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Research paper

The Effects of Minecraft Videogame On Creativity

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Abstract

The aim of this research is find out the effects of minecraft videogames on creativity. Eight undergraduates were assigned to experimental group and control group for recording of the brainwaves while playing minecraft video games and other videos. The results showed that the average of brain waves from different sub-bands for Minecraft games is higher than other games. The dominant of delta waves at Fp1 & Fp2 showed that the subjects are paying high attention and improved their decision-making levels. High T3 & T4 on Alpha(Minecraft's)wave indicates that it stimulates the brain to activate both parts of the brain. The results showed that Minecraft is able to increase high-level thinking. The core cognitive mechanism during playing minecraft video games was the attention network collectively referred as fronto-parietal attentional control network. This is indicated as sub-network known as executive control network, default mode network and salient network in the previous research.
Keywords: brainwaves ; Creativity; minecraft; Videogame

1. Introduction

According to the entertainment software Association, 72% of U.S households plays video. Research [1] on 500 children aged 12 year old found that as more kids played video games, the more creative they were in tasks such as drawing pictures and writing stories compared to use of cell phones, and computers (other than for video games). The findings should motivate games designers to identify aspects of video games that are responsible for the creative effects. Hence, video games can be designed to optimize the development of creativity while retaining their entertainment values such that a new generation of video game will blur the distinction between education and entertainment. It was suggested that [2] the elements of playing games are exactly the kinds of things that you need to do to be a successful leader and achieve goals. Some of the skills like "recruiting allies, focusing on strengths--using power-ups to get stronger, confronting the bad guys," help you develop what McGonigal calls a "gameful mindset." As a leader, you need to recruit allies and find the resources that will make your team stronger just like what we have to do when playing in a game.

The rush that you get while playing a game and your ability to beat that level increases your dopamine that trigger the feeling of reward when winning a game. These are the feeling that makes you want to keep playing the next level. Playing the right games should harness that feeling, and should be applied to something challenging in your life. "Dopamine is one of the strongest drivers of the work ethic [3] reiterate that with dopamine hit, the player need to go do something that is challenging, instead of playing the next level. Thus priming your brain to do great things.

In this research, the objective to find out the effects of playing minecraft video game on creativity using quantitative electroencephalograph (qEEG). Other objectives are: i) to identify the region of the brain (ROI) that response while the participants were playing minecraft video games versus other video game. ii) to identify the dominant brain waves while playing the minecraft and other video game.

2. Background of the Study

Video games is used as a treatment for a mental disorder people and they found that this ways is a very efficient ways to treat these patient [4]. In another study by S.R.I. International, a Silicon Valley research group with expertise in technology, found that playing Minecraft games can improve cognitive learning for students by 12 percent and improve hand-eye coordination, problem solving and memory capabilities. . Minecraft was founded by a Swedish game developer named Markus "Notch" Persson. The game comes in several modes which is the original Classic mode, Single Player mode and Multi Player mode. The game starts out by creating a 3-dimensional "blocky" imitation of nature (trees, clouds, sand, etc). The game does not have a clear instructions to players throughout the gameplay and thus may lead them to sort of confusion, sense of complacency or just pure excitement to explore the world of Minecraft [5].
In November 2011, Minecraft pervaded desktop computers, Google and Apple smartphones/tablets, and platforms like Microsoft's Xbox. The game was first demonstrated by Markus Persson, a Swedish video game programmer and designer known as Notch, in 2009. It started to gain reputaion among educators. Teachers use minecraft around the world to educate students and children on everything from science to city planning to speaking a new language" With Minecraft, students develop "that understanding on how to interact with people on line at a very early age" as Compared with kids that wrought on other social.
Minecraft is relatively simple which built in 16-bit, a computer term that means that graphics look blocky, like giant, digital Lego pieces. Minecraft offers an invitation for creativity, for customization and to engage on a level that is accessible. This creative ele-

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ment attracted children attention and fosters healthy cooperation. This a huge departure from previous games, previous toys and objects that were given to kids to play to make their own games in backyards and in schoolyards. And now they have an opportunity to make those games part of their shared culture."
Unlike other video games, minecraft like the name suggests, the goal of the game is to craft, or build, structures in these 16-bit worlds, and figuring things out on your own is a big part of it. In this "creative mode," Minecraft is about building, exploration, creativity and even collaboration. Minecraft is a multiplayer based video game in a virtual world that emits the real world. Players can build and create daily items using the block.

2.1 Brain Networks (ROI) Related to Creativity

In January 15 2018 [6], it was described in the Proceedings of the National Academy of sciences that scientists found a specific pattern of connectivity that correlated with the most creative responses. Researchers were then trying to predict creativity based on the peoples' responses by measuring the connections in this network. Roger Beaty, a Post-Doctoral Fellow in in this research said. "People who are more creative can simultaneously engage brain networks that don't typically work together. Hence, its shows that the creative brain is wired differently," Beaty and his colleagues analysis of brain data from previous research found that, regions across the brain were involved in creative thought, Beaty said the evidence pointed to three sub-networks -- the default mode network, the salience network and the executive control network -- that appear to play key roles in creative thought. The strength of connections in these peoples' brain networks could estimate how original their ideas would be.
The default mode network is involved in memory and mental simulation, so it plays an important role in processes like mind-wandering, imagination, and spontaneous thinking. The salience network detects important information, both in the environment and internally. When it comes to creativity, researchers believe it may be responsible for sorting through the ideas that emerge from the default mode network. The executive control network works to help people keep their focus on useful ideas while discarding those that aren't working**.** Syncronization between these systems are important for creativity. Thinking flexibly enable people to come up with more creative ideas and engage within these networks that don't typically work together and bring these systems online.

To identify the brain network involved in creativity,[7] the reseasarchers recruited a total of 163 volunteers, and used functional magnetic resonance imaging (fMRI) technology to scan their brains and identiy the brain network involved in creativity
"Creativity is typically defined as the ability to come up with new and useful ideas,"[8] the connectivity strength in this network were recoreded while they were thinking creatively with the quality of their responses".
Ultimately,the study was hoped to dispel some myths about creativity and where it comes from, and the myth of left versus right brain in creative thinking. Hence, creativity is a whole-brain endeavour. In addition, it's not clear that this can't be modified with some kind of training. "It's not something where you have it or you don't because creativity is complex, and much more research work need to be done in this area.

3. Methodology

This is a quantitative study using quantitative electroencephalogram (qEEG) to record the brain waves activity of eight undergraduate students from the Faculty of Cognitive Science and Human Development aged 20-25 years. Four participants were assigned to play minecraft video games while another four were playing other video games.

The procedure of this study begins by using qEEG (Mitsar amplifier) which consists of 19 electrodes Fp1, Fp2, F7, F3, Fz, F4, F8, T3, C3, Cz, C4, T4, T5, P3, Pz, P4, T6, O1, O2 sites in the International 10-20 system) with 250 Hz sampling rate in 0.3 – 70 Hz frequency range in the resting eyes opened (EO) conditions (. During the study, the participants sat comfortably on a sofa for approximate from 10-30 minutes to allow the brain wave recordings comfortably in a relax state. This condition is then stored in the computer using EEG. This step is vital to ensure any interference of the artifacts such as the movement of the participant, noise etc. are removed to obtain a clean and raw data. Hence, the steps are visually inspected and Fast Fourier Transform (FFT) are computed to provide spectral analysis output to examine for peculiar patterns. The, the output is then displayed as topographical "map" to identify for differences in cerebral functioning using estimates of absolute and total power.
Brain waves were recorded using 19 channels Mitsar qEEG while playing the games.All data recorded from qEEG were collected and keyed in into Microsoft Excel before T-test were conducted using SPSS to find out the difference between the two average mean from all the sub-bands while playing minecraft versus other video gamesAll paragraphs must be justified alignment. With justified alignment, both sides of the paragraph are straight.

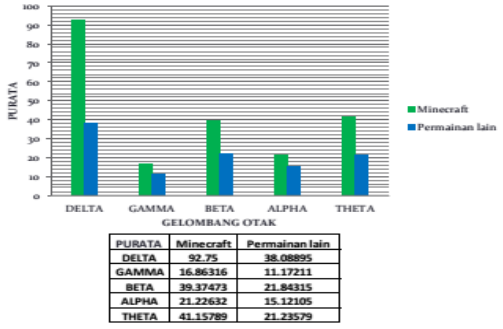
4. Discussion of Findings

Table 1: Total number of participants

Tasks/Participants	Boys	Girls	Total
Minecraft	2	2	4
Other video games	2	2	4
Total	4	4	8

The total number of participants recruited for the observation were 8 (4 male and 4 female). Four participant (2 male 2 female) ants were assigned to minecraft video games and four (2 male and 2 female) were assigned to playing other video games.

The results showed that Delta waves were higher while playing minecraft compared to other games especially at the frontal lobe. It showed that the participants were paying attention while playing minecraft. Decision making skills were increasingly improved. This is indicated by the high level of alpha at Temporal lobes (T3, T4). Alpha contributed to the participants' ability to process information.



PURATA	Minecraft	Permainan lain
DELTA	92.75	38.08895
GAMMA	16.86316	11.17211
BETA	39.37473	21.84315
ALPHA	21.22632	15.12105
THETA	41.15789	21.23579

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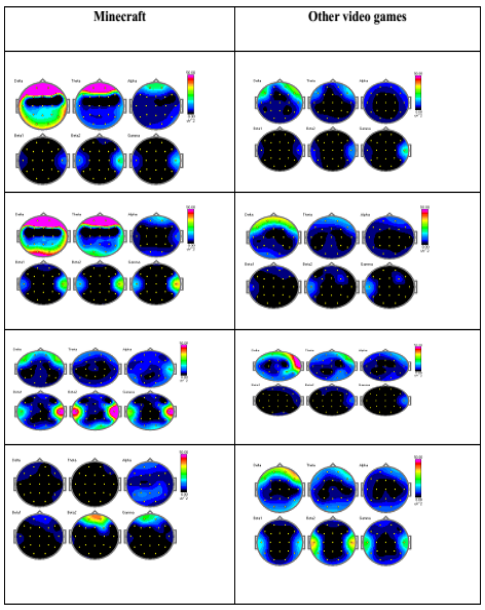
Fig.1: Brainwaves While playing0 minecraft and other video games



Fig,2: Brain Topography of Participants whle playing minecraft and other video games

Six regions of the brain; Prefrontal, Frontal, Occipital, Parietal, Post Central dan Temporal were involved while the participants were playing Minecraft and other video games. Delta has the highest value for both cognitive tasks and highest at the pre-frontal region. T test showed the difference of delta between the two tasks was (Mean 755.2,SD=5,5) t (5) = 0.049, followed by theta (M=388.7, SD 5.9) t (5)= 0.091, Alpha (Mean=281.6, SD=3.3) t(5) = 0.002, Beta (Mean=257.71, SD=5.5) t (5) = 0.016 Gamma (Mean=332.34, SD=3.6) t=(5) = 0.042. At the parietal region, the brainwaves demonstrated the same pattern as demonstrated at the Pre-frontal region. This is the executive control area as indicated by Beaty (2018) in his research on creativity. This two areas are the fronto-parietal attentional control network which is collectively refered to as attentional network mechanism where delta and beta are required while the participants are performing cognitive task that required attention.

Next ROI related to creativity is the Post central region and temporal area. T test between the brain waves while playing minecraft and other video games at this area where Mean was 5.97, SD=2.4 and t=0.027 for the temporal area. The results are consistent with the findings by Beaty where Beta2 and Gamma were dominant too during playing minecraft video game. This is the default mode network that involved in memory and mental simulation, which plays an important role in processes like mind-wandering, imagination, and spontaneous thinking.

5. Conclusion

To conclude, the results showed that the average of brain waves from different sub-bands for Minecraft games is higher than other games. The dominant of delta waves at Fp1 & Fp2 showed that the subjects are paying high attention and improved their decision-making levels.

High T3 & T4 on Alpha Minecraft's brainwave indicates that it stimulates the brain to activate both parts of the brain. (T3-left & T4-right). The results showed that Minecraft is able to increase high-level thinking.

The core cognitive mechanism during playing minecraft video games was the attention network collectively referred as fronto-parietal attentional control network. EEG delta, beta and gamma were dominant at this region when the subjects are actively engaged in playing minecraft. The attention mechanism allows the brain to utilize the limited resources depending on the tasks given. The sub-network area, the default mode network area were another ROI measured as strengthening its connection with the other regions while playing minecraft comparted to watching other video games. The whole brain endeavour were obviously seen in the fast waves such as alpha, beta and gamma in the default mode network and salient network for the detection of information internally and externally from the environment while working and making decision during the task of playing video games. This synchronized with the executive control network at the pre-frontal region where delta is dominant for the attentional network. Hence, this research recommended the use of minecraft video game for the training of children for peak performance and enhance creativity compared to other videogames..

Acknowledgement

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