RESEARCH PAPER

Comparative Study on Stress Level, Reaction Time and Working Memory in Video Gamers & Non-Gamers Among Medical Students

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ABSTRACT

Background

Video gaming has emerged as a widely practiced activity among young adults, including medical students who often experience high levels of academic stress. While gaming is commonly used as a recreational coping strategy, its effects on cognitive performance and psychological well-being remain complex and require further investigation.

Aim

To compare perceived stress levels, reaction time, and working memory between video gamers and non-gamers among medical students.

Methods

This comparative cross-sectional study was conducted at Dr. D.Y. Patil Medical College, Pune, from September 2023 to August 2026. A total of 108 first-year medical students were included, comprising 54 gamers (>4 hours/week for at least 6 months) and 54 non-gamers (<4 hours/week or none), matched for age. Perceived stress was assessed using the PSS-14 questionnaire, reaction time using the Tap Reaction Time Test, and working memory using forward and backward digit span tests. Data were analyzed using SPSS version 22, with $p < 0.05$ considered statistically significant.

Results

Age and BMI were comparable between the two groups ($p > 0.05$). Gamers demonstrated significantly lower perceived stress scores (15.96 ± 5.47) compared to non-gamers (28.06 ± 7.93). Reaction time was significantly faster among gamers (243.9 ± 17.53 ms) than non-gamers (307.2 ± 33.05 ms) ($p < 0.0001$). Working memory performance was also higher in gamers, with significantly better scores in both forward (6.63 ± 1.29 vs. 5.85 ± 1.07, $p = 0.00154$) and backward digit span tests (5.02 ± 1.07 vs. 4.41 ± 0.81, $p = 0.00174$).

Conclusion

Video gaming is associated with lower perceived stress, faster reaction times, and improved working memory among medical students. These findings suggest potential cognitive and psychological benefits of moderate gaming.

Keywords: Perceived Stress Score, Reaction Time, Working Memory, Video Gamers

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INTRODUCTION:

Video gaming has rapidly evolved into a mainstream digital phenomenon, cutting across age, gender, and socioeconomic barriers. The widespread availability of smartphones, computers, and gaming consoles has made video games one of the most accessible forms of leisure globally.[1] Recent analyses suggest that gaming now serves not only as a form of entertainment but also as a medium for cognitive stimulation, competition, and social connectivity. Within the academic community, medical students constitute a unique and high-stress population due to their demanding curriculum, extended study hours, and exposure to emotionally taxing clinical environments. These conditions often lead to chronic psychological stress, anxiety, and burnout. Consequently, many medical students resort to video gaming as a strategy for relaxation and stress relief.[2]

Physiological and psychological studies have shown that gaming can have both beneficial and harmful effects on cognitive performance and mental health, depending on the type, duration, and intensity of gaming sessions. [3-5] Action-oriented and competitive games often elicit transient stress responses, whereas casual or strategy-based games can foster relaxation, positive affect, and improved emotional regulation. [6, 7]

The cognitive benefits of gaming are thought to arise from the repetitive demands on attentional control, working memory, and executive function. [8-10] Studies have demonstrated that gamers outperform non-gamers in tasks involving visual tracking, mental rotation, and divided attention [11, 12]. Neurocognitive interventions using video games have also shown enhanced reaction times and processing speed in both young and older adults. [13-15]

However, excessive or maladaptive gaming behaviors have been linked to anxiety, depression, and attentional deficits. [16, 17] The relationship between gaming and stress is complex, and more research is needed to understand the underlying mechanisms.

Medical students academic workload requires high-level executive control, rapid reaction times, and efficient working memory, all of which are cognitive domains potentially influenced by gaming. [18] Evaluating whether gaming habits modulate these parameters could have both educational and psychological relevance.

Stress is a complex psychophysiological response that occurs when perceived environmental demands exceed an individual's adaptive capacity or coping mechanisms.[18] It involves a dynamic interaction between cognitive appraisal, emotional regulation, and physiological activation. Among medical students, stress commonly arises from intense academic workloads, continuous assessments, time pressure, and the emotional demands of clinical training.[2] Gaming can serve as a stress-relieving tool or a potential stressor, depending on the type, duration, and purpose of gaming.[4, 6] Moderate, recreational gaming can provide escapism and psychological recovery, while excessive or compulsive gaming can increase physiological arousal, disrupt sleep, and foster dependence. [16]

Reaction time is a robust index of sensory-motor coordination and central processing efficiency. Gaming has been associated with faster reaction times, particularly in tasks involving visual attention and rapid decision-making. [11, 22] Working memory is a limited-capacity system responsible for temporary storage and manipulation of information necessary for complex cognition. Gaming has been linked to improvements in working memory, particularly in visuospatial and attentional tasks. [8, 9]

Gaming's psychological consequences depend on game characteristics, exposure, and individual differences. Moderate gaming can provide relaxation, social connection, and cognitive stimulation, while excessive or compulsive gaming can lead to psychological harm, including anxiety, depression, and attentional deficits. [16, 17] Aim of the study to compare stress level, reaction time and working memory in video gamers and non-gamers among medical students. This study seeks to bridge this knowledge gap by systematically assessing the impact of gaming on stress, reaction time, and working memory among medical students. The findings may contribute to developing evidence-based recommendations for balanced screen use and wellness promotion in medical education environments.

AIM &OBJECTIVES:

Aim: To compare perceived stress levels, reaction time, and working memory between video gamers and non-gamers among medical students.

Objectives:

1. To compare the stress levels between gamers and non-gamers.
2. To compare the reaction time between gamers and non-gamers.
3. To compare the working memory between gamers and non-gamers.

MATERIAL AND METHODS:

Study Design

The present study was a comparative cross-sectional study comparing stress levels, reaction time, and working memory between video gamers and non-gamers among medical students.

Study Setting and Duration

The study was conducted at Dr. D.Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune, from September 2023 to August 2026.

Sample Size Determination

The sample size was calculated using G*Power software version 3.1.9.4. Based on an effect size of 0.55, an alpha error probability of 0.05, and a power of 80%, the required total sample size was estimated to be 106 participants. Therefore, the study included 54 gamers and 54 non-gamers, maintaining a 1:1 ratio between the groups. Gamers and non-gamers were matched equally according to age.

Study Population

Medical students age 18-25 years were categorized into gamers (playing >4 hours/week for 6 months) and non-gamers (playing <4 hours/week or not at all), matched for age.

Ethical Considerations

Ethical clearance was obtained from the Institutional Ethics Sub-Committee of Dr. D.Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune. Written informed consent was obtained from participants, ensuring confidentiality and adherence to the Declaration of Helsinki and ICMR guidelines.

Inclusion &Exclusion Criteria:

Inclusion criteria:

1. Healthy students between age group of 18 to 25 years of either sex
2. Age matched students not playing any video games of either sex for control.
3. Individuals who are categorized as "gamers" according to a survey conducted before the commencement of the study.
4. Gamers' will be identified as such if they have a video game playing time of more than 1 hour daily, or more than 4 hours in a week.

Exclusion criteria:

1. Students with any physical deformity
2. Students who are diagnosed with any psychological disorder and are on medication.
3. Students who are diagnosed with any endocrine or metabolic disorder and are on medications for it.
4. Students on any medications.
5. Individuals with colour-blindness.
6. People who play Violent games, stress inducing games or multiplayer games.

Data Collection Procedure

Participants underwent assessments in a quiet environment:

1. **Stress Levels:** Perceived Stress Scale (PSS-14) questionnaire.[19]

2. **Reaction Time:** Tap Reaction Time Test (Human Benchmark platform.[20]

3. **Working Memory:** Digit Span Test (forward and backward recall [21]

Statistical Analysis

Data were analyzed using SPSS version 22 software. Descriptive statistics (mean ± SD) and inferential statistics (unpaired t-test, Mann-Whitney U test) were applied, with $p < 0.05$ considered significant.

OBSERVATION & RESULT

The participant was divided in to two groups (Gamers: 54 & Non-Gamers: 54). Out of 54 gamers 25 (46.3%) were male and 29 (53.7%) were female participant, In non-gamers 10 (18.52%) were male and 44 (81.48%) were female.

Table 1: Descriptive statistics of age, BMI, stress levels, reaction time & working memory

Variables	Gamers		Non-Gamers	
	Range (Min. - Max.)	Median (IQR)	Range (Min. - Max.)	Median (IQR)
Age(yrs)	18 - 22	19 (18-19)	18 – 22	19 (18-20)
BMI(Kg/m$^{2)}$	17.19 - 31.91	22.21 (19.4-24.45)	17.58 - 32.79	21.05 (19.47-23.7)
PSS Score	6 – 29	16 (12-20)	13 – 46	28.5 (23-33)
Reaction Time Test(ms)	210 - 288	239 (233-255)	266 - 421	297 (288-319)
Digit Span Test (Fwd)	4 – 9	7 (6-7.75)	4 – 9	6 (5-6)
Digit Span Test (Rev)	3 – 8	5 (4-6)	3 – 7	4 (4-5)

IQR: Inter-Quartile Range

The above table shows the descriptive statistics of age, body mass index (BMI), perceived stress scores, reaction time, and working memory parameters among gamers and non-gamers medical students. **Age** range (18yrs – 22yrs) is same in both groups with an identical median 19 yrs. of age, indicating effective age matching. The median **BMI** was marginally higher among gamers at 22.21 (IQR: 19.4–24.45) compared with 21.05 (IQR: 19.47–23.7) among non-gamers. The **perceived stress** levels in gamers had a lower range of PSS scores (6–29) with a median value of 16 (IQR: 12–20). In contrast, non-gamers showed a broader and higher range of scores (13–46) with a median value of 28.5 (IQR: 23–33), indicating gamers perceive less stress. **Reaction time** is faster in gamers, median is 239 ms with inter-quartile range 233-255 milliseconds than non-gamers, median with IQR 297 (288-319)

millisecond. **Working memory** assessed by Digit Span Tests, shows almost similar range (4-9) for forward and in reverse range is slightly wider in gamers (3-8) as compare to non-gamers (3-7). Median score is higher for both forward (7 vs. 6) and reverse (5 vs. 4), the interquartile ranges indicate moderate variability within each group. Overall, gamers demonstrate lower perceive stress, faster reaction time and superior working memory compared to non-gamers.

Table 2: Comparing mean value of age, BMI, stress levels, reaction time & working memory between gamers & non-gamers subjects

Variables	Gamers	Non-Gamers	Mann Whitney U test/ t-test	P-Value	Significance
Age(yrs)	18.94 ± 1.0	18.94 ± 1.07	-0.172*	0.86342*	Not Significant
BMI(kg/m2)	22.55 ± 3.64	21.99 ± 3.59	0.805	0.42267	
PSS Score	15.96 ± 5.47	28.06 ± 7.93	-9.23	< 0.0001	Significant
Reaction Time Test(ms)	243.9 ± 17.53	307.2 ± 33.05	-12.434	< 0.0001	
Digit Span Test (Fwd)	6.63 ± 1.29	5.85 ± 1.07	-3.164*	0.00154*	
Digit Span Test (Rev)	5.02 ± 1.07	4.41 ± 0.81	-3.131*	0.00174*	

***: Using Mann-Whitney U test**

Table 2 shows the comparison between gamers and non-gamers in terms of **mean values** of age, body mass index, perceived stress scores, reaction time, and working memory. It was observed that the mean value of age in both gamers and non-gamers was similar. Gamers had an **average age** of 18.94 ± 1.0 years, while non-gamers had an average age of 18.94 ± 1.07 years, and it was found that there were no significant difference in the ages of gamers and non-gamers, with p-value = 0.86342. **The mean value of body mass index** was also similar in gamers and non-gamers, i.e., 22.55 ± 3.64 kg/m² and 21.99 ± 3.59 kg/m², respectively, and it was also found not significant with p-value = 0.42267. Gamers showed lower perceived stress scores, i.e., 15.96 ± 5.47, while non-gamers showed high perceived stress scores, i.e., 28.06 ± 7.93. It was a highly significant difference in mean of perceived stress scores between gamers and non-gamers, as determined by unpaired t-test, where p-value < 0.0001.

Similarly, **reaction times** also showed significant differences between the two groups. Gamers showed a mean reaction time of 243.9 ± 17.53 milliseconds, while non-gamers showed a relatively slower mean reaction time of 307.2 ± 33.05 milliseconds. This difference was highly statistically significant (p < 0.0001), showing that reaction times for gamers were relatively faster.

Regarding **working memory**, the scores for the forward digit span test showed a relatively higher mean score for gamers, i.e., 6.63 ± 1.29, compared to 5.85 ± 1.07 for non-gamers. This difference was statistically significant (p = 0.00154), showing relatively better working memory for gamers. When the reverse digit span test was performed, the mean scores for gamers were 5.02 ± 1.07, while the mean scores for non-gamers were relatively low at 4.41 ± 0.81. This difference was also statistically significant (p = 0.00174), showing relatively better working memory manipulation for gamers.

DISCUSSION

Over the past 20 years, digital gaming has changed dramatically and grown to be a popular pastime among teenagers and young adults. Video game exposure has significantly expanded due to the quick development of computer and smartphone technology. This change has prompted scholars in the behavioural sciences, psychology, and neuroscience to look at how gaming could affect psychological health and cognitive performance. The purpose of this study was to compare the perceived stress levels, reaction time, and working memory performance of gamers versus non-gamers.

The present study ensured comparability between gamers and non-gamers in terms of demographic characteristics, particularly age. Both groups had nearly identical age distributions, with a median age of 19 years and most participants falling within the 18–22-year range. This similarity reduces the likelihood of age acting as a confounding factor. Comparable findings have been reported in previous studies. **Toril et al. (2016)**[13] and **De Rosa et al. (2025)**[22] both emphasized the importance of balanced age distributions when examining cognitive outcomes,

while **Kurniawan et al. (2024)**[23] also reported a concentration of participants within a young adult age group.

Body mass index (BMI) was also similar between gamers and non-gamers in the present study, with both groups falling within the normal range. These findings align with previous research. **Falbe et al. (2017)** [24]reported normal BMI values among young adults, and **Kurniawan et al. (2024)**[23] observed similar results among mobile esports players, despite prolonged gaming durations. These findings suggest that moderate gaming behavior may not significantly affect body weight in young adults.

A key finding of the present study was the difference in perceived stress levels between gamers and non-gamers. Gamers reported significantly lower stress scores (median = 16; mean = 15.96 ± 5.47) compared to non-gamers (median = 28.5; mean = 28.06 ± 7.93), with high statistical significance ($p < 0.0001$). These findings suggest that gaming may serve as a stress-relieving activity, allowing individuals to temporarily escape daily stressors. **Mustafa and Lokesh (2022)**[25] reported similar results, indicating lower stress levels among gamers and proposing that gaming may function as a coping mechanism.

The analysis of reaction time revealed significant differences between the two groups. Gamers demonstrated faster reaction times, with a median of 239 milliseconds compared to 297 milliseconds in non-gamers. Mean values also showed a significant difference (243.9 ± 17.53 ms vs. 307.2 ± 33.05 ms, $p < 0.0001$). These findings are consistent with existing literature, which attributes faster reaction times in gamers to enhanced visuomotor coordination and rapid stimulus–response processing. **Qazi and Matharu (2023)**[26] reported similar improvements in reaction time following exposure to action video games.

Working memory performance, assessed using forward and backward digit span tests, was also higher among gamers. Gamers achieved a median forward digit span of 7 compared to 6 in non-gamers, and a backward digit span of 5 compared to 4. Mean scores were significantly higher in gamers for both forward ($p = 0.00154$) and backward ($p = 0.00174$) tests. These results suggest that gaming may enhance both the storage and manipulation components of working memory.

CONCLUSION:

The study contributes to the growing body of research on the cognitive and psychological effects of video gaming among young adults. It highlights the potential of gaming as both a cognitive enhancement tool and a stress management strategy, while also underscoring the importance of moderation. Future research should explore long-term effects, differences across game genres, and individual variability in response to gaming.

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