Effect of Mobile Phone Games on Reaction Time

DOI: 10.52629/jamsa.v10i1.362

Kamakshi Bansal (1), Ashish Goel (2), Afzal Parvez Khan (1)

1- Undergraduate Student, University College of Medical Science, India

2- Professor, Department of Medicine, University College of Medical Science, India

Corresponding Author:

1- Undergraduate student,

University College of Medical Sciences, India

bansalkam1999@gmail.com

Abstract:

Objectives To observe an association between playing mobile games and reaction time among students aged 18-25 years. Variation in reaction time with types of games, time spent on gaming, age of starting to play, and time of day was studied.

Methods This is a case-control study in which 94 participants studying MBBS at the University College of Medical Sciences were included after they consented to participate. Their gaming status was recorded and their reaction time was tested using the tap reaction time test and Reaction time ruler test. Unpaired t-test was applied to compare the reaction time of gamers and non-gamers.

Results The average reaction time was 488 milliseconds (+12 milliseconds) for gamers and 535 milliseconds (+20 milliseconds) for non-gamers with the tap reaction time test. With the reaction time ruler test, the average reaction time of gamers was 182 milliseconds (+30 milliseconds) and 196 milliseconds (+30 milliseconds) for non-gamers. The first reading was found to be higher than the subsequent readings. The age of commencement of playing did not significantly affect the reaction time. The increase in the variety of games and the number of days a person plays per week yielded better reaction times. The time of the day significantly affected the tap reaction time test but not the reaction time ruler test.

Conclusions People qualifying as gamers record lower response times than non-gamers. This may enable designers to create games fit for individuals with slower response time. Gaming can also benefit medical professionals by enabling them to react much faster in life-and-death situations and

increasing their proficiency in the daily management of patients.

Keywords: Gamers, Response time, Smartphone, Students, Technology.

Introduction

In recent times, technology has influenced different circles of our lives like never before in our history. Technology has had an impact on many things and the gaming sector is no exception.

Regular gamers are likely to play a more extensive scope of game classes than non-daily gamers. (1) With technological advances occurring every day in the gaming industry, it is sheltered to state that gaming is setting down deep roots.

Reaction time is defined as the period of time between the detection of a stimulus at a sensory receptor and the performance of the appropriate response by the effector organ. (2) The agility and the ability to deal with different stimuli and situations like driving are better in people who have a good reaction time. Good response time enables us to be agile and proficient with regards to reacting to improvements and circumstances like playing sports, having a discussion, etc. (3–5) In a study conducted on 711 individuals, it was found that people involved in Virtual reality gaming had a 20 percent decrease in reaction time as well as an increase in accuracy. (6) Dye et al. also proved that involvement in video gaming leads to a reduction in reaction time without compromising on accuracy and the increase in speed was observed in various tasks of daily life besides gaming. (7)

Different studies have shown that people who play more video games tend to have a better reaction time. (8) A faster response time while playing virtual reality games definitely translates into a better reaction time in daily life. Certain studies have found that playing computer games helped improved a wide assortment of general aptitudes that can help with regular exercises like performing various tasks, perusing little print, monitoring companions in a group, and exploring around town because of the expanded affectability of surroundings in gamers. (9)

In the field of medicine, quick response is almost always essential in making life-and-death decisions, especially in an emergency setting. Since reaction time can be enhanced using gaming, it can be used by medical students as well as doctors to help them react and make critical decisions faster.

A study of the relationship between reaction time and different games

may help developers make suitable games for people and will also help in understanding the positive effects of gaming.

The primary objective of this study was to observe an association between playing mobile games and reaction time among students aged 18-25 years. The variation in reaction time with the types of games played, time spent on playing games, the age at which the person started playing as well as the time of the day at which the games were being played were also studied.

Material and Methods

This is a case-control study in which students of the University College of Medical Sciences, Delhi aged between 18-24 years were included after they consented to participate. No exclusion criteria were defined. A sample size of 94 was taken in this case-control study. To calculate the sample size, we used a case-control design and after reviewing previous studies, (10) we found that the mean reaction time in gamers is 301.836 milliseconds and the mean reaction time in non-gamers is 346.326 milliseconds with standard deviations of 10.207 and 5.595 respectively. Using these values in Stata 13 software, we calculated the sample size of 34 gamers to 34 controls to correctly identify this sample size with a power of 80% and with an acceptable error limit of 0.05. In addition, we also evaluated and assessed the data in the statistical analysis plan by doing a regression analysis using the amount of time spent on gaming as a linear variable and using the co-variates and the risk factors envisaged in the study as independent variables. We invited students to complete an online screening form using the Google platform. Based on the responses to this form, we included all the responders who qualified as per our definition of "gamers". Then we included age, gender, and semester-matched students in a 1:1 ratio as "non-gamers".

While there were no previous studies available to determine what percentage of students in medical schools would qualify the definition of gamers, our best estimate based on informal conversations with students was that almost one in three students indulges in playing games enough to fulfill our definition. In addition, we assumed that only about 50% of students would respond to our initial screening request, and estimated that to identify 34 gamers, we were required to reach out to 204 students. Hence, we planned to reach out to students across two student batches (from years 2017-18, a total strength of 300) to enable us

to identify 34 responders who are "gamers".

A questionnaire was made to assess the use of mobile games by the students. All the data that was required for the study was included in the questionnaire. Their reaction time was calculated using two different approaches to reduce bias. The first method, i.e., tap reaction time was calculated using an online app "Human Benchmark" (11). The participant was asked to tap the screen as soon as the color on the screen changed. Five attempts were recorded and the average was calculated. In the second test (reaction time ruler test), the time taken by the participant to react by measuring the distance the ruler drops before the participant caught it was tested. Five attempts were recorded and the average was taken. From this information, the reaction time was formulated.

Unpaired *t*-test was applied to compare the reaction time of gamers and non-gamers. A gamer was defined as a person who engaged in gameplay for more than four hours a week irrespective of the type of game. On the other hand, a non-gamer was defined as a person who didn't engage in gameplay or played for less than four hours a week. Effect of various parameters on the reaction time was also observed:

- Age of commencement of game playing
- Time spent per day
- Time spent playing in a week
- Time of the day at which the games are mostly being played
- Different genres (Action, Board, Card, Casino, Education, Music, Puzzle, Racing, Simulation, Sports, Strategy, Trivia, Word)
- Type of games played (Single-player, Two players, Multiplayer)

The study was approved by the Institutional Ethics Committee with reference number IEC-HR/2019/38/5R. All the personal data collected was kept completely confidential.

Results

Out of the 300 students to which the screening questionnaire was administered, 160 responded. Of these 160 responders, 47 gamers were identified based on the above-mentioned criteria. Non-gamers were matched with gamers based on age, gender, and semester.

In our study sample, 88 of the 94 participants were males and six were females. The mean age was 19.6 (+ 1.0). All the respondents had their own smartphones and 79.8% played games on them. The median age for starting to play was 11-15 years. Non-gamers play for less than 2 days a week whereas Gamers played almost daily. It was seen that Gamers preferred playing at night whereas the afternoon was preferable for non-gamers. The evening was a common time in which both gamers and non-gamers enjoyed playing. Action was the most preferred genre. Single-player and multiplayer games were preferred over two-player games. The basic demographic details have been summarized in **Table 1**.

Tap Reaction Time

The average reaction time of gamers was found to be 488 milliseconds (+12 milliseconds), whereas for non-gamers the mean reaction time was 535 milliseconds (+20 milliseconds). The first of the five readings taken was found to be higher than the rest of the readings. **(Figure 1)**

The effect of various parameters on reaction time was also studied. There was no significant relationship (p>0.05) between tap reaction time and the age of starting to play or the number of days spent gaming per week. There was a significant impact (p=0.002) of the time at which game playing is preferred on tap reaction time. The variety of games played had no influence on the tap reaction time of individuals.

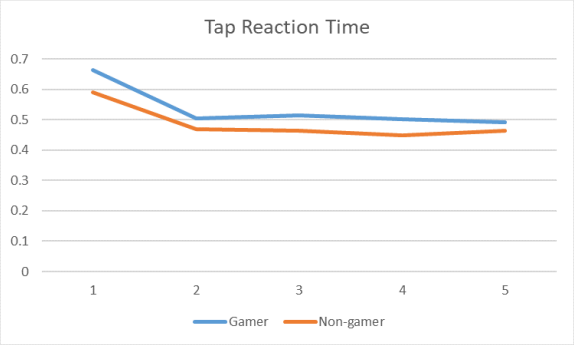

Figure 1 Pattern in readings of Tap Reaction Time in gamers and non-gamers.
Legend: x-axis indicates the reaction time noted using tap reaction time in seconds; y-axis indicates the order of readings, 1 referring to the first reading, 2 to the second, and so on.

The reaction time was non-gamers (red) was lower than that of gamers (blue). Also, the first reading of both gamers and non-gamers in tap reaction time test was higher than the consecutive 4 readings.

Reaction Time Ruler Test

The average reaction time of gamers was found to be 182 milliseconds (+30 milliseconds), whereas for non-gamers the mean reaction time was 196 milliseconds (+30

milliseconds). The first of the five readings taken was found to be higher than the rest of the readings. **(Figure 2)**

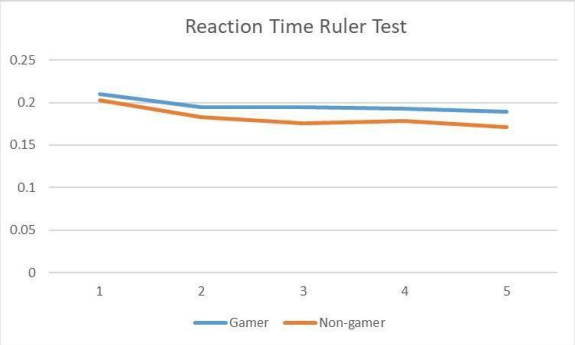

Figure 2 Pattern in readings of Reaction Time Ruler Test in gamers and non-gamers.

Legend: x-axis indicates the reaction time noted using the reaction time ruler test in seconds; y-axis indicates the order of readings, 1 referring to the first reading, 2 to the second, and so on.

The reaction time was non-gamers (red) was lower than that of gamers (blue). Also, the first reading of both gamers and non-gamers in the reaction time ruler test was higher than the consecutive 4 readings.

There was no significant relationship ($p>0.05$) between tap reaction time and the age of starting to play. The number of days spent gaming per week negatively correlated with the reaction time ruler test ($r = -0.270$; $p=0.008$). There was no significant association of the time at which game playing is preferred on the reaction time ruler test. The variety of games played influenced the reaction time of individuals ($r = -0.245$; $p=0.017$). There was a significant difference in the means of reaction times of players who played two-player games ($p=0.002$) and multiplayer games ($p=0.011$) versus those who did not. Playing single-player games did not affect reaction time. The reaction time ruler test also negatively correlated ($r = -0.221$; $p=0.032$) with the age of the participants.

Reaction times of gamers and non-gamers were compared using unpaired t-test. There was no significant difference in the means of reaction times when compared using the tap reaction time test. On the other hand, Reaction time ruler test results significantly ($p=0.013$) differed between the two groups.

The results of the regression model are given in **Table 2**.

Table 1. Basic demographic details of the participants

Characteristics	Observation
Total participants • Number of gamers • Number of non-gamers	**94** 47 (50%) 47 (50%)
Gender of the participants • Number of males • Number of females	 88 (93.6%) 06 (6.4%)
Semester • 2nd semester • 4th semester	 56 (59.57%) 38 (40.43%)
Mean age of participants (in years)	19.6 + 1.0
Number of participants with a smartphone	94 (100%)

Table 2. Linear Regression analysis for average Reaction time ruler test readings

	Exposure of interest	**Confounders**	
	Gaming status	Age	Gender
Crude	-13.7 (-25.8, -1.6)		
Adjusted	-13.6 (-25.5, -1.7)	-6.5 (-12.5, -0.5)	6.8(-17.6, 31.2)

Legend: Data is presented as the coefficient of the individual independent variable in the multivariable linear regression with the respective dependent variable.
*p-value of <0.05, considered significant

Discussion

In this case-control study of ninety-four young adults studying at the University College of Medical Sciences, Delhi, the mean reaction time of Gamers was found to be higher than the mean reaction time of non-gamers in both the tap reaction time test and the reaction time ruler test. Against the assumption, it was seen that the age of commencement of playing did not significantly affect the reaction time. The increase in the number of days a person plays per week yielded better reaction times. Also, people playing a wide variety of games had better reaction times than those who just play the same type of game every day. Time of the day at which the games are mostly being played significantly affected the tap reaction time test but had no effect on the reaction time ruler test.

Richardson et al. studied the differences in Reaction times in video game and non-video game players in 87 healthy adults aged 18-40 years in Washington using the visual oddball detection task as the stimulus and mouse-click as the reaction. They observed that the average reaction time of Gamers (people who played more than 4 hours a week) was significantly more than the non-gamers and the difference in reaction time due to gender was not significant. Another study by Rosenbaum RA found that the response time was significantly different (p=0.007) between gamers and non-gamers. (10) The findings of these studies are consistent with the findings of our study.

Bakar et al studied the effects of 12 weeks of exergaming using Xbox Kinect on the reaction time of adults (aged 18-40) in Turkey in 2018. Auditory and visual reaction times were measured using auditory and visual reaction time machines (Newtest 1000). They found that there was a significant difference in the visual reaction times at both baseline and post-intervention assessments (p=0.032). (12) This study had a wider age group than our study, which includes young adults (aged 18-25 years) only. Our study only tested the visual reaction time and was mainly focused on mobile gaming which does not include much physical activity.

Another study that analyzed the data from seven studies found that in gamers there is no speed-accuracy trade-off (the accuracy decreases with a decrease in reaction time) and also the speed-of-processing increases in not just gaming but also in other spectrums of life. (7) Gaming is also known to have a positive impact on visual cognition,

with gamers usually having better hand-eye coordination, increased visual processing in the periphery, and enhanced visuospatial memory. (13) All of our study findings can be explained by the above-mentioned studies.

Strengths and Limitations

This is the first study observing the impact that gaming has on the reaction time of medical sciences students thereby opening up new horizons for future improvements in medicine by incorporating gaming in training. While there have been previous studies to observe the impact that the number of hours spent on gaming has on the reaction time of individuals, the present work examines this relationship in more detail by studying the impact of several other parameters like the age of commencement of playing, time of the day at which gaming is preferred, variety of games played and types of games played. Also, most studies have used computer-based tests that could have shown bias towards gamers as they would be familiar with the interface, ours is the first study using the reaction time ruler test that tests the reaction time in a more realistic environment.

Conclusions

Gaming is frequently seen in a negative light, particularly by guardians and educators of kids. This investigation builds up the reality that gaming has some constructive outcomes as well, especially response time which is the main parameter being studied. The statistical distinction seen between gamers and non-gamers affirms the first theory that people qualifying as gamers would essentially record lower response times than non-gamers.

Declarations

Ethics approval and consent to participate

Not applicable.

Conflict of interests

There was no conflict of interest.

Acknowledgement

The corresponding author would like to thank the Indian Council of Medical Research for providing me with the opportunity of carrying out this research project under the Short-Term Studentship Program 2019.

Authors' contributions

YX Lee was the sole contributor of the manuscript

References

1. Quwaider M, Alabed A, Duwairi R. The Impact of Video Games on the Players Behaviors: A Survey. Procedia Comput Sci. 2019 Jan 1;151:575–82.
2. Reaction time [Internet]. Oxford Reference. [cited 2022 May 14]. Available from: https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100406536
3. Whitbourne SK, Ellenberg S, Akimoto K. Reasons for playing casual video games and perceived benefits among adults 18 to 80 years old. Cyberpsychology Behav Soc Netw. 2013 Dec;16(12):892–7.
4. Singh DKA, Rahman NNA, Seffiyah R, Chang SY, Zainura AK, Aida SR, et al. Impact of virtual reality games on psychological well-being and upper limb performance in adults with physical disabilities: A pilot study. Med J Malaysia. 2017 Apr;72(2):119–21.
5. Li L, Chen R, Chen J. Playing Action Video Games Improves Visuomotor Control. Psychol Sci. 2016 Aug;27(8):1092–108.
6. Recent Data Suggest Learning in Virtual Reality Leads to Faster Reaction Time and Better Performance [Internet]. Training Industry. 2017 [cited 2022 May 14]. Available from: https://trainingindustry.com/blog/learning-technologies/recent-data-suggest-learning-in-virtual-reality-leads-to-faster-reaction-time-and-better-performance/
7. Dye MWG, Green CS, Bavelier D. Increasing Speed of Processing With Action Video Games. Curr Dir Psychol Sci. 2009;18(6):321–6.
8. Guzmán JF, López-García J. Acute effects of exercise and active video games on adults' reaction time and perceived exertion. Eur J Sport Sci. 2016 Nov;16(8):1197–203.
9. Zirawaga VS, Olusanya AI, Maduku T. Gaming in Education: Using Games as a Support Tool to Teach History. J Educ Pract. 2017;8(15):55–64.
10. Rosenbaum A, Burt D. Response Time and Puzzle Solving Skills in Gamers vs. Non- gamers. Int J Exerc Sci Conf Proc [Internet]. 2017 Feb 10;2(9). Available from: https://digitalcommons.wku.edu/ijesab/vol2/iss9/12
11. Human Benchmark [Internet]. [cited 2022 May 14]. Available from: https://humanbenchmark.com/

12. Bakar Y, Tuğral A, Özel A, Altuntaş YD. Comparison of a 12-Week Whole-Body Exergaming Program on Young Adults: Differentiation in Flexibility, Muscle Strength, Reaction Time, and Walking Speed Between Sexes. Clin Nurs Res. 2020 Sep;29(7):424–32.
13. Green CS, Bavelier D. Action video game modifies visual selective attention. Nature. 2003 May 29;423(6939):534–7.