Masthead Logo **Pakistan Journal of Neurological Sciences (PJNS)**

Volume 14 | Issue 1 Article 8

3-2019

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COGNITIVE AND BRAIN PLASTICITY BY PERFORMING SMALL SCALE BRAIN ACTIVITIES IN YOUTH

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Date of submission: *December 17, 2018* ***Date of revision:*** *February 17, 2019* ***Date of acceptance:*** *February 26, 2019*

ABSTRACT

Background: Is playing video game really a waste of time? No…!!! It's merely a simple way of making the brain physiology better, smarter and faster. Great quality games, which are testing, enlightening, and retaining, can make learning charming and compelling. Studies have shown that people who are engaged in playing video games have more grey matter in their brains which results in boosting up their cognitive skills.

AIMS AND OBJECTIVES: This study was proposed to find out the enhanced cognitive skills of the brain acquired by playing small scale brain activities.

METHODOLOGY: A cross-sectional study conducted on 80 participants (age between 18 to 25years) of both genders recruited by convenience based sampling and equally divided into two groups: gamers and non-gamers. They were asked to fill the questionnaire and to assess their intellectual potentials six tests were performed namely vision sharpness, subitizing, mind alertness, multi-tasking, decision making and memory. Data analysis was done by SPSS version 22.

RESULT: The results showed that the mean of vision sharpness test for gamer group 7.96±1.83 and a non-gamer group 4.93±1.77, the mean of multi-tasking test 12.79±2.03 and 10.11±2.06 of both groups, mean memory test of gamer 11.18±2.97 and non-gamer 8.11±2.60. The mean subitizing test is 20.66±2.58 of gamer and 12.88±5.02 of non-gamer. All the tests showed statistically significant difference between gamer group and non-gamer group with the p-value < 0.05.

CONCLUSION: It was concluded that playing video games can be a significant tool to mold an inefficient brain to a skilled one.

KEYWORDS: Subitizing, vision sharpness, mind alertness, decision making, multi-tasking, cognitive skills

INTRODUCTION:

A videogame is "a diversion played by electronically controlling pictures delivered by a PC program on a screen or other display"(Perez-Marcos, 2018).these small scale brain activities are designed with two aims: enjoyment and sustained player engagement that integrates goal, rules, challenges, a feedback system and voluntary participation (Anguera & Gazzaley, 2015) Video game play is an extremely mainstream leisure activity.(Ballesteros, Voelcker-Rehage, & Bherer, 2018) Video games are turning into an inexorably focal piece of our social lives, affecting on different parts of regular daily existence, for example, our utilization, networks, and character arrangement.(Muriel & Crawford, 2018) Video games are now an everyday part of childhood and adolescence(Olson, 2010). Video games are winding up progressively famous and compelling in present day society.(Kerr et al., 2019).Great quality games, which are testing, enlightening, and retaining, can make learning charming and playing video games for 2 to 3 hours a day develop cognitive skills efficiently

(Durkin, Boyle, Hunter, & Conti-Ramsden, 2015) .Video games are presently a pervasive type of excitement that has periodically pulled in negative consideration. Video games have likewise been utilized to test intellectual capacity, as restorative mediations for neuropsychiatric scatters, and to explore mechanisms of experience-subordinate structural brain changes. Video games can likewise be helpful as neuropsychological assessment tools.(Shams et al., 2015).The brain is the vital organ for adaptation to skills, containing stressors, which are proficient of changing brain structural design as well as fluctuating systemic function via neuroendocrine, autonomic, immune, and metabolic systems.(McEwen, 2016).The possibility that playing computer games can encourage the advancement of cognitive skills was expressed over 30 years back in Loftus and Loftus (1983, p. 121) classic book, Mind at Play(Mayer, Parong, & Bainbridge, 2019).Scientists are progressively utilizing cognitive training platforms and video games to examine its effect on cognition and cerebrum versatility. (Ballesteros et al., 2018) There are numerous instances of off-the-shelf video games prompting significant enhancements in an assortment of perceptual and cognitive capacities. Such as, Green and Bavelier (2003) discovered that preparation tender foots for 10 h on an activity video game improved execution on enumeration, valuable field of view, and attentional squint undertakings when contrasted with members prepared with a non-action video game. Basak et al. (2008) discovered that playing a continuous procedure amusement improved executive control as estimated by task exchanging, short term memory, and thinking in more established grown-ups. (Deveau, Jaeggi, Zordan, Phung, & Seitz, 2015).Cognitive training, physical activity, and exercise have often been reported to improve cognitive performance in adults.(Bherer, 2015) Psychologically studies have shown that those who play video games have increased grey matter in the hippocampus, orbit frontal cortex, dorsal cingulated, and the cerebellum.These regions of brain are associated with memory formation, sensory information, strategic planning, decision making, mind alertness, muscle control and speech. Increase in grey matter in these regions, strengthen the associated skills. (Stewart et.al 2014).Video games already shows crucial devices as a wellspring of stimulation, and are soon expected to become basic likewise in another fields, including the emotional wellness panorama (Granic, Lobel, & Engels, 2014) Videogames can foster learning at multiple levels (cognitive, navigation, concentration, physical) Physiologically, dopamine is released in the body which creates a sensation of pleasure and award driven learning. It motivates the gamers to bring to the next level. Another hormone, oxytocin is released from hypothalamus into the body which increases the feeling of unity and team work ability. So video game is a simple form of exercise for the brain which makes it work efficiently..(Stanmore, Stubbs, Vancampfort, de Bruin, & Firth, 2017).Amusingly, playing videogames can create structural changes in the brain, such as gray matter increase and hippocampal formation, which could be utilized to neutralize known risk factors in neurological disorders(Kühn, Gleich, Lorenz, Lindenberger, & Gallinat, 2014).Cognition can be comprehensively defined as the actions of the brain engaged in understanding and functioning in our outside condition. As it is commonly acknowledged that cognition requires different mental procedures, this broader concept has been theoretically divided into multiple 'cognitive domains'. Although definitions differ, and the boundaries between domains often overlap, examples of distinct regions of cognitive functioning include the processes for learning and remembering verbal and spatial information, attentional capacities, response speed, problem-solving and planning .(Stanmore et al., 2017)

METHODOLOGY

In this cross sectional study we investigated the developing field of cognitive training through particular kinds of intelligent computerized media: those structured basically for excitement ('video games') and those made with the end goal of intellectual upgrade ('cognitive activities').(Anguera & Gazzaley, 2015) .80 healthy participants (age between 18 to 25years) of both genders were recruited by convenience based sampling. participants were equally divided in two groups 1st Gamer group (who are regularly playing video games at least 3 hours per day from last three years) and 2nd Non Gamer group (those who are not playing video games regularly).After taking the consent both groups were asked to fill the self-administered questionnaire and assessed their intellectual potentials by six tests which were performed namely vision sharpness, subitizing, mind alertness, multi-tasking, decision making and memory. Data analysis was done by SPSS version 22. The tools which were utilized to conduct the test were digital media, e.g., tablets, computer and cell phones. P-value of <0.05 was considered as the level of significance.The following 6 test were conducted.

1. VISION SHARPNESS TEST:

Ten trials of this test were performed on both groups to determine the VISION SHARPNESS by spotting the differences between the two same pictures which having slight difference.

2. **SUBITIZING:**
   Ten trials of this SUBITIZING test were performed on both groups which basically used to check the ability of the subjects to perceive or count the things at a glance.

3. **MIND ALERTNESS TEST:**
   Ten trials of this test performed namely MIND ALERTNESS in which the participants were directed to play a video game in which he/she had to recognize the direction of the arrows in a given time.

4. **MULTITASKING TEST :**
   The 4th test was MULTITASKING, in which the subject had to watch a video and draw diagrams simultaneously and afterwards 15 questions were asked regarding the video which he/she had to answer.

5. **DECISION MAKING:**
   The 5th test was DECISION MAKING, in which the subject had to match or unmatched the current picture with the previous one in the game in least possible time. 15 trials of this test performed on both groups.

6. **MEMORY TEST:**
   Lastly, the test which was performed is MEMORY in which 18 objects were shown to participants and then 30 seconds were given to recognize and write the names of those objects.

RESULTS:

Results indicated that mean age of participants was 22.33±1.34 years and it also reported that out of 80 participants females were slightly larger in number 56% and then male 44%.The result of the tests which were conducted to prove the mental abilities of the gamers and the non-gamers illustrates that the gamers have enhanced cognitive skills in comparison with the non-gamers. The results showed that the mean of vision sharpness test for gamer group 7.96±1.83 and a non-gamer group 4.93±1.77, the mean of multi-tasking test 12.79±2.03 and 10.11±2.06 of both groups, mean memory test of gamer 11.18±2.97 and non-gamer 8.11±2.60. The mean subitizing test is 20.66±2.58 of gamer and 12.88±5.02 of non-gamer. All the tests showed statistically significant difference between gamer group and non-gamer group with the p-value < 0.05.(Table 1). The study shows that the main reasons for not playing video games are that about 48.15% people have no interest in playing video games while, 37.04% people have no time for it .Moreover, 11.11% subjects consider it as a waste of time and about 3.70% people don't want to utilized their brain.(Figure 1)The study also depicts that the reason for which people spend time on playing video games are 33.96% people are fond of video games, 30.19% people play videos games just for fun and to relax their minds from hectic routine. Furthermore, about 5.66% subjects consider it as their addiction.(Figure 2).

TABLE 1: The Results of The Tests Carried Out on Gamers and Non-Gamers.

TESTS	GROUP	MEAN	STANDARD DEVIATION	P -VALUE	MEAN DIFFERENCE
Vision Sharpness	Gamer	7.96	1.829	0.000	3.036
	Non Gamer	4.93	1.774	0.000	3.036
Subitizing	Gamer	20.66	2.58	0.000	7.771
	Non Gamer	12.88	5.01	0.000	7.771
Mind Alertness	Gamer	9.34	0.68	0.000	1.182
	Non Gamer	8.16	1.78	0.002	1.182
Multi-Tasking	Gamer	12.79	2.032	0.000	2.68
	Non Gamer	10.11	2.06	0.000	2.68
Decision Making	Gamer	9.27	0.74996	0.483	-1.572
	Non Gamer	10.85	16.29	0.620	-1.57
Memory	Gamer	11.18	2.97	0.000	3.07
	Non Gamer	8.11	2.606	0.000	3.07

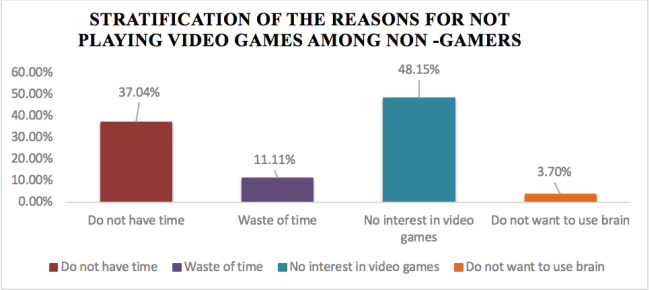

FIGURE 1: Demonstrating the Reasons for not Playing Video Games

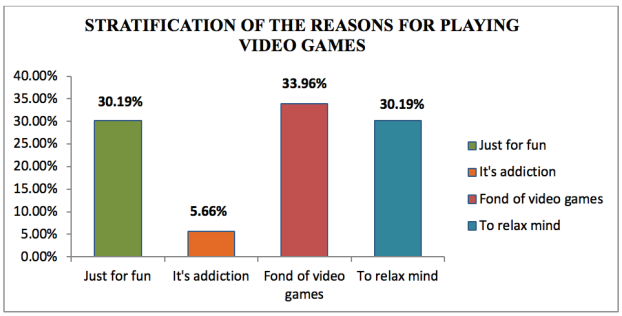

FIGURE 2: Demonstrating the Results for Playing Video Games

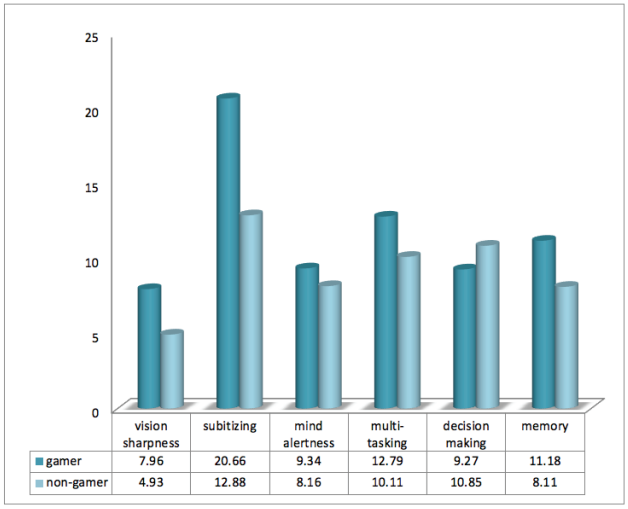

FIGURE 3: Independent Sample t Test Results of All tests in Both Groups

DISCUSSION:

The current study evaluated the enhanced skills of the brain acquired by playing video games. People are being getting mentally relaxed, feeling fun and improved self-esteem by playing video games and it's a good source of fun.Previous studies illustrates that playing action games induces changes in a number of sensory, perceptual, and attentional abilities that are important for many tasks in spatial cognition. These basic capacities include contrast sensitivity, spatial resolution, the alert visual field, enumeration, multiple object tracking, and visual motor coordination and speed(Spence & Feng, 2010) Moreover, figure 3 illustrates that the level of vision sharpness, subitizing, mind alertness, multiple tasking, decisions making and memory test were significantly higher in gamer group in comparisons with non-gamers. As a result of playing video games, younger adults noted that they felt sharper vision, improved perceptional thoughts, quick judgmental experience, improved memory and perform more tasks in less time which ultimately improved person's work performance. (Whitbourne, Ellenberg, & Akimoto, 2013) In addition, action videogames have been shown to be beneficial for a range of mental skills (including attention, faster processing of information, task switching and mental rotation) in healthy participants , and to improve visual acuity in the amblyopic eye these positive effects of playing evedio games has clearly observed in figure 3 that mind alertness and multitasking aspect of gamer group has significantly improved.(Vedamurthy et al., 2015) Another study illustrates that video game is actually playing a multifaceted positive role in improving people's intelligence, or making people smarter on the physiological aspect, the psychological aspect as well as the sociological aspect. (Yuan & Hu, 2018)

Playing video games might enhance the usage of declarative knowledge as well as hippocampal involvement and enhances overall learning performance during probabilistic learning. In contrast to non-gamers, video gamers showed better categorization performance, independently of the uncertainty of the condition.(Schenk, Lech, & Suchan, 2017) In sum, game elements have clear prospective to improve training through multiple mechanisms. Several studies have shown benefits from videogames for cognitive purposes such as visual attention, and multitasking(Band, Basak, Slagter, & Voss, 2016) We explored whether training with video games improved memory functions that decline with age, especially visuospatial working memory and episodic memory(Toril, Reales, Mayas, & Ballesteros, 2016)

Several studies have shown benefits from videogames for cognitive functions such as visual attention (Green and Bavelier, 2003, 2007), and multitasking. Video game training might be an effective intervention tool to enhance working memory and other cognitive functions in adults. (Toril et al., 2016)

CONCLUSION:

It has been concluded by running out the tests that the cognitive skills of gamers are better than non-gamers. Furthermore, this study highlighted the importance of video games as a significant tool to mold an inefficient brain to a skilled one.

ACKNOWLEDGEMENT:

We are thankful for the study participants, co-workers and research team member's .we are thankful to Muhammad Faisal Qureshi for his valuable guidance and constructive criticism during this study.

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Conflict of interest: Author declares no conflict of interest.
Funding disclosure: Nil

Author's contribution:
Sonya Arshad; concept, data collection, data analysis, manuscript writing, manuscript review
Muhammad Nisar; data collection, data analysis, manuscript writing, manuscript review
Mushkbar Fatima; data analysis, manuscript writing, manuscript review
Sadaf Ahmed; data analysis, manuscript writing, manuscript review