and anxiety among learners, potentially improving their WM performance.

9.   Conclusion:

Despite these limitations, the present study provides important insights into the relationship between stress, anxiety, and WM performance. The findings demonstrate that these factors can differentially impact WM, with some individuals experiencing a decreased WM capacity while others perform well on WM tasks. Furthermore, future research should consider the time taken to perform cognitive tasks, acknowledging that anxious participants might require more time than their non-anxious counterparts. This dimension could offer a more comprehensive understanding of how anxiety influences not only the quality of cognitive performance but also the efficiency.

References

Al-Khani, A., Sarhandi, M., Zaghloul, M., Ewid, M., & Saquib, N. (2019). A cross-sectional survey on sleep quality, mental health, and academic performance among medical students in Saudi Arabia. *BMC Res Notes, 12*(1). https://doi.org/10.1186/s13104-019-4713-2

Alloway, T., & Alloway, R. (2010). Investigating the predictive roles of working memory and IQ in academic attainment. *Journal of Experimental Child Psychology, 106*(1), 20-29. https://doi.org/10.1016/j.jecp.2009.11.003

Aronen, E., Vuontela, V., Steenari, M.-R., Salmi, J., & Carlson, S. (2005). Working memory, psychiatric symptoms, and academic performance at school. *Neurobiology of Learning and Memory, 83*(1), 33-42.

Ashcraft, M. H., & Krause, J. A. (2007). Working memory, math performance, and. *Psychomomic Bulletin & Review, 14*(2), 243-248.

Beilock, S. L., & Carr, T. H. (2005). When high-powered people fail: Working memory and "choking under pressure" in math. *Psychological Science, 16*(2), 101-105.

Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition & Emotion, 6*(6), 409-434.

Greenberg, M., Domitrovich, C., & Bumbarger, B. (2001). The prevention of mental disorders in school-aged children: Current state of the field. *Prevention & Treatment, 4*(1). https://doi.org/10.1037/1522-3736.4.1.41a

Jaschke, A., Honing, H., & Scherder, E. (2018). Longitudinal analysis of music education on executive functions in primary school children. *Front. Neurosci., 12*. https://doi.org/10.3389/fnins.2018.00103

Johnson, D. R., & Gronlund, S. D. (2009). Individuals lower in working memory capacity are particularly vulnerable to anxiety's disruptive effect on performance. *Anxiety, Stress, & Coping, 22*(2), 201-213. http://dx.doi.org/10.1080/10615800802291277

Khan, N. U., Ali, S., & Irfan, M. (2022). Influence of mobile phone usage on the academic performance of students: A case study of Malakand division students. *Journal of Tianjin University Science and Technology, 55*(9).

Khan, Z., Azeem, M., & Irfan, M. (2022). Habit of study and academic achievements in District Dir (Lower) and District Malakand. *University of Limerick. Journal contribution.*

Luine, V., Beck, K., Bowman, R., & Frankfurt, M. (2007). Chronic stress and neural function: Accounting for sex and age. *J Neuroendocrinol, 19*(10), 743-751. https://doi.org/10.1111/j.1365-2826.2007.01594.x

Lukasik, K., Waris, O., Soveri, A., Lehtonen, M., & Laine, M. (2019). The relationship of anxiety and stress with working memory performance in a large non-depressed sample. *Front. Psychol., 10*. https://doi.org/10.3389/fpsyg.2019.00004

Owens, M., Stevenson, J., Hadwin, J., & Norgate, R. (2012). Anxiety and depression in academic performance: An exploration of the mediating factors of worry and working memory. *School Psychology International, 33*(4), 433-449. https://doi.org/10.1177/0143034311427433

Owens, M., Stevenson, J., Norgate, R., & Hadwin, J. A. (2008). Processing efficiency theory in children: Working memory as a mediator between trait anxiety and academic performance. *Anxiety, Stress, & Coping, 21*(4), 417-430.

Pascual, A., Muñoz, N., & Quílez-Robres, A. (2019). The relationship between executive functions and academic performance in primary education: Review and meta-analysis. *Front. Psychol., 10*. https://doi.org/10.3389/fpsyg.2019.01582

Rogers, M., Hwang, H., Toplak, M., Weiss, M., & Tannock, R. (2011). Inattention, working memory, and academic achievement in adolescents referred for attention deficit/hyperactivity disorder (ADHD). *Child Neuropsychology, 17*(5), 444-458. https://doi.org/10.1080/09297049.2010.544648

Stornes, T., & Bru, E. (2011). Perceived motivational climates and self-reported emotional and behavioural problems among Norwegian secondary school students. *School Psychology International, 32*(4), 425-438.

Corbetta, M., & Shulman, G. L. (2002). Control of goal-directed and stimulus-driven attention in the brain. *Nature Reviews Neuroscience, 3*(3), 201-215.

Derakshan, N., & Eysenck, M. W. (2009). Anxiety, processing efficiency, and cognitive performance: New developments from attentional control theory. *European Psychologist, 14*(2), 168-176.

Luethi, M., Meier, B., & Sandi, C. (2008). Stress effects on working memory, explicit memory, and implicit memory for neutral and emotional stimuli in healthy men. *Front Behav Neurosci, 2*, 5. https://doi.org/10.3389/neuro.08.005.2008

Moran, T. P. (2016). Anxiety and working memory capacity: A meta-analysis and narrative review. *Psychological Bulletin, 142*(8), 831.