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Article

Memory Dynamics in Students During the Academic Process

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Abstract: This study investigates the dynamics of short-term memory in first- and second-year university students throughout the academic year. Memory is a key cognitive function that determines the effectiveness of learning, encompassing the processes of receiving, storing, and retrieving information. The relevance of the topic is particularly pronounced among first-year students, as they face significant adaptation challenges upon entering higher education. The theoretical foundation of the study is based on the working memory model developed by Baddeley and Hitch, which remains a widely accepted conceptual framework in cognitive science. Research indicates that academic stress is one of the most critical external factors affecting memory performance, as it triggers cortisol release through the hypothalamic-pituitary-adrenal axis and reduces working memory capacity. The study was conducted during the 2025–2026 academic year at Karshi State University, involving 88 biology students (18 males and 70 females) from the first and second years. Memory was assessed at four stages: the beginning of the academic year (September), before examinations (January), after examinations (February), and at the end of the academic year (May). Both figurative visual memory (FVM) and numerical visual memory (NVM) were measured using the modern NS-Psychotest apparatus. The results demonstrated a wave-like pattern of memory dynamics in all groups: a significant decline before examinations, partial recovery after examinations, and a repeated decline by the end of the academic year. In first-year male students, FVM decreased from 82.5% in September to 75.8% in January, recovered to 82.2% in February, and fell again to 76.0% in May. Similar trends were observed in female students and in both groups of second-year students. All differences between September and January/May values were statistically significant ($P<0.05$). A notable finding was that female students showed a more pronounced recovery of figurative memory after examinations compared to males, which may reflect gender differences in post-stress cognitive resilience. Second-year female students exhibited a sharper memory decline in January compared to first-year females, suggesting cumulative cognitive fatigue over successive academic years. The study concludes that short-term memory indicators are highly sensitive to academic workload and that the observed patterns reflect the combined influence of examination stress and cumulative cognitive fatigue. The findings hold practical significance for planning the educational process, distributing cognitive load rationally, and scheduling rest periods to support memory recovery in university students.

Keywords: Short-term memory, working memory, memory dynamics, figurative visual memory, numerical visual memory, academic stress, cognitive load, academic year, examination period, gender differences, NS-Psychotest, cognitive performance.

Introduction

Memory is one of the most important indicators of cognitive processes in humans, determining the effectiveness of learning activities. Memory — which encompasses the processes of receiving, storing, and retrieving information — occupies a central place in the intellectual functioning of students [1].

The study of memory indicators in higher education is recognized as one of the urgent problems in both physiology and psychology. This issue is particularly significant for first-year students, as this period is characterized by the process of adaptation to a new educational environment. Research shows that the transition to higher education significantly increases students' intellectual load, which in turn naturally affects memory negatively [2].

In contemporary physiology and psychology, memory is understood as a multi-component system. The working memory model developed by Baddeley and Hitch remains an important conceptual framework to this day. According to this model, all parameters of memory perform specific functions in learning activities [3].

Studies conducted in recent years demonstrate that the limited capacity of working memory increases cognitive load during the educational process, which in turn affects academic outcomes [4]. Moreover, a close relationship between memory and academic achievement has been confirmed in various fields of study including language learning, mathematics, and written expression [5].

Stress is one of the most significant external factors that noticeably affects memory performance. Neurobiological research proves that academic stress increases cortisol secretion through the hypothalamic-pituitary-adrenal axis, leading to a decline in functions such as memory and attention [6]. Furthermore, stress reduces working memory capacity, causing additional cognitive overload during the learning process [7]. It has been established that 47–55% of university students experience moderate levels of academic stress, a condition that must be assessed as directly affecting memory processes [8]. The relationship between memory and the effectiveness of learning processes has also been confirmed in recent studies involving students from a South African university [9].

Research conducted with students of medical universities in Uzbekistan has also noted that the learning process is accompanied by high intellectual and psycho-emotional load, a situation that increases the likelihood of problems such as stress, anxiety, and cognitive decline [10].

Studying memory indicators holds important practical significance within physiological, psychological, and pedagogical sciences. In particular, the structure, delivery sequence, and volume of information in the educational process directly affects memory processes.

Based on this theoretical framework, it is recommended to identify students' memory indicators in advance and develop appropriate educational approaches in order to effectively organize the learning process [11].

The problem of studying memory processes in Uzbekistan's higher education system has not been sufficiently investigated. In particular, the relationship between academic stress and cognitive processes has barely been studied in the context of our republic. This situation once again confirms the necessity of conducting scientific research in this direction.

Materials and Methods

Short-term memory is also referred to as working memory. It is the brain's system for temporarily storing, processing, and manipulating information. Short-term memory can be subdivided into components such as auditory and visual memory.

Our studies involved 70 female and 18 male students enrolled in the 1st and 2nd years of the Biology program at Karshi State University. All students reside in the hot-climate region of our republic, and their ages do not differ significantly from one another.

Unmarried students were selected for the study. Attention was also paid to selecting students with similar socio-economic backgrounds.

The studies were conducted during the 2025–2026 academic year. Cognitive indicators were examined at 4 stages: at the beginning of the academic year (Stage 1), before examinations (Stage 2), after examinations (Stage 3), and at the end of the academic year (Stage 4). All tests were conducted in the morning from 8:30 to 12:30.

The studies were carried out using a modern Psychotest apparatus (NS-Psychotest, LLC "Neurosoft"). To study memory, the volumes of figurative visual memory (FVM) and numerical visual memory (NVM) were determined.

In determining FVM, subjects memorize 16 images, and for NVM — 12 numbers, within 20 seconds. After 1 minute, they must recall and select them from among many images and numbers. Memory volume is expressed as the ratio of recalled information to the total amount given. Results are presented as percentages [12]. For figurative memory, a score from 0 to 5 is below norm, while 6 to 16 is considered normal. The normative indicators for numerical memory are as follows: 0–1 — low; 2–3 — below average; 4–5 — average; 6–9 — above average; 10–12 — high [13].

Before testing, students were informed about the content and purpose of the research and proper consent was obtained. Prior to beginning the main study, students performed all three tests several times on the Psychotest apparatus and completed a preliminary trial to acquire the necessary skills.

Results and Discussion

The following tables 1. present the results obtained from studying short-term memory.

Table 1. Memory dynamics in 1st-year students during the academic year.

No.	Indicators, %	Study Stages			
		Beginning of academic year (September)	Before exams (January)	After exams (February)	End of academic year (May)
Males (n=10)					
1.	Figurative visual memory	82.5±1.6	*75.8±2.4	82.2±1.6	*76±2.2
2.	Numerical visual memory	80.5±1.5	*74.7±1.8	78.4±2	*74.4±2
Females (n=34)					
3.	Figurative visual memory	84±1.8	#75.3±3.3	86.8±2.5	#74.5±3
4.	Numerical visual memory	82.5±2	#74±2.3	80.4±3.8	#73.8±2.2

** Note. In males, results in January and May compared to September are statistically significant for both memory types (P<0.05).*

 # Note. In females, results in January and May compared to September are statistically significant for both memory types (P<0.05).

As shown in the table, short-term memory indicators in students changed throughout the academic year depending on the educational process. In 1st-year male students, FVM at the beginning of the academic year was 82.5±1.6%, dropping to 75.8±2.4% by January. After examinations (February), this indicator rose to 82.2±1.6%, approaching the initial level. However, by May, FVM dropped again to 76±2.2%. NVM showed a similar dynamic: 80.5±1.5 in September, 74.7±1.8 in January, 78.4±2 in February, and 74.4±2% in May. Statistical analysis showed that the declines in January and May compared to September constituted a significant difference (P<0.05) for both memory types in males.

In females, FVM at the beginning of the academic year was 84±1.8%, dropping to 75.3±3.3% in January. In February it reached 86.8±2.5% and dropped again to 74.5±3% in May. A similar trend was observed for NVM: 82.5±2 in September, 74±2.3 in January, 80.4±3.8 in February, and 73.8±2.2% in May. In females, the differences in January and May compared to September were also assessed as statistically significant (P<0.05).

In representatives of both genders, memory dynamics had a wave-like character: a decline before exams, recovery after exams, and another decline at the end of the academic year. This situation demonstrates the impact not only of exam stress, but also of cumulative cognitive fatigue accumulated throughout the academic year. Noteworthy is the fact that in females, the recovery of figurative memory in February was considerably higher than in males. This can be explained by females' relatively faster recovery of cognitive resources following Table 2. exam stress.[14]

Table 2. Memory dynamics in 2nd-year students during the academic year.

No.	Indicators, %	Study Stages			
		Beginning of academic year (September)	**Before exams (January)**	**After exams (February)**	**End of academic year (May)**
Males (n=8)					
1.	Figurative visual memory	84.5±2.4	*75.4±2.8	80.5±2.1	*74.8±2.8
2.	Numerical visual memory	82±3	*73±1.8	78.8±3.2	*72.6±2.4
Females (n=36)					
3.	Figurative visual memory	83±3.2	#68.8±4	82.5±1.8	#70.5±3.6
4.	Numerical visual memory	81.7±3	#68.2±4.4	80.5±1.6	#73.2±2.5

** Note. In males, results in January and May compared to September are statistically significant for both memory types (P<0.05).*

 # Note. In females, results in January and May compared to September are statistically significant for both memory types (P<0.05).

In 2nd-year male students, FVM at the beginning of the academic year was 84.5±2.4%. By January, this indicator dropped to 75.4±2.8%, rising to 80.5±2.1% in February. By May, FVM dropped again to 74.8±2.8%. NVM showed a similar trend: 82±3% in September, 73±1.8% in January, 78.8±3.2% in February, and 72.6±2.4% in May. For males, the results in January and May compared to September constituted a significant difference (P<0.05) for both memory types.

In 2nd-year females, FVM in September was 83±3.2%. By January, this indicator dropped to 68.8±4%. In February it rose to 82.5±1.8%, and in May it equalized again at 70.5±3.6%. NVM results were as follows: 81.7±3 in September, 68.2±4.4 in January, 80.5±1.6 in February, and 73.2±2.5% in May. In this group as well, the differences in January and May compared to September were assessed as statistically significant (P<0.05).

Several important features stand out in the 2nd-year results. First, the January decline in 2nd-year females was considerably more sharp than in 1st-year females. Second, the February recovery in

2nd-year males was lower than in 1st-year students. Third, the May results were equally low for both years and both genders. This confirms that cognitive fatigue at the end of the academic year manifests uniformly across all groups.

The overall analysis of the results can be summarized as follows. At the beginning of the academic year, students have low stress levels, no fatigue, and relatively high motivation. As students engage intensively in the educational process, memory gradually declines — reaching its lowest point at the end of the first semester, which is associated with heavy load on the nervous system. During the examination period, the nervous system faces even greater strain, but once examinations are completed, the brain's cognitive activity recovers, leading to improved results.

In the second semester, memory indicators decline again. A considerable memory decline is observed at the end of the academic year. The same pattern was observed in both 1st and 2nd year students. The difference between 1st and 2nd year students lies in the fact that motivation is considerably higher in 1st-year students — the new environment and new workloads ensure relatively higher cognitive functions. In 2nd-year students, sufficient adaptation exists, which in turn serves as the criterion determining the dynamics of cognitive functions. Accordingly, the memory decline in 2nd-year students differs from that in 1st-year students. However, in our studies this difference was not statistically significant.

It is known that short-term memory is closely linked to students' motivation levels, sleep duration, and many other indicators. However, since studying these factors was not planned in our research, we limited ourselves to certain results and interpretations.[15]

Conclusion

Based on the overall analysis of the results obtained, the following conclusions can be drawn. Memory indicators in 1st and 2nd year students change in a wave-like manner throughout the academic year: a notable decline in the pre-examination period, recovery after examinations, and another decline at the end of the academic year. This trend was statistically significant in all groups, indicating the high sensitivity of memory indicators to academic load.

As indicated in the literature, females typically experience stress more intensely; however, this does not exert a strong influence on cognitive effectiveness, including short-term memory. This can be termed the stress paradox. In males, stress levels may be lower compared to females, but cognitive functions (memory, attention) are more sensitive to the effects of stress. This situation was also reflected in our research.

The results obtained are of significant importance in planning the educational process in higher education — for the rational distribution of cognitive load, prevention of fatigue before examination periods, and the proper scheduling of rest periods to facilitate memory recovery.

REFERENCES

[1] V. B. Shapar, A. V. Timchenko, and V. N. Shvydchenko, *Practical Psychology: Tools*. Rostov-on-Don, Russia: Feniks, 2002, 688 p.

[2] A. M. Bodnar, *Psychology of Memory: A Course of Lectures*. Yekaterinburg, Russia: Ural Univ. Press, 2014, 100 p.

[3] U. Zetsche, P.-C. Bürkner, and L. Schulze, “Shedding light on the association between repetitive negative thinking and deficits in cognitive control: A meta-analysis,” *Clinical Psychology Review*, vol. 63, pp. 56–65, 2018.

[4] K. Allen, S. Higgins, and J. Adams, “The relationship between visuospatial working memory and mathematical performance in school-aged children: A systematic review,” *Educational Psychology Review*, vol. 31, no. 2, pp. 509–531, 2019.

[5] J. Sweller, J. J. G. van Merriënboer, and F. Paas, “Cognitive architecture and instructional design: 20 years later,” *Educational Psychology Review*, vol. 31, pp. 261–292, 2019.

[6] A. Baddeley, “Working memory,” in *Memory*, 3rd ed. London, U.K.: Routledge, 2020, pp. 71–111.

[7] J. P. Jamieson, A. E. Black, L. E. Pelaia, and H. T. Reis, "The impact of mathematics anxiety on stress appraisals, neuroendocrine responses, and academic performance," *Journal of Educational Psychology*, vol. 113, no. 6, pp. 1164–1176, 2021.
[8] W. Atiomo, Y. Mbaki, K. Bhardwaj, and P. Hagan, "Academic attainment in international medical students might be optimised by educating them about cognitive load theory," *International Journal of Medical Education*, 2022.
[9] Z. D. Umarkulova and N. A. Askarova, "Mental health problems in medical university students and psychological support measures," *Inter Education & Global Study*, no. 3, 2025.
[10] D. Miller-Cotto and R. Gordon, "Revisiting working memory 50 years after Baddeley and Hitch," *Quarterly Journal of Experimental Psychology*, vol. 78, no. 2, pp. 425–435, 2025.
[11] D. W. Nordstokke and Y. Hindes, "Relationships between first-year student resilience and academic stress," *Behavioral Sciences*, vol. 15, no. 6, p. 772, 2025.
[12] J. Harvey, "Exploring the impact of working memory capacity on academic reading and achievement," *Reading Psychology*, vol. 46, no. 3, pp. 271–293, 2025.
[13] G. A. Miller, "The magical number seven, plus or minus two: Some limits on our capacity for processing information," *Psychological Review*, vol. 63, no. 2, pp. 81–97, 1956.
[14] N. Cowan, *Working Memory Capacity*. New York, NY, USA: Psychology Press, 2005.
[15] R. E. Mayer, *Multimedia Learning*, 2nd ed. Cambridge, U.K.: Cambridge Univ. Press, 2009.