P-ISSN: 2790-6795	Annals of Human and Social Sciences	Jul-Sep 2024,Vol. 5, No. 3
O-ISSN:2790-6809	http://doi.org/10.35484/ahss.2024(5-III)21	[234-244]

Annals of Human and Social Sciences
www.ahss.org.pk

RESEARCH PAPER

The Association between Video Gaming and Cognitive Abilities: Attention, Memory and Problem Solving in Youth

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ABSTRACT

The current study aims to analyze the relationship between juvenile video gaming and cognitive skills, with a particular emphasis was on problem-solving, attention, and memory. The foundation for comprehending the cognitive processes involved in video gaming was provided by the theoretical framework of Cognitive Load Theory. Data was collected through a purposive sampling technique; a quantitative analysis was carried out on a sample of 350 young people. The participants' video gaming habits and cognitive abilities were evaluated by the completion of a Likert scale survey questionnaire. The study examined how video games affect attention, memory, and problem-solving abilities, uncovering a mix of positive and negative connections to cognitive functions.The study's findings hold significant importance for policymakers, parents, and educators, offering valuable insights into how video gaming affects the cognitive abilities of youth. It presents recommendations for promoting positive gaming habits and lays the groundwork for further exploration in the field of video game.

Keywords: Attention, Cognitive Effects, Memory, Online Gaming, Problem-Solving

Introduction

Social media has become an essential component of young people's life in recent years, revolutionizing the ways in which they engage with others, exchange information, and communicate (Muzaffar, et. al., 2019; Muzaffar, et. al., 2020).) Due to the dominance of platforms like Facebook, Instagram, Twitter, Snap chat, and Tik Tok in the digital world, youth are continuously connected, chronicling their life, and looking for approval from their online peers. While there was little question that social media has many advantages, such as improved disconnected, information sharing, and creative expression, there was rising worry over its effects on children's mental health.

This study seeks to investigate the connection between young people's use of social media and their mental health. The researcher examines the possible detrimental impacts that excessive or unhealthy social media use may have on young people's mental health while also taking into account methods for encouraging good online participation that might advance their general welfare.

Beyond low self-esteem and social isolation, social media has a significant negative influence on mental health. Young persons who use social media excessively have been found to have increased levels of stress, anxiety, and depression. Constantly being exposed to internet turmoil, cyber bully, and unpleasant content can be harmful to one's mental health. Additionally, the compulsive nature of social media, together with its constant scrolling and alerts, can interfere with sleep cycles, resulting in exhaustion and poor mental health.

Social media has the capacity to both negatively and positively affect the mental health of young people, notwithstanding any possible concerns. It may serve as a forum for

inspiration and support by connecting users with groups of youth who have similar interests and experiences. Social media may also be used to raise mental health awareness, reduce stigma around mental health conditions, and offer resources for those in need of assistance.

In current study, the researcher investigates the numerous elements that affect how social media affects young people's mental health. The researcher investigates the psychological processes that underlie the detrimental outcomes, including social comparison, cyber bully, and the addictive properties of social networking sites. Additionally, the researcher discussed approaches and procedures that may be used to encourage wholesome online interaction and lessen the possible negative effects of excessive social media use on mental health.

This study intends to contribute to the creation of evidence-based treatments and guidelines for young people, parents, educators, and policymakers by getting a thorough knowledge of the link between social media usage and the mental wellness of children. In order to establish a positive and empowering digital environment for the younger generation, it was important to be aware of the difficulties and possible threats posed by social media.

Literature Review

Farchakh et al. (2020) carried out a cross-sectional investigation in Lebanon to analyze the influence of video game addiction on cognitive abilities in schoolchildren. The results demonstrated a significant connection between video game addiction and deficits in various cognitive skills, indicating a relationship between video game addiction and reduced academic performance, memory, attention, and cognitive abilities in Lebanese school children. Choi et al. (2020) conducted a review of literature to investigate the correlation between commercial video games and cognitive functions. They discovered that playing video games could enhance cognitive skills, with this association being impacted by factors like age and gender. A systematic review by Pallavicini et al. (2021) and Reynaldo (2021) explored the effectiveness of commercially available video games in reducing stress and anxiety, revealing that various types of video games, including action games, were successful in alleviating stress and anxiety across all age groups. In a similar vein, Martinez et al. (2022) conducted a systematic review focusing on the educational potential of entertainment video games. Their findings suggested that entertainment video games could serve as valuable tools for academic learning, particularly in subjects like science and foreign languages, enhancing the learning experience. Sun et al. (2022) delved into the impact of prior gaming experience on problem-solving abilities in Taiwanese elementary school students. Their study revealed that individuals with more years of gaming experience exhibited enhanced problem-solving skills, underscoring the importance of problem-solving cognitive processes in various contexts and scenarios. Denson et al. (2022) put forth the integrative motivational theory of violent video games, aiming to elucidate the allure of violent video games and the underlying psychological motives for engaging with them. They emphasized the individual differences in motivational factors and proposed potential avenues for future research in this area.

Leonard et al. (2009) conducted a quasi-experimental study focusing on the impact of a genetics-themed video game on education, noting no significant changes in student learning but significant differences in student engagement with the game. Wouters et al. (2013) carried out a meta-analysis exploring the effectiveness of serious games in learning and motivation, indicating that serious games outperformed traditional teaching methods in terms of learning and retention, especially when combined with other teaching strategies and collaborative work. Kazimoglu (2013) delved into the use of video games in educational settings, stressing the necessity for further investigation into the development of cognitive skills and knowledge through video games, particularly in programming concepts and

computational thinking. A serious game aimed at enhancing computational thinking and programming knowledge demonstrated positive impacts on students' motivation and problem-solving abilities.

These studies collectively underscore the potential influence of video games on cognitive abilities, academic learning, stress management, and problem-solving skills, underscoring the importance of additional research in these domains.

Barman (2019) investigates the quality assessment of live passive gaming video streaming services, a rapidly growing phenomenon alongside the popularity of cloud gaming services and e-sports. Despite the enormous user bases and traffic that websites like Twitch. TV and YouTube gaming produce, quality assessment in this field has received little attention. For these services to be successful, end users must have high-quality experiences. The research paper uses both subjective and objective quality evaluation techniques to close this research gap. It starts by evaluating the compression effectiveness of many compression standards that are often used in game videos. The trade-off between quality and data-rate after compression for gaming and non-gaming videos is then explored in a comparative research. An open-source game video dataset is generated to aid in the research, and it is then used to assess how well-liked Video Quality Assessment (VQA) measures perform. To determine their effect on the VQA measures, several temporal pooling techniques and content-based categorization methods are investigated. Additionally, the research paper creates two machine learning-based No-Reference (NR) models employing NR features and current NR measures in order to improve the performance of existing No-Reference (NR) VQA metrics for gaming videos. These models perform on par with cutting-edge Full-Reference (FR) VQA metrics while outperforming current NR metrics in terms of performance. The study advances our knowledge of quality evaluation in the context of live passive gaming video streaming services.

Allcoat (2020) highlights the significance of researching the effects and optimal use of virtual environments, particularly in the context of video games, which are widely used applications of virtual environments. Conflicting findings are found in the corpus of existing video game research in a number of areas, including training, emotional consequences, and visual attention. He investigates how playing video games affects visual attention, finding that the effects differ based on the attentional process being examined and the kind of video games being played. The measuring of video game experience points to a more all-encompassing strategy that takes into account different video game genres and platforms. It also looks at any potential links between various video game genres and cognitive abilities. He investigates the connection between impulsivity, task switching, and playing video games. In comparison to playing video games on mobile devices, the effects of playing video games at home on implicit and explicit memory are investigated. A research evaluating the impacts of virtual reality on learning is presented in relation to the advent of virtual reality as a more recent type of virtual environment. Compared to textbook-style or video resources, the results show more motivation and engagement with learning tools. contrasts learning experiences in mixed reality, virtual reality, and traditional lecture-style modalities, demonstrating better levels of engagement and joyful feelings in these settings.

Gordillo Bravo (2020) conducted a series of five experiments to explore whether the presence of motion and tracking in video games enhances declarative memory for semantic information associated with objects compared to when objects remain stationary. In a game, participants had to recognize items that had prime numbers and take appropriate action. The findings indicated a speed-accuracy trade-off, with prime numbers learn under the motion condition being identified more quickly but not more precisely than in the control game. There was no discernible difference in learning between the motion and static circumstances throughout numerous game sessions, though. The game's addition of social competitiveness increased the precision of the data gleaned from detecting moving objects. Overall, the results indicate that although motion tracking in video games may boost

attentional resources while playing, it did not provide appreciable gains in future declarative memory tests. The paper covers conceptual underpinnings and task restrictions.

Bozdog (2019) explores the intersections between performance and video games through a practice-based research methodology.The research paper looks at how modern performance practice and game design might influence and help create new hybrid experiences. The Inchcolm Project and Generation ZX(X) are two substantial, interdisciplinary initiatives whose design, development, and critical reflection serve as the basis for this study's mapping of the process of designing for the moving body in both virtual and real worlds. The projects use a variety of design techniques, including environmental storytelling, trans media storytelling, adaptation, site-specific design, and game-responsive design. The research paper proposes the idea of "story walking," a design method that blends elements of mixed reality and interdisciplinary to produce immersive experiences in which the player or audience travels through intricately detailed worlds that are rich in narrative. In the written reflection, the advantages and disadvantages of designing for a moving body across media are emphasized, and it is also shown how interdisciplinary study has the potential to advance the disciplines of game design and modern performance. The research makes suggestions for new approaches, methods, know-how, and tool kits for practitioners in both domains while also advancing our knowledge of hybrid activities. A practice research portfolio that records the findings and procedures used to produce the work is part of the research.

Murray (2020) undertakes a research paper to explore the categorization, construction, and consumption of the Utopian genre in interactive media. The study examines three case studies, Bloodborne, Persona 5, and The Wolf Among Us, using a mix of qualitative and quantitative research techniques. The goal is to create three Utopian schemata that may be used as analytical codes to find and study utopic indications in a single playtime of the games. In this study, utopia is defined as behaviors or things that help youth achieve their highest potential or remind them of it. This concept affects how to spot Utopian symbols in the games. The research paper dives deeper into the case studies, examining the varied shapes utopia might take in various video game story worlds, including refugee narratives, worlds that mimic our own but with accentuated corruption, and dystopian story worlds devoid of hope. Despite the many settings, utopia is always present, representing humanity's innate desire for utopic journeys and objectives. Video games create story lines that emotionally engage players, influencing their actions and highlighting social faults. The research paper emphasizes how video games can be a powerful medium for developing immersive experiences that give players agency, while also examining social structures and impacting player experiences. The project offers a reproducible technique for researching utopia and dystopia in games in addition to highlighting the importance of utopia in video games, offering novel insights into the connection between utopia and video games.

Hypotheses

H1: There is a positive association between young people's cognitive capacity and how much time they spend playing video games. Better attention, memory, and problem-solving abilities correlated with more advanced levels of video gaming.

H2: The effects of various video game genres on young people's attention spans differ. Due to their rapid speed, action games may develop attention powers, whilst strategy games may boost planning and attention control. Youth attention performance thus influenced by the kind of video games they choose.

H3: Youth problem-solving skills positively connect with the amount of time spent playing video games. Over time, playing more video games may improve one's cognitive flexibility, pattern identification, and decision-making abilities, which improve one's problem-solving abilities.

Material and Methods

Research design

Data about video gaming behaviors and young people's cognitive capacities gathered at one specific moment in time.

Participants:

The participants selected from a diverse pool of youth, aged between 18-25 years, representing different socio-economic backgrounds. To ensure a comprehensive analysis, participants with varied video gaming experiences be included.

Sample

A sample of 350 participants are selected for this study. (n=350)

Sampling techniques:

A purposive sampling technique used to recruit participants, aiming to ensure a balanced representation of both heavy and light video gamers.

Data collection

Video Gaming Habits:

Participants' video gaming behaviors evaluated using self-report questionnaires and/or activity logs that track details such game length, frequency, and genres.

Cognitive Capabilities:

Using standardized cognitive assessment instruments such as attention tasks, memory assessments, and problem-solving exercises, cognitive abilities such as attention, memory, and problem-solving be assessed.

Demographic Information:

Additional demographic data gathered to account for any confounding factors, such as age, gender, education level, and socioeconomic status.

Data analysis:

Statistical analysis was done to determine whether playing video games is related to improved cognitive function. To find possible links and any mediating or moderating factors, correlation and regression analysis may be utilized. In this data analysis, a sample size of 350 participants was gathered using purposive sampling. The data sets was subjected to descriptive analysis to provide a comprehensive overview of the variables under consideration. Subsequently, a normality test was conducted, revealing that the data followed a normal distribution. Given this normal distribution, further statistical tests were applied. An independent t-test was utilized to examine differences in age groups, while a One-way ANOVA test was employed to assess variations in other factors. These tests allowed for a rigorous examination of the data, enabling the identification of statistically significant differences and insights into the factors under investigation.

Variables and Indicators:

Cognitive Capacity and Video Game Engagement (CCE)

Variables: Attention Skills, Memory Abilities, Problem-Solving Abilities, Time Spent on Video Games

Indicators: Improvement in attention skills, Enhancement in memory abilities, Improvement in problem-solving abilities, Positive correlation with enhanced memory abilities

Effects of Video Game Genres on Attention Span (EGA)

Variables: Video Game Genre

Indicators: Improvement in planning abilities

Problem-Solving Skills and Video Game Engagement (PSS)

Variables: Cognitive Flexibility, Pattern Identification Abilities, Decision-Making Abilities, Time Spent Playing Video Games

Indicators: Improvement in cognitive flexibility involving memory, problem-solving, and attention due to playing video games, Enhancement in the ability to identify patterns, Improvement in decision-making abilities, Positive correlation with improved cognitive flexibility, encompassing memory, problem-solving, and attention, as the duration of video game engagement increases.

Results and Discussion

The results show that the majority of the study's participants were young adults, with 99.6% falling within the 18-25 age range. In terms of gender distribution, 68.85% identified as male, while 30.86% identified as female. The data also highlighted a variety of gaming habits among the participants, with 31.71% playing games once a month, and 11.71% playing games for 3-5 hours several times a week. In relation to gaming devices, PCs or laptops were the most popular choice, favored by 75.43% of respondents. The average time spent gaming varied, with 34% playing for less than 1 hour and 25.43% playing for 1-2 hours. When it comes to preferred gaming genres, action games were the top choice at 26%, followed by sports games at 22.85%. Moreover, the engagement data showed that 26.57% of participants reported frequent engagement with games, while 22.86% claimed to never engage with games. These results offer valuable insights into the gaming habits and preferences of the study's participants, providing information on the prevalence of gaming among young adults, their gaming frequency, preferred gaming devices, genres, and levels of engagement.

The results present essential statistical measures and tests of normality for three variables: Cognitive Capacity and Video Game Engagement (CCE), Effects of Video Game Genres on Attention Span (EGA), and Problem-Solving Skills and Video Game Engagement (PSS). For CCE, the data displays a mean score of 2.7927 and a median of 2.8333, with a variance of 0.74 and a standard deviation of 0.86021, indicating moderate variability. The skewness value of 0.144 suggests a slightly right-skewed distribution, and the normality test shows that the data is approximately normally distributed. In the case of EGA, the mean score is 2.7364, and the median is 2.75, with a variance of 0.742 and a standard deviation of 0.86124. The skewness value of 0.221 indicates a minor rightward skew, and the normality test also indicates a relatively normal distribution. As for PSS, the mean is 2.7125, and the median is 2.8, with a variance of 0.764 and a standard deviation of 0.87393. The skewness value of 0.317 suggests a slight rightward skew, and the normality test results show that the data is approximately normally distributed.

The results of the t-test analyses comparing Cognitive Capacity and Video Game Engagement (CCE) and Effects of Video Game Genres on Attention Span (EGA) between age groups (18-25) reveal that there are no statistically significant differences in CCE or EGA among the 18-25 age group. For CCE, the t-test analysis shows a mean score of 2.8065 and a standard deviation of 0.8673 for the 18-25 age group, with a calculated t-statistic of 1.043 and a corresponding p-value of 0.232. The 95% confidence interval for the difference in means (-0.16 to 0.53) further supports the conclusion that there is no significant age-related difference in CCE. Likewise, for EGA, the t-test analysis indicates a mean score of 2.7322 and a standard deviation of 0.85513 for the 18-25 age group, and a mean score of 2.78 with a standard deviation of 0.96911 for the other age group. The calculated t-statistic is -0.267, with a p-value of 0.437. The 95% confidence interval for the difference in means (-0.40 to 0.30) reinforces the finding that age does not significantly impact EGA. In conclusion, the t-test analyses demonstrate that there are no statistically significant differences in Cognitive Capacity (CCE) or Effects of Video Game Genres on Attention Span (EGA) between the 18-25 age group. These results suggest that age does not play a significant role in explaining variations in CCE and EGA among the study's participants.

The data demonstrates that there are statistically significant differences in Cognitive Capacity and Video Game Engagement (CCE), Effects of Video Game Genres on Attention Span (EGA), and Problem-Solving Skills and Video Game Engagement (PSS) among the groups being compared. The analysis for CCE reveals significant differences between groups, with a p-value of 0.000, indicating that there are statistically significant variations in CCE scores among the groups. Similarly, significant differences between groups are observed for EGA and PSS, with p-values of 0.000 for both variables. These findings provide support for the hypotheses, suggesting a positive correlation between video game playing time and cognitive ability (CCE), variations in the effects of different video game genres on attention spans (EGA), and a beneficial relationship between problem-solving abilities and video game playing habits (PSS). In conclusion, the results of the one-way ANOVA analysis confirm that video game engagement and specific video game genres have a statistically significant impact on cognitive capacity, attention span, and problem-solving skills among the participants of the study. The analysis conducted for CCE reveals significant differences between groups, with a p-value of 0.000, indicating statistically significant variations in CCE scores among the groups. Similar significant differences between groups are observed for EGA and PSS, with p-values of 0.000 for both variables. These findings support the hypotheses and demonstrate a positive correlation between the amount of time youths spend playing video games and their cognitive ability (CCE), variations in the effects of different video game genres on attention spans (EGA), and a favorable relationship between problem-solving skills and video game engagement (PSS). In conclusion, the results of the One-way ANOVA analysis confirm that video game engagement and specific video game genres have a statistically significant impact on cognitive capacity, attention span, and problem-solving skills among the participants of the study. The correlation matrix offers valuable insights into the connections among different variables in the study, revealing that factors such as gaming frequency, choice of gaming devices, and preferred gaming genres could impact cognitive skills and engagement, while age and gender have a relatively minor role in these relationships. Age displays weak negative correlations with most variables, indicating a slight decrease in certain factors as age increases. Gender, on the other hand, shows a weak positive correlation with gaming frequency, suggesting that males might engage in gaming more frequently than females. Moreover, gaming frequency is positively linked to cognitive skills and engagement, hinting at a potential connection between gaming habits and performance in these areas. Additionally, the total scores for cognitive capacity, attention span, and problem-solving skills are strongly positively correlated with each other, indicating an overall positive relationship among these aspects within the realm of video game usage. In conclusion, the results derived from the correlation matrix underscore the potential impact of gaming behaviors on cognitive skills and engagement, offering

valuable insights for further exploration and research in the domain of video game psychology and behavior.

Analysis of Hypotheses:

In light of the hypotheses presented and the comprehensive data analysis conducted, several key conclusions can be drawn:

The data analysis provides some support for this hypothesis. While there is a slight negative correlation between average hours of gaming and cognitive capacity (CCE), it is essential to note that the correlation is weak. This suggests that spending more time gaming does not significantly correlate with lower cognitive capacity. However, the correlation between gaming frequency (often use) and CCE is positive but weak, implying that more frequent gamers may have slightly higher cognitive capacity. While the relationship exists, the overall impact on cognitive capacity appears to be limited.

The data analysis provides some support for this hypothesis. Preferred gaming genres show positive correlations with engagement levels, suggesting that individuals who prefer specific genres tend to report higher engagement levels. However, the specific impact on attention span is not directly addressed in the data analysis. Further research specifically focusing on the relationship between gaming genres and attention span would be needed to confirm this hypothesis.

The data analysis partially supports this hypothesis. While there is a weak negative correlation between average hours of gaming and problem-solving skills (PSS), it is important to note that the correlation is modest and that spending more time gaming does not significantly correlate with lower problem-solving skills. Additionally, gaming frequency (often use) exhibits a positive correlation with PSS, indicating that more frequent gamers may have slightly higher problem-solving skills. Similar to H1, the relationship exists, but the overall impact on problem-solving skills appears to be limited.

Conclusion

The results of the analysis unveiled a nuanced link between cognitive abilities and gaming behaviors. Although, a minor negative correlation was detected between the average hours spent gaming and cognitive abilities, it was weak, indicating that an increase in gaming time did not significantly relate to lower cognitive abilities. Furthermore, a weak positive correlation was discovered between gaming frequency and cognitive abilities, suggesting that individuals who game more frequently might possess slightly higher cognitive abilities. These outcomes stress the necessity for further examination of factors like the types of games played and their incorporation into daily routines to obtain a comprehensive understanding of this connection.

While preferred gaming genres were positively linked to engagement levels, the specific impacts on attention span were not explored. This underscores the requirement for targeted research, including experiments that evaluate attention span before and after engaging in different game genres, to gain clearer insights into this association.

Similar to cognitive abilities, the association between problem-solving skills and gaming behaviors seemed intricate. Despite a minor negative correlation between the average hours spent gaming and problem-solving skills, it was moderate, indicating that an increase in gaming time did not significantly correlate with lower problem-solving skills. Additionally, gaming frequency displayed a positive correlation with problem-solving skills, implying that individuals who game more frequently may possess slightly higher problem-solving skills. These findings highlight the multifaceted nature of the relationship between problem-solving skills and gaming behaviors.

Recommendations

The analysis of the data suggests that gaming has a limited effect on cognitive abilities and problem-solving skills, showing only weak connections. Further investigation is required to understand the relationship between different gaming genres and attention span. Age and gender play a small part in clarifying the differences in gaming behaviors and cognitive abilities. These results provide important information for future studies in the field of video game psychology and behavior.

The research highlights the importance of conducting detailed examinations into the connections between gaming behaviors and cognitive abilities, taking into account variables like the specific genre of games played and individual variations. Future studies could gain from long-term investigations, experimental alterations of gaming encounters, and explorations into the potential advantages of video games for particular cognitive skills. In general, this research adds to our comprehension of the intricate interplay between video gaming behaviors and cognitive abilities among youth, underscoring the necessity for thorough and focused research in this domain.

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