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Association between anxiety level and short-term memory performance among medical students during examinations

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Abstract

Background: Anxiety is a common psychological response experienced by medical students during academic examinations and may influence cognitive functions, including short-term memory, which plays an important role in learning and academic performance.

Purpose: To determine the relationship between anxiety level and short-term memory performance during the academic examination phase among Class of 2024 medical students.

Method: An observational analytic study with a cross-sectional design was conducted among 130 Class of 2024 medical students selected using a total sampling technique. Anxiety level was measured using the Hamilton Anxiety Rating Scale (HARS), while short-term memory performance was assessed using the Digit Span Backward Test. Data were analysed using descriptive statistics and the Spearman rank correlation test.

Results: Most respondents experienced mild anxiety (60.0%) and demonstrated moderate short-term memory performance (60.0%), with no respondents classified as having low memory performance. Spearman rank correlation analysis revealed a very weak positive correlation between anxiety level and short-term memory performance; however, the association was not statistically significant ($r = 0.107$, $p = 0.226$).

Conclusion: Anxiety level was not significantly associated with short-term memory performance among Class of 2024 medical students during the academic examination phase. These findings suggest that the anxiety experienced by most students remained within an adaptive range and did not substantially affect short-term memory performance. Stress management and psychological support may help students maintain psychological well-being during periods of academic demands.

Keywords: Anxiety; Medical Students; Short-Term Memory; Digit Span Backward Test.

INTRODUCTION

Anxiety is a common emotional response characterized by excessive worry, tension, and physiological symptoms that arise when individuals perceive uncertain or threatening situations (Carlucci, Watkins, Sergi, Cataldi, Saggino, & Balsamo, 2018). Although anxiety is a normal adaptive response to stress, persistent or excessive anxiety may impair psychological well-being and cognitive functioning, particularly among students facing academic demands (Bright, 2022). Anxiety is one of the most prevalent mental health conditions worldwide, while recent evidence indicates that anxiety remains a

growing concern across Asian countries because of academic pressure, socioeconomic challenges, and limited access to mental health services (Chen, Huang, Xu, Peng, Wang, Li, & Tang, 2024; World Health Organization, 2023).

In Indonesia, anxiety is also a significant public health issue. The 2018 Basic Health Research (BHR) reported that approximately 6.0% of individuals aged ≥ 15 years experienced emotional mental disorders related to anxiety and depression (Ministry of Health of the Republic of Indonesia, 2018). Indonesia National Mental Health Survey (I-NAMHS) found that

anxiety disorder was the most common mental disorder among adolescents aged 10–17 years, affecting 3.7% of this population (Wahdi, Wilopo, & Erskine, 2023). Among university students, anxiety has been associated with poorer academic adjustment and achievement (Awadalla, Davies, & Glazebrook, 2024). A previous study involving health-related students in Lampung also reported that 40.2% of respondents experienced anxiety of varying severity (Melyana, Pribadi, & Elliya, 2021).

Anxiety may influence cognitive functions that are essential for learning, particularly working memory or short-term memory. Working memory enables individuals to temporarily store and manipulate information required for reasoning, learning, and problem-solving (Diotaiuti, Valente, Corrado, Tosti, Carissimo, Di Libero, Cerro, Rodio, & Mancone, 2024). According to Attentional Control Theory, anxiety mainly reduces the efficiency of cognitive processing by diverting attentional resources, although individuals may compensate to maintain task performance (Eysenck, Moser, Derakshan, Hepsomali, & Allen, 2023). Consequently, prolonged anxiety has the potential to interfere with students' learning processes and academic performance. Medical students are particularly vulnerable to anxiety because of intensive academic workloads, frequent examinations, and high performance expectations (Almutairi, Baabbad, Alhumaidan, Alshahrani, Alabdulkarim, & Alsughier, 2024). Although previous studies have reported the prevalence of anxiety among medical students, evidence regarding its relationship with short-term memory performance during examination periods remains limited, particularly among medical students in Indonesia.

RESEARCH METHOD

A quantitative approach with an observational analytic method and a cross-sectional design to examine the relationship between anxiety level and short-term memory performance among Class of 2024 medical students at Universitas Malahayati. The study was conducted at Universitas Malahayati on 16 April 2026, immediately after the respondents completed their block-end examination. The population comprised all 130 Class of 2024 medical students. Although the minimum sample size calculated using Slovin's formula with a 5% margin of error was 98 respondents, total sampling was applied;

therefore, all 130 students who met the inclusion criteria were included in the study. The inclusion criterion was being a Class of 2024 medical student at Universitas Malahayati. Students who declined to participate or had a psychiatric diagnosis other than anxiety based on DSM-5 or PPDGJ-III criteria were excluded. The independent variable was anxiety level, while the dependent variable was short-term memory performance. Anxiety was measured using the Hamilton Anxiety Rating Scale (HARS), which assesses psychological symptoms, including tension, fear, and restlessness, as well as somatic symptoms of anxiety. The total HARS score was categorized into three levels: mild anxiety (18–24), moderate anxiety (25–30), and severe anxiety (31–56). Short-term memory performance was assessed using the Digit Span Backward Test, in which respondents were required to repeat a sequence of digits in reverse order. Each level consisted of two trials, with a correct response scored as 1 and an incorrect response as 0. The test was discontinued after two consecutive failures at the same level. Scores were categorized as low (0–3), moderate (4–7), and high (8–10). The Digit Span Test is a widely used neuropsychological measure of working-memory capacity and has been shown to reflect age- and load-related changes across prefrontal and parietal brain networks (Bahri, Farrahi, Mahdavinataj, & Batouli, 2024). It is also considered one of the established span-based measures of working memory compared with alternative instruments such as the Corsi Block-Tapping Test (Arce & McMullen, 2021).

Data were collected directly from respondents as primary data. Following written informed consent, the HARS and Digit Span Backward Test were administered to each respondent during the same session. The collected data were subsequently subjected to editing, coding, processing, and cleaning before statistical analysis using SPSS version 26.0. Univariate analysis was performed to describe the frequency distribution of the study variables. Bivariate analysis was conducted using Spearman's rank correlation test because the variables were measured on an ordinal scale and the data were not normally distributed. A p -value < 0.05 was considered statistically significant. Ethical approval was obtained from the Research Ethics Committee of Universitas Malahayati under ethical clearance No. 5218/EC/KEP-UNMAL/III/2026. Research permission

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was obtained prior to data collection, and written informed consent was obtained from all respondents before participation. The confidentiality and privacy of

respondents were maintained throughout the research process.

RESEARCH RESULTS

Table 1. Distribution of Respondent (N = 130)

Variable	Results
Age (Mean±SD)(Range)(Years)	(19.97±1.21)(18–26)
Gender (n/%)	
Female	95/73.1
Male	35/26.9
Short-Term Memory Performance (n/%)	
Low	0/0.0
Moderate	78/60.0
High	52/40.0
Anxiety Level (n/%)	
Mild	78/60.0
Moderate	12/9.2
Severe	40/30.8

Table 1 shows that the mean age of the respondents was 19.97 ± 1.21 years, with ages ranging from 18 to 26 years. The majority of respondents were female, comprising 95 respondents (73.1%), while male respondents accounted for 35 respondents (26.9%). The distribution of anxiety level and short-term memory performance among the respondents. Most respondents demonstrated a moderate level of short-term memory performance (78; 60.0%), followed by a high level (52; 40.0%), while no respondents were categorized as having low short-term memory performance. Regarding anxiety level, most respondents experienced mild anxiety (78; 60.0%), followed by severe anxiety (40; 30.8%) and moderate anxiety (12; 9.2%).

Table 2. Relationship between Anxiety Level and Short-Term Memory Performance

Variable	r (Spearman)	p-value
Anxiety level and short-term memory performance	0.107	0.226

The relationship between anxiety level and short-term memory performance among Class of 2024 medical students. Spearman's rank correlation analysis showed a very weak positive correlation ($r = 0.107$); however, the association was not statistically significant ($p = 0.226$). These findings indicate that

anxiety level was not significantly associated with short-term memory performance among the respondents during the academic examination period.

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DISCUSSION

The present study found that most respondents demonstrated a moderate level of short-term memory performance, while none were categorized as having low short-term memory performance. These findings indicate that most Class of 2024 medical students were able to maintain moderate-to-high short-term memory performance despite being assessed immediately after a block-end examination. Working memory plays an essential role in learning and academic performance because it enables individuals to temporarily store and manipulate information required for reasoning, learning, and problem-solving (Arce & McMullen, 2021). The predominance of moderate-to-high performance may indicate that the respondents were generally able to maintain the cognitive processes required to temporarily retain and manipulate information during the examination period. This finding may also be considered in the context of the intensive learning demands experienced by medical students, in which continuous studying and preparation for examinations are important components of medical education (Sunarti, Diani, Muhammad, Cing, Arodes, Kurniaty, & Fachly, 2022; Marek, Maj, Przybyla, Skrzynski, Pasicz, Fabiszewska, & Rowinski, 2023).

The results also showed that most respondents experienced mild anxiety, whereas fewer respondents experienced moderate or severe anxiety. Examination periods may increase anxiety because students face academic demands, performance expectations, and concerns about examination outcomes. Medical students may be particularly exposed to these demands because of the intensive academic workload and frequent examinations characteristic of medical education (Sunarti, Diani, Muhammad, Cing, Arodes, Kurniaty, & Fachly, 2022; Huang, Wu, Huang, Liang, Yang, Cheng, & Chen, 2025). Nevertheless, the predominance of mild anxiety suggests that anxiety symptoms among most respondents were present at a relatively lower level during data collection. According to Attentional Control Theory, anxiety can influence the efficiency of attentional processing by directing attention toward threat-related information and away from task-relevant stimuli. However, individuals may compensate by increasing cognitive effort, allowing task performance to be maintained despite the presence of anxiety (Eysenck, Moser, Derakshan, Hepsomali, & Allen, 2023). Thus,

the presence of mild anxiety does not necessarily indicate substantial impairment in cognitive performance.

From a cognitive perspective, anxiety may be associated with changes in cognitive functioning, although the magnitude and pattern of these effects may vary across individuals and tasks (Rabner, Ney, & Kendall, 2024). Previous research has also examined the relationship between working memory, state anxiety, and academic performance among university students, suggesting that these psychological and cognitive domains may interact within academic contexts (Wang, Chung, & Jhuo, 2025). From a physiological perspective, anxiety involves activation of stress-related physiological responses that may influence cognitive functioning. The effects of anxiety and stress on memory and attention may vary according to the intensity and duration of the stress response. Mild levels of arousal may facilitate alertness and task engagement, whereas excessive or prolonged stress may interfere with cognitive processes involved in attention and memory (McEwen & Akil, 2020; Ariño-Braña, Zareba, Ibanez Montolio, Visser, & Picó-Pérez, 2025). In the present study, although some respondents experienced severe anxiety, most respondents experienced mild anxiety, and short-term memory performance was predominantly moderate. This pattern suggests that the level of anxiety experienced by most respondents may not have been sufficient to produce measurable differences in short-term memory performance.

The present study found no statistically significant relationship between anxiety level and short-term memory performance. This finding indicates that, within the study population and conditions under which the data were collected, variations in anxiety level were not significantly associated with variations in short-term memory performance. The finding is consistent with Attentional Control Theory, which proposes that anxiety may reduce the efficiency of cognitive processing without necessarily resulting in poorer task performance. Individuals experiencing anxiety may compensate by increasing cognitive effort or using additional attentional resources, thereby maintaining performance despite increased anxiety (Eysenck et al., 2023). Evidence from university student research also indicates that the

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relationships among anxiety, working memory, and academic performance may vary according to individual and contextual characteristics (Wang, Chung, & Jhuo, 2025). Therefore, the absence of a statistically significant relationship in the present study should not be interpreted as evidence that anxiety has no effect on cognitive functioning; rather, the relationship may depend on the level and type of anxiety, task characteristics, and other individual factors.

The absence of a significant association may also be related to the relatively homogeneous characteristics of the study population. All respondents were Class of 2024 medical students at the same institution and were assessed immediately after completing the same block-end examination. Consequently, the respondents were exposed to relatively similar academic demands, learning environments, and examination conditions during data collection. Such similarities may have reduced variability in both anxiety and cognitive performance, making it more difficult to detect a statistically significant association between the two variables. Medical education involves intensive and continuous learning, and students may adopt different approaches to managing examination demands, including intensive study or cramming (Sunarti, Diani, Muhammad, Cing, Arodes, Kurniaty, & Fachly, 2022). In addition, repeated exposure to academic examinations may allow students to become familiar with examination-related demands and develop strategies for maintaining performance. Previous research has shown that examination-induced stress can change around examination periods and may be accompanied by changes in memory performance (Ahmed, Dubey, Garg, & Srivastava, 2023). Thus, the relatively uniform examination context in the present study may have influenced the variability in anxiety and cognitive performance.

Several factors that were not examined in the present study may also have contributed to differences in short-term memory performance. Working-memory performance can be influenced by multiple cognitive and contextual factors, including individual cognitive capacity, executive functioning, sleep, fatigue, attention, motivation, and task demands (Bahri, Farrahi, Mahdavinataj, & Batouli, 2024). Cognitive functioning in individuals experiencing anxiety may also vary across different

cognitive domains and task conditions (Rabner, Ney, & Kendall, 2024). In addition, the intensive learning demands experienced by medical students may influence cognitive processes involved in learning and memory (Marek, Maj, Przybyla, Skrzynski, Pasicz, Fabiszewska, & Rowinski, 2023). These factors may have contributed to the maintenance of short-term memory performance despite differences in anxiety levels among respondents. Future studies should therefore consider measuring and statistically controlling relevant cognitive, behavioral, and contextual variables to obtain a more comprehensive understanding of the relationship between anxiety and short-term memory performance. Studies involving more heterogeneous populations may also provide greater variability in anxiety and cognitive performance, thereby improving the ability to identify potential associations.

Overall, the findings indicate that anxiety level was not significantly associated with short-term memory performance among Class of 2024 medical students during the examination period. The findings suggest that short-term memory performance may be influenced by multiple interacting cognitive, psychological, and contextual factors rather than anxiety level alone. This interpretation is consistent with evidence indicating that anxiety, stress, cognitive functioning, and academic performance may interact in complex ways among students, including medical students (Huang, Wu, Huang, Liang, Yang, Cheng, & Chen, 2025; Wang, Chung, & Jhuo, 2025). Further research should examine these factors simultaneously and involve broader and more heterogeneous student populations to clarify the conditions under which anxiety may be associated with short-term memory performance.

CONCLUSION

No statistically significant relationship between anxiety level and short-term memory performance among Class of 2024 medical students during the academic examination period ($r = 0.107$, $p = 0.226$). Most respondents experienced mild anxiety and demonstrated moderate short-term memory performance, with no respondents categorized as having low short-term memory performance. These findings suggest that anxiety level alone was not significantly associated with short-term memory performance in this study population. Short-term

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memory performance during examinations is likely influenced by multiple cognitive, psychological, and environmental factors beyond anxiety.

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