THE EFFECT OF DURATION OF TIME SPENT ON PLAYING VIDEO GAMES ON COGNITIVE ABILITIES AND IMPULSIVITY AMONG ADOLESCENTS

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ABSTRACT

Background- People had to isolate themselves due to the abrupt COVID-19 outbreak, which caused worry and anxiety. As a result, people turned to video games for enjoyment as a way to reduce stress. Prior research emphasized the detrimental consequences of video games on teen behaviours. But recently study has focused on the possibility that video games can improve neurocognitive abilities. The purpose of the study is to evaluate the effect of duration of time spent on playing video games on cognitive abilities, and impulsivity among adolescents.

Methodology- Data was collected form 101 participants belonging to age group 15-18 years; those who play games for 2 hours and for 30 minutes. Non-probability convenient sampling was used. Cognitive abilities were assessed using Mackworth clock test, Corsi block Tapping Test and Tower of Hanoi test while impulsivity was assessed using Barratt impulsiveness scale-short form. Data was entered and analysed in SPSS version 20.

Result- There were 50 gamers (49.50%) who play games for 2 hours and 51 gamers (50.50%) those who play games for 30 minutes. Result suggests that there is a significant difference in motor impulsivity, non-planning impulsivity, attentional impulsivity, correct responses, false alarm, mean reaction time, number of correct trials, memory span, total score, shortest and steps but no significant difference was found between time/steps. Findings also reveal that those who play games for longer period of time has scored high in impulsivity than those who play for limited amount of time.

Conclusion- Gamers exhibit a wider range of cognitive abilities, particularly in the areas of vigilance, visual-spatial working memory, and problem-solving. In this study, people who played video games for two hours had higher impulsivity and better cognitive ability than those who played for only a brief time. It indicates that playing video games enhances cognitive abilities but playing them for a long-time foster impulsivity.

Keywords- Neurocognitive; convenient sampling; Mackworth clock test; Corsi block tapping test; Tower of Hanoi; impulsivity; false alarm; memory span.

I. INTRODUCTION

The unexpected breakout of COVID-19 had had a significant impact on people's lives. Governments around the world had called for social separation and quarantine to limit the spread of the disease, resulting in people being segregated. As a result, people's jobs and lifestyles migrated from offline to online, including social gatherings via video chat, and the entire concept of schooling evolved from the chalkboard to the mobile phone or computer. As a result of COVID-19 restrictions, people were stressed and anxious [1] [2]. As a result, people sought ways to cope with and control stress and concern. People choose to play video games instead. WHO advised those who were isolated in their homes to play games to relieve stress. Children and teenagers during this time become independent of their parents because their parents were unable to spent a sufficient amount of time with them, and they choose to decompress their stress through peer interactions. In an effort to feel socially connected and

emotionally supported, adolescents tried to interact online with their classmates. Teenagers who were socially alienated spent more time online, using social media, and playing video games throughout the pandemic as a result.

According to a poll conducted in the third quarter of 2021, 86.4 percent of female internet users in the age range of 16 to 24 played video games on any device. Male respondents in the same age range who 4 participated in the poll said they played video games 91.1 percent of the time [3]. There are growing worries regarding the increase of videogame engagement at COVID-19. Playing video games has been shown to be an adaptive coping mechanism, but some people have raised concern that it could also develop into a dysfunctional and problematic coping mechanism. Videogames may distract people from confronting life's issues head-on and may be seen as a hindrance to effective functioning in trying circumstances. The ability to handle stress and emotions in a healthy way, build positive social connections, and promote personal change are all advantages that videogames may offer during challenging life situations.

The majority of studies are looking at the detrimental effects of violent video games due to the behavioural consequences associated with playing them. There has been a noticeable trend recently study has focused in particular on the possibility that playing video games can improve perceptual, motor, and neurocognitive abilities. According to recent studies, playing video games, even for a brief time, enhances performance on a variety of tests that gauge visual and attentional skills. Because of this, there has been a recent increase in interest in video games as a way to enhance fundamental cognitive and perceptual skills. For instance, playing video games was found to dramatically improve reaction time [4]. More recent research has shown that playing video games can enhance performance on a variety of attentional and perceptual tasks [5].

Researchers are becoming more concerned about the effects that prolonged game play has on players due to the growing popularity of video games. The emergence of impulsivity in video games has been one of the worries in this area. According to Daruna and Barnes (1993), impulsivity is the tendency to take unplanned activities without carefully considering the potential repercussions. One must press the buttons rapidly and stop improper behaviours at the appropriate moments while playing a video game. As a result, such a cognitive task may either result in a decreased ability to inhibit inappropriate responses [6] or a greater ability to exercise executive function and make decisions [7] [8]. In activities other than playing video games, such as perceptual decision [9], switching between tasks [10]; and visual search [11], there is evidence that playing video games slows reaction time.

Video game addicts could find it challenging to limit their playing time. As a result, people could feel a great need to play a game again and struggle to control their impulse. According to research, impulsivity contributes to the emergence of a gaming addiction. Video game addictions are increasingly being classified by psychologists as an impulse control disorder because they have become such a common issue. Therefore, during the preparation of the fifth version of the Diagnostic and Statistical Manual of the Mental Disorders (DSM-V) (APA, 2013) (Hiller, 2014), there have been substantial attempts to include Internet gaming addiction disorders in impulse control disorder.

Boot [12] conducted a study to assess the effect of video game playing on wide range of cognitive abilities and also whether video-game benefits are restricted to visual and attentional task, or the improvement can be broader. The result showed that expert gamers are better in attention, memory and executive control than non-gamers. Nash Unsworth [13] did research to see whether there is a link between video-game experience and cognitive abilities. In experiment 1, 252 volunteers were recruited, and the results revealed that experienced video-game players outperformed non-players in terms of working memory, fluid intelligence, and attention-control. However, 586 people were recruited for study 2, and data analysis demonstrated that there is no significant relationship between video-game experience and cognitive abilities. Meghna [14] investigated the effect of video game play on the cognitive skills of teenagers. The study found that playing video games had a substantial effect on executive function, short-term working memory, alertness, attention, and inferences-inhibition. There 5 is no significant effect of video game activity on adolescents' visuospatial memory. The strategy genre of video games has a considerable impact on gamers' cognitive capabilities.

Lioret & Gomis [15] conducted a study to analyse the relationship between impulsiveness, amount of video gaming and addiction to video gaming. Result indicate that impulsiveness is associated with addiction to video games, and it appears to be related to time spent on video games only in weekdays. According to the results, impulsiveness is a factor to consider for understanding the development of addiction to video games. Griffiths [16] conducted a systematic review of literature the objective was to identify studies evaluating the association

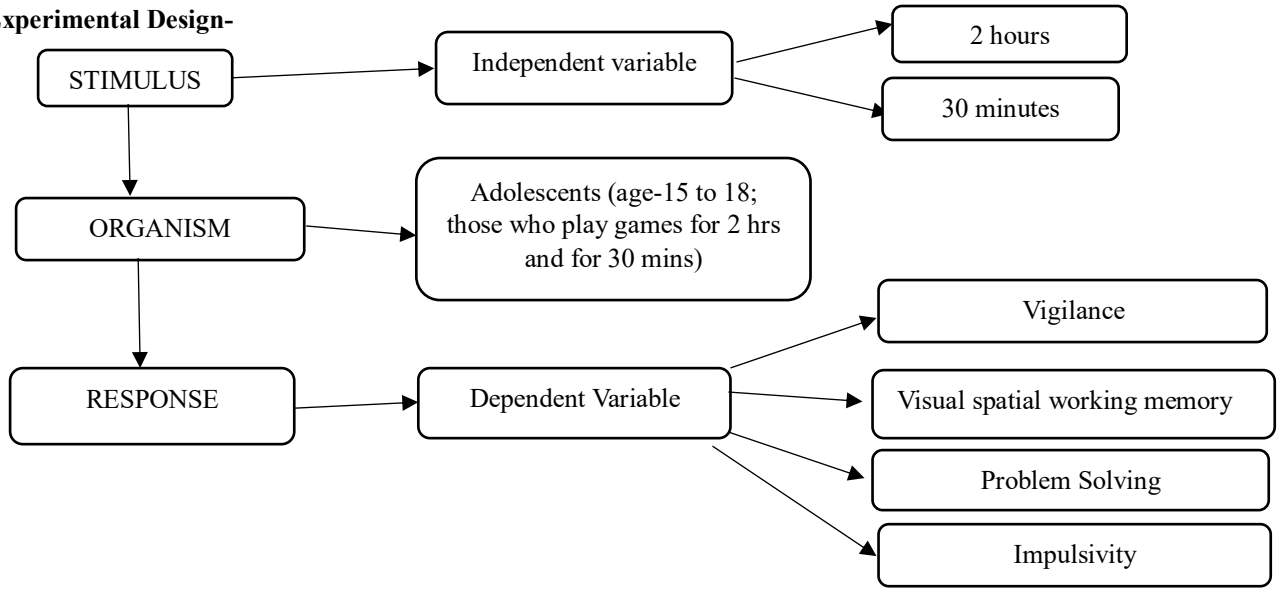
between impulsivity and Internet gaming disorder. With the exception of one study [17], all of the remaining studies found a positive relationship between impulsivity and IGD.

Aim- The current study's goal is to examine if there is a difference in relevant cognitive abilities such as vigilance, visual spatial working memory, problem solving, and impulsivity between those who play video games for 2 hours and those who play for 30 minutes.

Objective of the study-

A. To compare three cognitive abilities-vigilance, visual spatial working memory, and problem solving- of people who play video games for 2 hours and for 30 minutes.
B. To compare quantitatively the influence of video game duration on impulsivity in those who play for 2 hours and others who play for 30 minutes.

Experimental Design-



II. METHODOLOGY

Sample- convenient sampling method was used for this study. A total of 120 individuals were screened. From which, 101 urban population participants (2 hours gamers = 50; 30 minutes gamers = 51) were chosen for this study. The age range was set at 15 to 18 for both sexes. Participants' written informed consent was obtained. Based on their gaming preferences, participants were then split into two groups. They were required to actively participate in a battery of tests that were given to them. Which will evaluate each person's cognitive abilities according to three criteria. For comparison and analysis, the subjects will be rated, and average of the scores will be taken. Those who didn't fit the requirements were excluded.

Research Instruments- screening tool used was video game questionnaire to determine how much time they spent playing video games each day and what kind of games they played. A short information schedule was used for collecting the sociodemographic data.

The Psychology Experimental Building Language (PEBL) test battery version2, developed by Muller in 2010 was used. it consists of many classic tests in experimental psychology (cognitive neuropsychology) and behavioural neurology.

Mackworth Clock Test (MCT; Mackworth, 1948)- computerised PEBL, MCT version (Muller & Piper, 2014) was used for the current study. Participants had to keep an eye on a large circular path made up of numerous smaller circles while a red light flashed roughly every second in one direction. The players must be alert to when the light shifts positions and must press the button as quickly as possible. The test, which assesses vigilance, sustained attention, and reaction time, typically takes one minute to complete [18]. Correct target, false alarms, and mean reaction times are recorded.

Corsi block tapping task (Corsi; Corsi, 1972; Kessels at al., 2000;2008)- The PEBL was also utilised to give the Corsi Block Tapping Test [19], which measures a visual spatial working memory task. On the screen, nine blue square blocks are stacked in an asymmetrical manner, and a certain number of the squares are then sequentially lit up in yellow, one by one. The participants were told to memorise the order before clicking on the blocks in that order. The total score, the number of trials properly remembered, and memory length were all recorded. Stimulus Independent Variable 2 hours 30 minutes Action Organism Adventure Adolescents (age-15 to 18; those who play games for 2 hrs and for 30 mins; action & adventure) Response Dependent Variable Vigilance Visual spatial working memory Problem Solving Impulsivity

Tower of Hanoi (TOH; Kotovsky et al., 1985)- Tower of Honai is largely used to gauge problem-solving and planning. Three discs are arranged in the issue, from the smallest to the largest. The objective is to arrange the three discs in the same manner as in the image above. A larger disc cannot be stacked on top of a smaller disc, and only one disc can be moved at once. To evaluate the individual differences, these parameters are important: time taken to complete the steps, the number of steps needed to complete the task (steps), the number of 'extra' steps needed (steps-shortest)

Barratt impulsiveness scale-short form (BIS-15; Spinella, 2007)- The BIS-15 is an abbreviated form of the original BIS-11 for the assessment of trait impulsivity. It comprises 15 measures that measure motor impulsivity (doing without thinking), non-planning impulsivity (lack of forethought), and attentional impulsivity (inability to focus). A higher score on BIS-15 reflects higher levels of impulsiveness. BIS-15 is a reliable measure of impulsivity that can be used with Indian adolescent population [20]. Validity- Patton et al., (1995) found that the internal consistency of the scale as measure by Cronbach's alpha (α) ranged from 0.79 to 0.82

Procedure- Participants were selected based on the exclusion and inclusion criteria, and their consent was taken. The sociodemographic details were collected. After that one by one the test was given Mackworth clock test was given to assess vigilance, then Corsi block tapping task was given to assess visual spatial working memory, followed by tower of Hanoi test was given to assess problem solving ability and lastly BIS-15 scale was given to measure the impulsivity. The whole bunch of tests was completed within 10-15 minutes. After the collection of the data Statistical Package for Social Sciences (SPSS) Version 20 was used for the statistical analysis of the data.

III. STATISTICAL ANALYSIS

To present the characteristics of the data, the mean and standard deviation was calculated. T-test was carried out to find if there is any significant difference between the two group (those who play games for 2 hours or for 30 minutes) on relevant cognitive abilities and impulsivity.

RESULTS

Mean difference: 2 hours and 30 minutes The result (Table-1) shows that there is a significant difference as demonstrated by paired t-test in motor impulsivity (t= 8.932, p=0.00), non-planning impulsivity (t= 4.332, p=0.00), attentional impulsivity (t=7.244, p=0.00), correct target (t=3.119, p=0.002), false alarm (t=12.29,p=0.00), mean reaction time (t=7.931, p=0.00), number of correct trial recalled (t= 6.47, p=0.00), memory span (t= 4.7931, p=0.00); total score (t= 7.098, p=0.00), shortest (t=-2.29, p=0.00) and steps (t=14.81, p=0.00)for 2h and 30mins condition. But there is no significant difference found between time/steps (i.e., the average time taken between the steps during solution) (t= 0.223, p=0.824) for 2 hours and 30 minutes condition

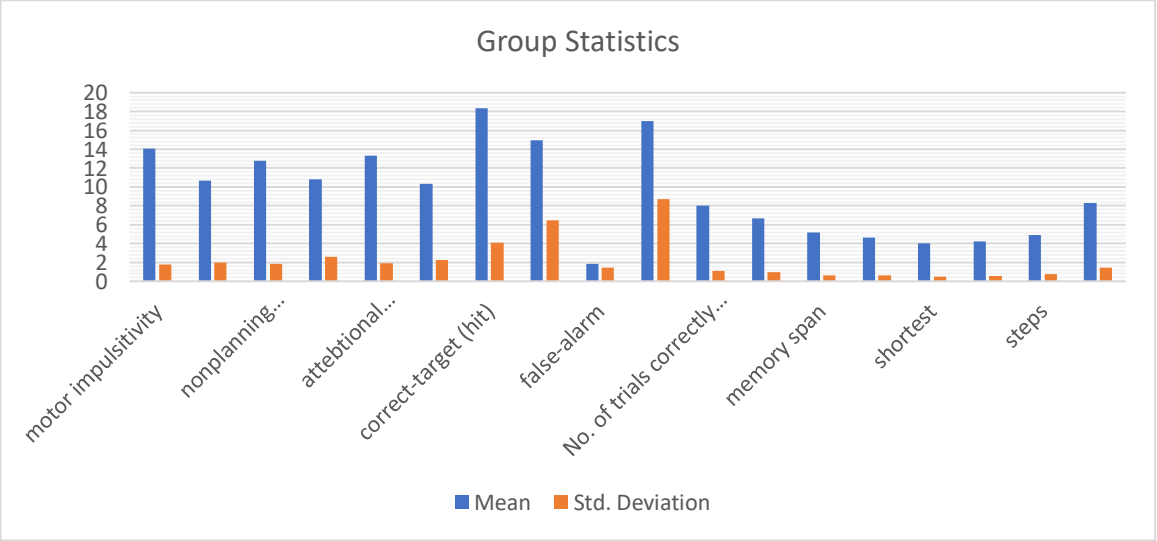
Table1: t-value for mean difference between 2 groups on relative cognitive abilities and impulsivity

	Domains	Time spent on playing	N	Mean	Standard deviation	t-value	Significant level
Impulsivity	Motor impulsivity	2 hrs	50	14.06	1.75	8.932	**0.00****
		30 mins	51	10.71	2.01		
	Non-planning impulsivity	2 hrs	50	12.76	1.87	4.332	**0.00****
		30 mins	51	10.82	2.57		
		2 hrs	50	13.32	1.91	7.244	**0.00****

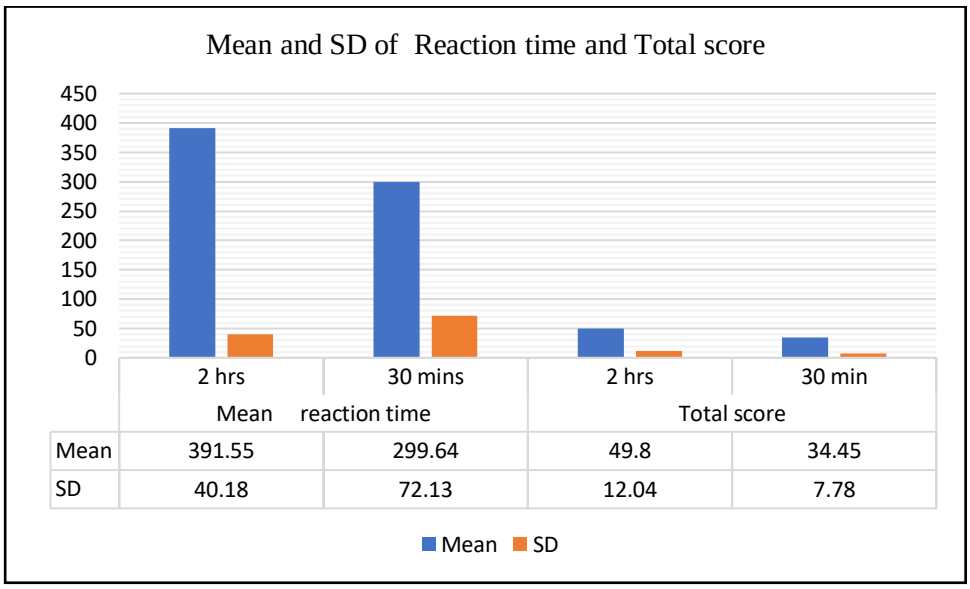
	Attentional impulsivity	30 mins	51	10.31	2.249		
Mackworth clock test	Correct target	2 hours	50	18.32	4.10	3.119	**0.02***
		30 mins	51	14.96	6.48		
	False alarm	2 hours	50	1.82	1.45	12.29	**0.00****
		30 mins	51	17.02	8.71		
	Mean reaction time	2 hrs	50	391.55	40.18	7.931	**0.00****
		30 mins	51	299.64	72.13		
Corsi block tapping test	Number of trials correctly recalled	2 hrs	50	8.00	1.07	6.47	**0.00****
		30 mins	51	6.68	0.97		
	Memory span	2 hrs	50	5.19	0.65	4.738	**0.00****
		30 min	51	4.59	0.60		
	Total score	2 hrs	50	49.80	12.04	7.098	**0.00****
		30 min	51	34.45	7.78		
Tower of honai test	Shortest	2 hrs	50	4.02	0.47	-2.29	**0.00****
		30 min	51	4.25	0.56		
	steps	2 hrs	50	4.89	0.77	14.81	**0.00****
		30 min	51	8.30	1.44		
	Time/steps	2 hrs	50	3183.46	4098.46	0.223	0.824
		30 min	51	3388.33	5086.01		

*p<0.05 level, **p<0.01 level

Graph 1: Graphical representation of the Mean and SD of two groups of gamers for relevant cognitive abilities and impulsivity



Graph 2: Graphical representation of Mean and SD of two groups of gamers mean reaction time and total score



IV. DISCUSSION

This study examined the performance between two groups on 3 different cognitive abilities (vigilance, visual spatial working memory, problem solving) and the effect of time spent on playing video games on impulsivity. Total of 101 students were tested for different cognitive ability. The result shows that the with the increase of the time spent on playing video games there is a sharp increase in the level of impulsivity, perform better in vigilance task, visual spatial working memory, and problem-solving task. A study conducted in 2020 found a positive correlation between playing video games and cognitive abilities (inhibition of adolescence, short-term working memory, alertness, attention span, interference-inhibition), but there was no a significant difference in the groups' visual scan speeds [21].

Result revealed that there is a difference between duration of time spent in playing video games on impulsivity. Those who play for 2 hours have scored significantly higher in motor, non-planning, and attentional impulsivity than those who play for only 30 minutes. This study can be related to earlier research that involved 3034 children, and the findings showed that children with attention issues play more video games, while children in general who spend a lot of time playing video games may also experience impulsivity and attentional problems [22].

The results of this study showed that those who spent more time playing video games had higher correct responses and fewer false alarms than those who played less. This may be because regular gaming improves one's ability to make decisions, which makes it easier for them to distinguish between relevant and irrelevant stimuli. This finding is corroborated by another study, which found that when working in a setting where video games are included, gamers outperformed non-gamers in terms of vigilance [23]. In this study, it also came to light that those who play games for longer periods of time have high reaction times. This finding may be related to the fact that playing games for extended periods of time helps people act swiftly through practise. This outcome is consistent with past video game studies, which have shown that training with action games increases reaction time, cognitive speed, and stress reduction [24].

The result for shows that those who play games for 2 hours, got a large number of trials correct. also, significant difference was found among the two groups, regarding the memory span, the total score obtained. Thus, there is a significant difference between those who spent 2 hrs in playing video and those who play for 30 mins on visual spatial working memory. This finding supports the result found by Serrano [25], conforming that those who play action-video game can be distinguished by a high performance in visual spatial working memory test respect to regular players and non-violence players.

According to the results, those who played for two hours took fewer extra steps than those who played for only 30 minutes. There is also a significant difference between the two groups in terms of the number of steps needed

to solve the problem, but no such significances were found between the two groups in terms of the average amount of time taken between steps during solution. According to this study, the ability to solve problems differs significantly between individuals who spent two hours playing video games and those who only played for 30 minutes. This outcome is consistent with earlier studies that discovered that well-designed games provide students with challenging scenarios that promote problem-solving skills [26].

There is evidence to support the idea that playing video games may have cognitive advantages. According to a survey of 2,000 kids, those who admitted to playing video games for at least three hours a day outperformed kids who had never played video games on tests of working memory and impulse control. Children who played video games for three or more hours per day had stronger brain activity in areas of the brain linked to attention and memory than children who never played, according to functional MRI brain imaging studies. The researcher hypothesizes that these patterns may result 12 from practicing cognitively challenging video game activities related to impulse control and memory [27].

V. LIMITATION

Although the PEBL tests are being used increasingly often, there is currently relatively little knowledge about their psychometric characteristics. The key drawback of the current study was the limited time and data, which prevented a thorough grasp of cognitive ability from being obtained.

VI. IMPLICATION FOR FURTHER STUDY

Positive and unfavourable cognitive changes might result from playing video games. On the one hand, playing video games can help players get better at solving problems and exercising executive functions including attentional processing and visuospatial skills. On the other hand, playing video games can cause people to lose focus, exhibit poor impulse control, and suffer from diminished academic performance despite the cognitive benefits. If the addiction becomes strong enough, it can also lead to worry, anxiety, and even solitude.

VII. FURTHER SCOPE

Further research can be complemented by increasing the sample size and evaluating similar immersive, well-designed software, this study can be done on a variety of time durations, helping people not to acquire impulsivity. In order to confirm the changes in cognitive ability, this study concentrated on a few psychological assessment tasks. To examine performance improvement and how this cognitive skill employed in playing video games can be transferred to an educational setting, this research can be expanded with more psychological tests and games with various game elements and attributes.

VIII. CONCLUSION

Gamers exhibit a wider range of cognitive abilities, particularly in the areas of vigilance, visual-spatial working memory, and problem-solving. In this study, people who played video games for two hours had higher impulsivity and better cognitive ability than those who played for only a brief time. It indicates that playing video games enhances cognitive abilities but playing them for a long-time foster impulsivity.

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