

3-4-2021

## Effects of Creative Video Games on Creativity

Haiqal Sazalli

*Embry Riddle Aeronautical University, Binsazam@my.erau.edu*

Sharil Sungkono

*Embry Riddle Aeronautical University, sungkos1@my.erau.edu*

Mohammed Rashaun

*Embry Riddle Aeronautical University, mohamm28@my.erau.edu*

Khalis Muzakir

*Embry Riddle Aeronautical University, Abubakak@my.erau.edu*

Follow this and additional works at: <https://commons.erau.edu/ww-research-methods-rsch202>



Part of the [Adult and Continuing Education Commons](#), [Art Education Commons](#), [Community College Leadership Commons](#), [Curriculum and Instruction Commons](#), [Curriculum and Social Inquiry Commons](#), [Early Childhood Education Commons](#), [Educational Methods Commons](#), [Educational Psychology Commons](#), [Education Economics Commons](#), [Elementary Education Commons](#), [Science and Mathematics Education Commons](#), and the [Secondary Education Commons](#)

---

### Scholarly Commons Citation

Sazalli, H., Sungkono, S., Rashaun, M., & Muzakir, K. (2021). Effects of Creative Video Games on Creativity. , (). Retrieved from <https://commons.erau.edu/ww-research-methods-rsch202/17>

This Article is brought to you for free and open access by the Course Projects at Scholarly Commons. It has been accepted for inclusion in Introduction to Research Methods RSCH 202 by an authorized administrator of Scholarly Commons. For more information, please contact [commons@erau.edu](mailto:commons@erau.edu).

## **Final Research Proposal**

Rashaun, Sharil Sungkono, Khalis Muzakir, Muhammad Haiqal Bin Sazalli

College of Research and Statistics, Embry-Riddle Aeronautical University

RSCH 202 and Research Methodology

Dr Somi Shin

4<sup>th</sup> March 2021

## **Abstract**

The purpose of this research is to find the effects of creative games on the Creativity Quotient of human beings. Assessing creativity is based on divergent thinking consisting of fluency, originality and uniqueness in thinking methods. The theoretical framework assesses the creative thinking of candidates through a 4-week gaming programme consists of a pre- and post-assessment of Creativity Quotient Test which consists of 10 critical thinking questions. These questions will test the fluency, originality and uniqueness of the candidates. To provide a fair result, the same questions will be used for the pre- and post-assessment. Results will prove that games are beneficial to creative thinking. On a larger scale, the success of this study will support the incorporation of creative games as a tool in conducting lessons in school.

## **Literature Review**

Gaming has benefits in them, including making people more creative mentally, and physiologically. Gaming also has proven to develop problem-solving and critical thinking skills. Studies have shown and proved that games have the potential to enable new forms of learning. It can potentially affect students' ability to develop creative skills and critical thinking, knowledge transfer, acquisition of skills in digital experience, and a positive attitude toward learning as well as provide for deep, insightful learning. From the proof provided with existing test methods and results, we can see that most of the articles support our claim in the potential that video games do improve creativity in humans. However, one of the articles that we found seemed to contradict the other sources as playing a certain type of video game, such as Grand Theft Auto (GTA), which allows the player to be influenced by the negative and violent gameplay. Even though an article contradicts the other sources, it helps us to adjust our variables accordingly to produce a fair and probable result. An example would be by making one of the controlled variables, allowing the users to play video games which advocates and challenges creativity in them. As GTA is an "R" Rated game which contains violence characteristics, we decided that it will not be used as one of the games that will be played during the test. Instead, Minecraft will be used as our primary source of game for our test as it contains an online segment where players can create their own environment, a similar concept to GTA. As our objective is to testify the effect of creativity in all groups of humans, we believe that this will be a fair decision.

## **Existing Test Methods and Results**

Journal Article: Minecraft and machinima in action: development of creativity in the classroom.

- Test Method: CREA Test
- Variables: Duration of the test, Children in the classroom.
- Results: Playing games did improve an individual's creativity

Journal Article: Creativity in Digital Game-Based Learning Among Young Children

- Test Method: Case study and experiment
- Variables: Age and Games
- Results: It affected student ability to develop creative skills and critical thinking

Journal Article: Understanding Children's Choices and Cognition in Video Game Play

- Test Method: Survey & creativity assessment, in-depth qualitative study, and online survey
- Variables: Children aged 9-11, young adults
- Results: Children are actually motivated by the challenge and thinking required by video games. Creativity is not hindered by video gameplay

Journal Article: Are video games bad for you? Most people agree that gaming affects

- Test Method: Experiment and Surveys
- Variables: Types of Video Games Played, American Kids, Duration of Gaming
- Results: Games are harmful and encourage risky behaviours in children

Journal Article: An Evaluation of Alternative Ways of Computing the Creativity Quotient in a Design School sample.

- Test Method: Testing participants in their Creativity Quotient (CQ) which looks into the fluency, flexibility and originality of their ideas to answer a question and solve a problem. CQ test.
- Variables: Idea generation task test with materials and equipment catered to their experience.
- Results: Self-efficacy and reflexivity were found to be positively and significantly correlated with each other where both demonstrated a positive and significant relation to creative achievement and creative experience. Creative experience demonstrates a positive and significant relation to creative achievement. Year of education had a significant positive association with the CQ, indicating that the ability to generate many, distinct, and original ideas on a divergent thinking task. Lastly, the creative experience was found to have a positive influence on CQ.

### **Decision on Chosen Test Method**

We found the test on Creative Quotient would produce a credible result. This is because the Creativity Quotient Test is based on fluency (the number of ideas generated), flexibility (the number of categories into which the generated ideas can be partitioned), and originality, the number of unique or unusual ideas produced. In our research, the root of creativity thinking lies in a combination of fluency, the number of ideas generated, flexibility in the number of categories into which the generated ideas can be partitioned. Based on these three dimensions, we will be able to test out the ability of divergent thinking in our participants.

## **Test Variables**

Participants will be assessed on originality by calculating the number of unique ideas they mentioned, and the number of ideas mentioned. Flexibility would be measured by counting the number of distinct category ideas that the participants produced and the number of subdivided parts their ideas can be divided into (Seddon, 1983; Snyder et al., 2004). The scoring procedure aims at a more objective evaluation that accounts for both the number of ideas (fluency) and the number of distinct categories they represent (flexibility) ; ( Bossomaier, Harré, Knittel, & Snyder, 2009; Ellwood, Pallier, Snyder, & Gallatte, 2009; Snyder et al., 2004).

## **Credibility of CQ Test**

The CQ metric test results relate to “creativity as an ability to link very different ideas into novel synthesis” (Snyder et al., 2004, p. 416), and the ability to apply divergent thinking to generate a wide range of associations to a specific stimulus (DeHaan, 2009). The possibility of reaching such a novel synthesis is only possible when an individual has generated many ideas for a large number of distinctly different categories (Snyder et al., 2004).

## **Solutions**

Solutions explored so far include the types of video games that will be included in the test. Games such as Minecraft can invoke creativity as the game itself allows players to create anything beyond a person’s limits. As creativity is linked to Creativity Quotient (CQ) one must have the ability to apply divergent thinking in solving a question or problem. Playing games such as Minecraft allows participants to facilitate creative thinking because games such as this offer new rules and realities bounded with limitless possibilities. Being creative is to be able to generate a wide range of associations to a specific stimulus (DeHaan, 2009). As for Minecraft,

it allows children to discover new resources and experiment with different recipe combinations to create tools to solve a problem. This is one example where a user has to link a wide range of associations to a specific stimulus. Thus, Minecraft would be a good choice of game to test the Creativity Quotient (CQ) in people as it is suitable for all ages.

For a more credible result, the experiment will be conducted on different types of participants regardless of their creative experiences. The same set of test questions will be given before and after the experiment. This method is to test out the effectiveness of video games such as Minecraft in stimulating creativity. Their creativity quotient will be tested out through a series of problem-solving questions testing their flexibility, fluency and originality in providing solutions to a set of problems.

### **Summary of Literature Review Findings**

From our findings, we saw that games have some improvement in the creativity of people. Minecraft is a three-dimensional (3D) Sandbox game which allows the user a large amount of freedom in choosing how to play the game. This game was released in 2011 on November 18th. This game consists of different modes but mainly, it is for the player to immerse themselves in a world free of obstruction where they can create anything they want. Apart from creating what they intend to, they can also craft tools from whatever they have mined or harvested. This game has been a hit since its release and has since won many awards. It is still a fan favourite game amongst people of all ages. Minecraft has been an educational tool for art students as a game based as well as a learning platform (Baek, Min, & Yun, 2020). It is proven that Minecraft allows the students to be more enthusiastic, interested, and engaged as well as gaining new things that they learn from the game itself. The game has been implemented with class subjects to entice the students better in learning.

Games such as Minecraft have proved to increase the Creative Quotient (CQ) of a person as it allows them to apply divergent thinking and have fluency, flexibility and originality in completing a task and solving a problem through the game. Minecraft is similar to GTA in terms of the degree of freedom that the user has in choosing to play the game. Other than just creativity, video games have also proven to enhance lifestyle skills such as knowledge transfer and adaptation to different circumstances. For example, the experimentation on the age group between 3-6 years old verified that visual display, painting, and colouring attracted the most attention from children (Behnamnia, Kamsin, Ismail, & Hayati, 2021). This has led preschool children to improve in some skills, including writing, painting, collage, and other artistic and creative activities. Our finding has also shown positive impacts to other age groups. Researchers seem to keep trying to prove that playing video games can improve creativity in humans and advocate divergent thinking in many situations. The CREA Test and CQ Test portrayed a positive impact thus supporting our alternative hypothesis that creativity can be honed via video games.

### **Research Question**

In our research, we are focusing on the improvement of creativity in humans before and after playing video games. Hence, our research question is, Will video games be beneficial or detrimental to creativity in humans?

### **Theoretical Framework**

To discover whether video games increase, decrease, or have no effect on the creativity in humans, we will be putting the participants through a 4-week video gaming program where we control the environment they are in, the type of game that they will play, and the number of hours they play. This will allow us to compare the results obtained from the CREA tests and CQ tests before and after the participants are put through an 8-week video gaming program.

Therefore, with the results, we can determine if video games have indeed increased the creativity of the participants, which we can then conclude whether video games can be beneficial or detrimental to the creativity in humans. Accordingly, the dependent variable is the creativity of the participants at the end of the 4-week program.

### **Decision Arriving to Duration of Test**

Based on the article that was discussed earlier (Romero, 2017), a duration of 8 weeks was held for the experiment used in the research and have shown positive results. With the results given, we have decided to shorten the experiment duration to 4 weeks as Singaporeans are known to be busier (2010). We have also decided to stretch each duration of gameplay of about 1 hour a day as Singaporeans are busy and would not have that much time to spend playing Minecraft in a day. Thus, the experiment will be a duration of 4 weeks with 1 hour of gameplay each day.

### **Controlled Variable**

There are a few key factors that will be placed under control for our 4-week program. These factors are the number of time participants will have to clock on playing Minecraft or alike creativity games during the 4-week program, the environment requirement during their gaming session, the type of games and the type of gaming platform. Each participant will have to clock at least 1hr of gaming time per day during the 4-week program. The environment of their gaming session will require to be quiet, consisting of a gaming chair, in a comfortable room with stable WiFi. The types of game are limited to creative enticing games such as Minecraft, Monster Hunter World and Little Big Planet.

The dependent variables for this research are the CQ Scores and CREA test scores which are designed specifically to test the different factors of creativity in a person. The key

independent variable of this research is the video games that the participants play. Since our research is focusing mainly on creativity, not all video games are valid. Video games such as first-person shooter games and sports games do not stimulate creativity in a person as much as video games such as role-playing games (RPG), puzzle games, strategy games, and action-adventure games. This is also in line with Mednick's (1962) work involving associative theory, which emphasized that the narrower an individual's associations with a particular stimulus, the less likely they are to generate creative solutions.

Some examples of RPG, strategy and action-adventure games are games such as Monster Hunter World, Overcooked, Minecraft and Grand Theft Auto (GTA). Another key independent variable specifically for the CQ Test is Creative Experience and Creative Achievements of the participants. This is applied as our test is catered for all types of people from different group age and different career backgrounds.

### **Hypotheses**

The null hypothesis of this research is that video games do not improve creativity in humans. Our research will determine if creativity in humans can be nurtured through video games and not just books.

H0: Video games do not improve creativity in humans.

H1: Video games do improve creativity in humans.

## **Paradoxical Perspective**

In our research, games are proving to be a great tool to enhance creativity. However, it is only natural for it to also pose a negative impact. Of which, its association with psychological health. Video games that impose a negative impact on a person's cognitive skills are violent games such as Grand Theft Auto V and Call of Duty Modern Warfare. These video games involve violent actions like the killing of people or robbing stores. If played for a prolonged period of time, one would be addicted and deeply involved. This could affect them psychologically. Violent video games have proven to have an influence on young and growing teens to the point where they feel eager to carry out the violent acts that they play in the games in real life. A study conducted by Dittrick, C. J., Beran, T. N., Mishna, F., Hetherington, R., & Shariff, S. (2013), in Canada, found that 10 to 17-year-olds whose favourite games involved violence were more likely to report bullying their friends in real life and in the virtual world.

Also, games are most often played while sitting in front of a screen, using either a cell phone, tablet, a console attached to a television or a computer monitor (Huard Pelletier., Lessard, A., Piché, F., Tétreau, C., & Descarreaux, M., 2020). Evidently, those that play games have a higher screen time and are reported to be less active and more likely to be overweight. These factors are accurate reasonings as it proves that video games are not necessarily only beneficial.

However, the root of creativity lies in fluency, originality and flexibility in thinking. The kind of games that we will be using for our research is part of our controlled variables where video games with violent contents will be ruled out. Hence, these violent games will not be used in our research as it has no relevance to the purpose of our research, which is to find out how video games affect creativity.

## **Study Design**

**Research Question:** In our research, we are focusing on the improvement of creativity in humans before and after playing video games. Hence, our research question is, “Will video games be beneficial or detrimental to creativity in humans?”.

**Hypothesis:** The null hypothesis of this research is that video games do not improve creativity in humans. Our research will determine if creativity in humans can be nurtured through video games and not just books.

**H0:** Video games do not improve creativity in humans.

**H1:** Video games do improve creativity in humans.

For this research, the experimentation and observation are to test out the thesis of the effects of creative games on the creativity of human beings. We will be collecting data through critical thinking questions testing their creativity level, before and after the exposure period of playing the suggested video game (Minecraft). The participants will be assessed upon their fluency, flexibility and number of ideas generated in answering the critical thinking questions. The critical thinking questions are as follows represented in Figure 1.1 and Figure 1.2:

**Creativity Quotient Test**

Critical Thinking Questions

- 1) "If you were a pizza delivery man, how would you benefit from scissors?"  
(To assess the ability to think critically and make well-formed arguments.)

Answer:

- 2) "How would you test a calculator?"  
(To assess the ability of candidate to think strategically.)

Answer:

- 3) "An apple costs 40 cents, a banana costs 60 cents and a grapefruit costs 80 cents.  
How much does a pear cost?"  
(To assess the flexibility thinking of the candidates)

Answer:

- 4) "A farmer needs to cross the river with his chicken, a sack of corn and a fox. His boat unfortunately only fits himself and one other thing. The fox and chicken are hungry, so if he leaves the fox with the chicken, the chicken will get eaten, whilst if he leaves the chicken with the corn, the corn will get eaten. How will the man get safely across with all 3?"  
(To assess fluency thinking of the candidates produce)

Answer:

- 5) "How many potatoes (in kg) does McDonald's sell in a year in the UK?"  
(To assess fluency and strategic thinking of candidates)

Answer:

- 6) "How do you know if the light inside the fridge is on or off?"  
(To assess the fluency and flexible thinking of candidates)

Answer:

Figure 1.1, Source: (Wilkinson, n.d)

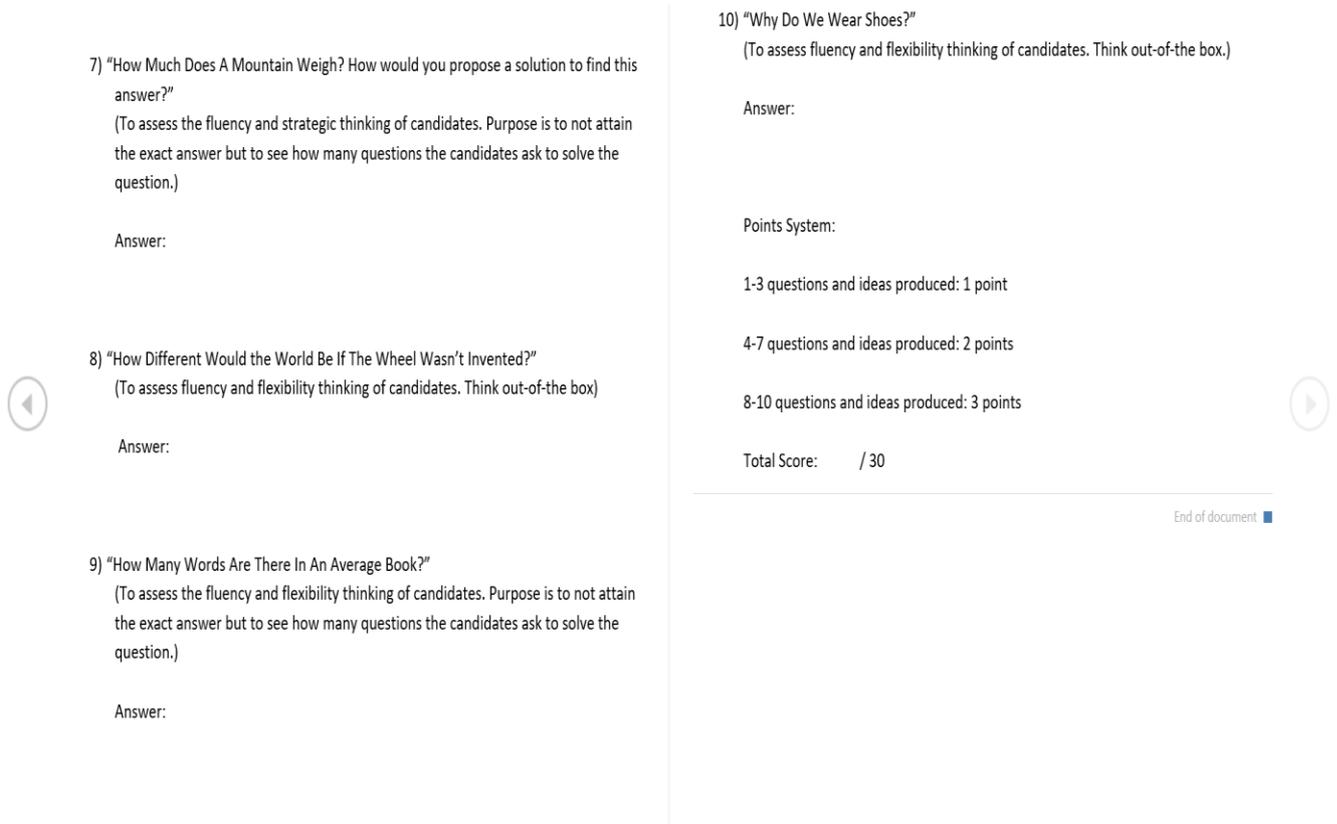


Figure 1.2, Source: (The Royal Society of Medicine, n.d)

## Population and Sample

We will be using a sample size of 80 participants. The samples could be both voluntary or handpicked. Utilizing the four corners of Singapore (North, South, East, and West) will eliminate chances of the results being biased. Thus, a maximum number of 20 samples will only be used from each location. As discussed, we have concluded that a stratified sampling would be best for our experimentation. Using this sampling method ensures each subgroup within the population receives proper representation within the sample (2021). This will provide better coverage of the population since we have control over the subgroups to ensure all of them are represented in the sampling.

## **Variables and Measures**

Our study includes these variables as follows. The dependent variables of our study are the Creative Quotient (CQ) scores as well as the CREA test scores which are designed specifically to test the different factors of creativity in a person. The independent variable of our study is video games itself. Since we are focusing on the creativity of human beings, we are mainly focusing on games that invoke creativity. The game we have chosen is called Minecraft. It is a video game that allows players to create things beyond their imagination. The relationship between the variables is as such so that Minecraft can help to boost their creative minds to think beyond the horizon and for the participants to be as creative as possible in the world of Minecraft. Minecraft can either improve their CQ scores or bring them down after playing.

Apart from the variables, the control measures of our experiment include a duration of 4 weeks for the participants to play Minecraft an hour a day. Their time is controlled in such a way that every time they play, they can log into the server and their gameplay will be monitored. This is done so that at least their activity can be tracked. This also ensures that even if they log in, Away from Keyboard (AFK) can be avoided because gameplay inactivity will not count the hours that they play (2019). Thus, with these variables and control measures, the experiment can be conducted properly.

## **Data Collection Methods**

There will be 10 critical thinking questions in total. Their creativity level will be assessed on 3 factors: fluency, flexibility, and originality. Fluency, is the ability of the participants in producing solutions or sub-questions to solve the problem in the critical thinking question. The participants will be scored on the number of credible solutions or ideas that they produce. Flexibility is the ability to produce solutions which will differ in types/categories from

each other. Originality is the ability to produce unique responses. Sample questions could be seen from our CQ test section. As the experimenters to be surveyed before and after, this makes our findings a time-series data because we are finding differences in the results of the same group over a period of time. The Creativity Quotient Test will provide us with the data needed for this research, through two different scenarios: online assessment, where the survey questions will be sent to their emails and to be completed with the upmost honesty, or alternatively, inviting them down to a specific community centre for the conduct of the Creativity Quotient test. The data will be collected both before and after the experiment and the results will be compared.

### **Data Analysis Methods**

We will perform the T-test data analysis technique to analyse the data. The purpose of the T-test is to assess for a change in the Creativity Quotient of the participants after the 4-week gaming experiment. More specifically, we are looking at using the paired two-sample t-test. To provide with a credible hypothesis, participants will be assessed with the same Critical Thinking Test questions before and after the experiment. Therefore, with this method, we will be able to compare the differences between the two sets of answers.

The objective is to compare their answers before and after the test with accordance to fluency (the number of ideas generated), flexibility (the number of categories into which the generated ideas can be partitioned), and originality or uniqueness in the ideas or solutions produced. In our research, the root of creativity thinking lies in a combination of fluency, the number of ideas generated, flexibility in the number of categories into which the generated ideas can be partitioned. Based on these three dimensions, we will be able to test out the ability of divergent thinking in our participants. Hence, this method would be appropriate because it will make the differences clear when we are comparing the answers to the test before and after.

Prior to the 4-weeks programme, the candidates will be made to take a Creativity Quotient Test which comprises of 10 critical thinking questions assessing their fluency, flexibility and originality on solving critical thinking questions. At the end of the test, they will be graded by a point system. The points scored in the first assessment will be set as the benchmark for the experiment. After the 4-weeks programme, the same candidates will take the critical thinking question test and will be re-assessed. Their current test scores will be collected and compared to their previous test scores. This will be done through a T-test to attain the p-value of the test before and after the experiment. This is to test the effect of creative games on their creativity quotient.

For example, we will compare the p-values of the test before and after the experiment. If the p-value of the test after the experiment is larger than the significance level of 0.05, we do not reject our null hypothesis and conclude that there are no effects of creativity games on the creativity quotient of humans which would conclude that video games does not improve the creativity of human beings.

### **Post Experiment Follow-up**

A post experiment follow-up will be conducted after the study. We believe it is relevant and important. A follow-up on our test candidates is important as to ensure they do not have any post-experiment effects such as addiction, social, and/or emotional issues. Our study involves one cycle (4 weeks) of gaming, an hour each day. Thus, 3 follow up checks that are 3 months apart, having the last follow up at the 9th month, would be done (2021). A survey will be created and be available online, which only they have the access to. A set of questions will be prompted regarding their mental and physical state of mind. Questions provided will be short answered format, hence, they will have to answer in their own words. The survey will give us an insight of their wellbeing after the study, boosting credibility and reliability of our study.

## **Conclusion**

In conclusion, the purpose of this research is to find out the effects of implementing the use of creative games to the development of creativity quotient in human. As the study is for the general people, the test candidates for this research will be coming from different walks of life and backgrounds to deter biasness in our conclusion. In our research experiment, the candidates will be placed on a 4-week induction programme of playing creative video games such as Minecraft which is a video game believed to allow the user to link a wide range of creative stimulus to solve a problem. The candidates will also be doing a pre- and post- Creativity Quotient Assessment before and after the 4-week induction programme. The results of the test will be collated and then compared through a T-Test and Regression analysis to find out the difference in P-Value. The comparison result in the P-Value is to affirm our objective to find out the effects of creative games to the development of creativity quotient in humans. As the research team believes that creative games will have a positive effect to creativity quotient of humans, our hopes are to receive a p-value of lesser than 0.05 significance level to prove our hypothesis. If the research results tally with our hypothesis, we hope that our study will be able to recommend the use of creative games such as Minecraft to the confines of the everyday classroom as a tool to improve creativity thinking.

## References

- “AFK: Short for ‘Away from keyboard’. (GAMER GLOSSARY).” *Boys’ life*. 109.2 (2019): n. pag. Print.
- Anastasia, L. (2015). Are video games bad for you? most people agree that gaming affects teens--the question is how. *Junior Scholastic*, 117(11), 20.
- Alamri, A. (2016). Should Video Games Be Included in the Learning Process? *International Journal of Education*, 8(1), 23. <https://doi.org/10.5296/ije.v8i1.8388>
- Baek, Y., Min, E., & Yun, S. (2020). Mining educational implications of minecraft. *Computers in the Schools*, 37(1), 1-16.  
[doi:10.1080/07380569.2020.1719802](https://doi.org/10.1080/07380569.2020.1719802)
- Behnamnia, N., Kamsin, A., Ismail, M., & Hayati, A. (2020, September 1). The effective components of creativity in digital game-based learning among young children: A case study. *ScienceDirect*.  
<https://www.sciencedirect.com/science/article/abs/pii/S0190740920303716>
- Crystal J., D., Tanya N., B., Faye, M., Ross, H., & Shaheen, S. (2021). Do Children Who Bully Their Peers Also Play Violent Video Games? A Canadian National Study.  
<https://www-tandfonline-com.ezproxy.libproxy.db.erau.edu/doi/full/10.1080/15388220.2013.803244>
- ECA financing sparkles for asian borrowers. (2010). *Trade Finance* (1998),
- Gideon Dishon, Yasmin B. Kafai. (2019) Connected civic gaming: rethinking the role of video games in civic education. *Interactive Learning Environments* 0:0 pages 1-12.
- Green, G., Kaufman, J., Levy, N., Limbert, M., & Barajas, M. (2016). *Video games and creativity*. Academic Press.
- Gerardus, L., van der Wijst, A., Petru, C., & Wilhelmina, L. (2013, August 19). An Evaluation of Alternative Ways of Computing the Creativity Quotient in a Design

School Sample. Taylor & Francis.

<https://www.tandfonline.com/doi/abs/10.1080/10400419.2013.813811>

Huard Pelletier, V., Lessard, A., Piché, F., Tétreau, C., & Descarreaux, M. (2020). Video games and their associations with physical health: A scoping review. *BMJ Open Sport & Exercise Medicine*, 6(1), e000832-e000832. doi:10.1136/bmjsem-2020-000832

Karla R., H. (2015). *Understanding Children's Choices and Cognition in Video Game Play*.

Retrieved from, [https://econtent-hogrefe-](https://econtent-hogrefe-com.ezproxy.libproxy.db.erau.edu/doi/10.1027/2151-2604/a000136)

[com.ezproxy.libproxy.db.erau.edu/doi/10.1027/2151-2604/a000136](https://econtent-hogrefe-com.ezproxy.libproxy.db.erau.edu/doi/10.1027/2151-2604/a000136)

Minecraft Official Site. (2021, January 5). Minecraft.Net. <https://www.minecraft.net/en-us/>

Mirian, C.-R., & Isabel, P. G. (2018, November 7). *Minecraft and machinima in action:*

*development of creativity in the classroom*. Taylor & Francis.

<https://www.tandfonline.com/doi/abs/10.1080/1475939X.2018.1537933?journalCode=rtpe20>

Pros and Cons of Stratified Random Sampling. Investopedia. (2021). Retrieved 19 February 2021, from <https://www.investopedia.com/ask/answers/041615/what-are-advantages-and-disadvantages-stratified-random-sampling.asp>.

Wilkinson, M. (n.d.). 7 Interview Brainteasers to Assess Your Interviewee's Critical

Thinking. Coburg Banks. [https://www.coburgbanks.co.uk/blog/assessing-](https://www.coburgbanks.co.uk/blog/assessing-applicants/7-interview-brainteasers-to-assess-your-interviewees-critical-thinking/)

[applicants/7-interview-brainteasers-to-assess-your-interviewees-critical-thinking/](https://www.coburgbanks.co.uk/blog/assessing-applicants/7-interview-brainteasers-to-assess-your-interviewees-critical-thinking/)

The Royal Society of Medicine. (n.d.). Creativity and Imagination Questions. The Medic

Portal. [https://www.themedicportal.com/application-guide/medical-school-](https://www.themedicportal.com/application-guide/medical-school-interview/medicine-interview-questions/creativity-and-imagination-questions/)

[interview/medicine-interview-questions/creativity-and-imagination-questions/](https://www.themedicportal.com/application-guide/medical-school-interview/medicine-interview-questions/creativity-and-imagination-questions/)