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# Influence of Non-linear Storytelling in Video Games on Cognitive Development among Students with Learning Disabilities

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**Abstract.** This study seeks to answer the question, aiming to investigate whether playing video games affects the cognitive development of students with learning impairments in Saudi Arabia" by looking at the possibility of gender differences in the cognitive results of video game play. A quantitative method of research was used to investigate whether or not certain aspects of video game play, such as playing frequency, game genre, and length, are associated with cognitive growth in memory, attention, and problem-solving among a sample of 350 students. The results showed a link between frequent play and involvement in certain game genres, such as action and role-playing games, to the improvement of students' cognitive development. It was also noted that female participants consistently outperformed male participants on tests of memory, attention, and problem-solving, highlighting the moderating influence of gender. These results have major ramifications for educators, parents, and policymakers. Thus, the need to develop healthy gaming habits and apply strategies that are welcoming to students of both sexes, illuminating the potential of video games as tools for fostering cognitive growth is deemed necessary.

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## 1. Introduction

The gaming industry has seen a dramatic shift, becoming a mainstream source of entertainment and information. Young Saudi Arabian students are not immune to its appeal, which draws people from all walks of life. The phenomenal development of the gaming business in Saudi Arabia over the last several years is without dispute. The present uptick in video game use is especially notable among young people, and especially among students. A significant number (12.5%) of pupils, exhibit signs matching with the features of such disorders (Alqahtani, 2015), making the presence of learning disabilities a notable concern within the educational landscape of Saudi Arabian schools. Because of the prevalence of both video games and learning difficulties in the Kingdom of Saudi Arabia, research on the effects of video games' non-linear narrative patterns on players' mental development is urgently needed.

Video games have come a long way from their pixelated arcade days, becoming a robust medium for gripping stories and compelling user participation. Like many other countries, the Kingdom of Saudi Arabia has seen the video gaming industry explode in recent years. The Entertainment Software Association (ESA) has reported that the video game business in the United States generated an astounding $36.9 billion in sales in 2019. This staggering sum dwarfs the total profits of the film and music industries combined, and it demonstrates the outsized influence and effect of video games on the modern entertainment scene. The Kingdom of Saudi Arabia is not immune to the prevalent worldwide phenomena; the country's rapidly expanding gaming industry is a reflection of the medium's widespread appeal and cultural significance. Source? Alqahtani's (2015) study emphasizes the seriousness of the problem of pupils with learning difficulties in Saudi Arabian schools. According to research by Al-Jarrah et al. (2016), school-aged children in the Kingdom of Saudi Arabia exhibit signs of dyslexia, a learning condition characterized by difficulties in the area of reading. The above data illustrate the critical need to address the unique educational challenges faced by kids with learning impairments in the United States immediately.

The world of video games is fascinating because it is a dynamic and participatory experience in which players take part. Green and Bavelier (2003) and Boot et al. (2011) found that this kind of activity boosted participants' memory, attention, problem-solving, and spatial abilities. Extensive research has been conducted on the mental advantages of playing video games, with researchers unearthing a wealth of evidence showing increases in visual attention, spatial cognition, and reaction speed. Action video games are not an exception, as studies by Green and Bavelier (2003) and Boot et al. (2008). In addition, video games have shown exceptional potential as a tool for cognitive rehabilitation across a variety of therapeutic situations, especially in cases requiring traumatic brain damage, as underlined by (Blundon & Smits, 2000).

The introduction of video games marked a major change in storytelling since non-linear stories are now the norm for the medium. A narrative approach known as non-linear storytelling involves telling the story out of chronological sequence. This can take many different forms. For example, non-linear plotlines might simulate human memory recall by using dream sequences, flashforwards, flashbacks, and foreshadowing (Abu Talib et al., 2020). They can also incorporate fanciful aspects like time travel or clairvoyant. The reason for this is that video games are unlike any other medium since they allow the user to influence the story via their actions and choices. Video games like "The Elder Scrolls" and "The Witcher" have been wildly successful, and this is largely because they have non-linear storylines. Scientific studies have recently started to use theoretical foundations to design, explain, and evaluate gamified interventions. These theoretical foundations use conceptual propositions as a basis, such as the foundations of game-based learning in which Plass, Homer, and Kinzer argue that various affective, motivational, cognitive, and sociocultural foundations, e.g. situated learning theory, achievement goal theory, social cognitive theory, and activity theory, provide the basis for the successful design of game-based learning (Krath et al., 2021). These features give players a say in the game's plot, letting them forge their path and choose their destiny. Non-linear narratives have been shown to have positive effects on the cognitive processes of children with learning difficulties, however, this area of study is still in its infancy. A full investigation of this phenomenon is necessary if we are to learn how non-linear storytelling affects brain development in this age range.

Individuals afflicted with learning impairments occasionally encounter challenges in maintaining focus and effectively utilizing educational resources such as printed literature and audio-visual media. The manifestation of this underlying concern is characterized by the incapacity to engage in literacy, comprehend information, or execute various cognitive functions such as strategic thinking and logistical arrangements (Giedd et al., 2015). Engaging in the interactive realm of video games featuring non-linear narratives can present a diverse array of intellectually stimulating hurdles for students grappling with learning disabilities. The intricate intricacies of the game's environment necessitate a profound cognitive engagement from the player, as they navigate through its diverse narratives, employ critical thinking skills, and surmount complex challenges (Krath et al., 2021). Hence, it is imperative to incorporate the perspectives and encounters of students grappling with learning disabilities when evaluating the ramifications of non-linear storytelling within the realm of video games.

**Objectives of the Study**

The primary goals of this research are to examine the potential effects of non-linear storytelling on cognitive growth, to identify subtypes of non-linear storytelling that may have a more significant impact, and to examine how demographic variables like age, gender, and type of learning disability may moderate the relationship between non-linear storytelling and cognitive growth.

**Literature Review and Previous Studies**

Video games' non-linear narrative sets games apart from traditional media like books and movies. Video game narratives are interactive in the sense that player choices affect the game's progression. (Abu Talib et al., 2021). This fast-paced section of the story may capture the attention of readers. Video games have a wide range of non-linear narrative structures, from role-playing games with branching tales like "Mass Effect" (Winter, 2022) to sandbox games with emergent stories like "Minecraft" (Rahimi et al., 2023). By making these adjustments, players feel like they are the ones writing the plot. There is a large body of work that discusses games with non-linear storylines. There has been prior research on the effects of player agency on narrative and immersion (Calleja, 2011; Zagal et al., 2013). Research by Zagal et al. (2013) on the emotional impact of choices in "The Walking Dead" (Games, 2012) demonstrates the potential for emotional engagement in non-linear narratives.

Students with learning issues such as dyslexia, ADD/ADHD, or autism spectrum disorder can face exceptional challenges to their intellectual development. A person's ability to encode and decode information is impaired by dyslexia (Shaywitz et al., 2003). Attention deficit hyperactivity disorder is characterized by difficulties in maintaining focus, controlling impulses, and planning (American Psychiatric Association, 2013). Disabilities in social communication and confined, repetitive patterns of behaviour are hallmarks of autism spectrum disorders, as defined by the American Psychiatric Association (2013). The process of cognitive development in children with learning disabilities has been examined before. Neuroimaging research, such as that conducted by Shaywitz et al. (2003), has shown that patients with dyslexia have distinctive patterns of brain activity when reading. Studies of cognitive therapy for children with ADHD demonstrate improvements in both executive function and attention (Pelham & Fabiano, 2008). It's crucial to have a good grip on cognitive profiles when considering how kids with learning disabilities engage with the non-linear narrative in video games.

For typically developing kids, video games are beneficial to their brains. The benefits of meditation on cognitive abilities have been shown in several scientific investigations. Green and Bavelier (2003) found that those who played action video games had enhanced visual attention and spatial competence. Boot et al. (2008) demonstrated that training with action video games enhanced working memory and attention among other cognitive capacities. The game's potential as a cognitive rehabilitation method has also been explored. Alashram et al. (2019) investigated the use of video games for cognitive rehabilitation after traumatic brain injury and found encouraging results. Therapeutic video game interventions enhanced cognitive and psychosocial outcomes, suggesting their potential for application with clinical populations.

The widespread usage of video games among students and the educational system in Saudi Arabia both contribute to the context of this inquiry. The Saudi Arabian educational system has undergone several modifications in recent years in an attempt to both improve the quality of education and make it available to a wider variety of pupils (Al-Seghayer, 2015). These initiatives aim to assist children with learning issues by providing them with access to specialized educational programs and resources. Video games have become more popular in Saudi

Arabia. The large number of gamers in Saudi Arabia has resulted in a strong gaming community and several gaming events. The prevalence of video game addiction among Saudi Arabian students, especially those with cognitive disabilities, calls for more study of the issue.

Although there is a dearth of research specifically addressing the problem, the studies that are relevant give useful insights into the impact of non-linear narratives in video games on the cognitive development of students with learning challenges in Saudi Arabia. According to Alqahtani's (2015) findings, tailored educational support is necessary due to the prevalence of learning challenges among Saudi Arabian students. Al-Jarrah et al. (2016) did another study that aimed to better understand the challenges faced by students with dyslexia in the Saudi Arabian context. Most research on games' non-linear storylines has been conducted in the West. Researchers like Zagal et al. (2013) have explored the emotional impact of in-game choices, but their studies haven't focused on students with learning issues. Studies such as Green and Bavelier's (2003) and Boot et al.'s (2008) that have shown favourable benefits of gaming on cognition have also mostly focused on typically developing populations.

## 2. Methods

To better understand how non-linear storytelling in video games may affect the brain development of children with learning difficulties in Saudi Arabia, the current study used a quantitative research approach. The executed plan allowed for the systematic collection of quantitative data, which in turn allowed for an in-depth examination of the complex relationships and strong effects under investigation. The participants in this research were all Saudi Arabian students with learning difficulties who were recruited from various educational institutions around the country and who were selected randomly. Researchers took great care to adhere to all relevant ethical guidelines, including obtaining informed permission from participants' parents or legal guardians. The students' consent to participate in the research was also an active part of the decision-making process. The initial phase of the study was to recruit a sample size of 350 people to take part.

The impact of video game playing on people's development as thinkers was studied using a battery of questionnaires and surveys. The study probed players deeply, asking about everything from how frequently and for how long they play to their favourite game genres and whether they prefer linear or non-linear stories. The development of memory, focus, and problem-solving skills were all evaluated using a battery of standardized cognitive tests.

The instruments used to collect data were surveys, questionnaires, and cognitive tests please mention and discuss the instruments. Everyone who took part in the cognitive tests had their own private space in which to work. In-depth assessments of memory capacity were performed using the well-respected Wechsler Memory Scale (WMS-IV) (Wechsler, 2009). Not only was long-term memory retention and recall considered, but also short-term memory. We utilized Conners' Continuous Performance Test (CPT-3) (Conners et al., 2003) to assess levels of concentration and attention. Researchers employed the Tower of London

Test to assess the participants' problem-solving abilities. This test is designed to evaluate candidates' capacity for strategic thinking and executive function. Then how many respondents were in the final phase? Since you mentioned that the 350 was in the initial phase.

The data from the survey, questionnaire, and cognitive tests were analyzed statistically using SPSS version 26. The social sciences rely heavily on this software for data analysis. Means, standard deviations, and frequency distributions are all examples of descriptive statistics that were computed to offer a brief overview of the data. The researchers employed the statistical method of regression analysis to check their hypothesis. This study used a methodical approach by using multiple regression analysis to investigate the complex relationship between children's cognitive development and the adoption of non-linear storytelling tactics in video games. Furthermore, the investigation eliminated other potential confounding variables. Memory, focus, and problem-solving are just a few of the many types of cognition that have been dissected in these studies.

## 3. Results

The following section presents the results to achieve the objectives of this study.

**Table 1: Descriptive Statistics for Video Game Engagement**

| Variable | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Frequency of Video Game Play | 5.2 | 2.1 | 2 | 9 |
| Duration of Video Game Play (hrs) | 2.8 | 1.5 | 1 | 6 |
| Types of Video Games Played | | | | |
| - Action Games | 3.5 | 1.8 | 1 | 7 |
| - RPGs | 2.9 | 1.4 | 1 | 5 |
| - Simulation Games | 1.8 | 0.9 | 1 | 4 |

The degree of participation in video games among the participants is summarized in great detail in the descriptive statistics table. The average number of days per week that individuals played video games was found to be around 5.2, with a standard deviation of 2.1 indicating some variation in this habit. Sessions typically last 2.8 hours on average, with a standard variation of 1.5 hours. According to these numbers, there is a huge disparity in how much time different people spend playing video games. Action games had the highest mean score (3.5) for respondents' degree of engagement in video gaming, followed by role-playing games (2.9) and simulation games (1.8).

The following table presents the data obtained for the cognitive development assessment.

**Table 2: Descriptive Statistics for Cognitive Development Assessments**

| Cognitive Domain | Mean Score | Standard Deviation | Minimum Score | Maximum Score |
|---|---|---|---|---|
| Memory Assessment | 78.4 | 10.2 | 55 | 95 |
| Attention Assessment | 65.8 | 12.5 | 40 | 85 |
| Problem-Solving Assessment | 45.6 | 8.7 | 30 | 60 |

Three different types of cognitive examinations are summarized in the table, along with descriptive data. Participants averaged 78.4 out of a possible 100 on the memory test, with a standard deviation of 10.2. Since participants' scores varied from as low as 55 to as high as 95, this data suggests that there is some variation in individuals' recall abilities. With a mean score of 65.8 and a standard deviation of 12.5 on the attentiveness test, the students performed average. It seems from these data that participants paid varying levels of attention during the test. An average of 45.6 was attained on the test of problem-solving ability, with a standard deviation of 8.7. These results demonstrate individual differences in the capacity for problem-solving.

**Table 3: Descriptive Statistics for Subgroup Analysis by Gender**

| Gender | N | Mean Memory Score | Mean Attention Score | Mean Problem-Solving Score |
|---|---|---|---|---|
| Male | 175 | 77.2 | 66.4 | 46.1 |
| Female | 175 | 79.7 | 65.1 | 45.2 |

Descriptive information on cognitive development scores is broken down by gender and shown in the table below. Compared to the average score of 79.7 attained by female participants, male participants averaged a score of 77.2. Males averaged 66.4 on the attentiveness test, while females averaged 65.1. The average score for males on a problem-solving test was 46.1, whereas the average score for women was 45.2. Small but significant differences were found between the sexes in terms of cognitive development, with females showing somewhat better performance on memory tests and males on attention-related activities.

**Table 4: Multiple Regression Analysis for Memory Assessment**

| Predictor Variable | Beta Coefficient | Standard Error | t-Value | p-Value |
|---|---|---|---|---|
| Frequency of Game Play | 0.32 | 0.08 | 4.00 | <0.001 |

| | | | | |
|---|---|---|---|---|
| Types of Video Games Played (Action) | 1.25 | 0.18 | 6.94 | <0.001 |
| Types of Video Games Played (RPGs) | 0.82 | 0.15 | 5.47 | <0.001 |
| Duration of Game Play (hrs) | -0.15 | 0.06 | -2.50 | 0.014 |
| Gender (Female) | 2.18 | 0.42 | 5.20 | <0.001 |

Results from a multiple regression analysis performed for the aim of assessing memorization are shown in the table. Video game play frequency, game genre (action vs. role-playing games), total play time (in hours), and participant gender (males were utilized as a control group) were all included as predictors in the model.

Playing games more often was associated with higher memory scores, and this link was shown to be statistically significant (β = 0.32, p 0.001). This may indicate that regular gamers have superior recall abilities. The research indicated that playing some video games, namely action games (β = 1.25, p 0.001) and RPGs (β = 0.82, p 0.001), improved memory scores significantly. People who played these types of games tended to have better memories. The research found that longer gameplay times were associated with worse memory scores (β = -0.15, p = 0.014). Longer periods of gaming may be related to a little decline in memory performance. Gender was shown to significantly affect memory scores, with females benefiting more than their male counterparts (β = 2.18, p 0.001). These results show that women generally have better memory than men.

**Table 5: Multiple Regression Analysis for Attention Assessment**

| Predictor Variable | Beta Coefficient | Standard Error | t-Value | p-Value |
|---|---|---|---|---|
| Frequency of Game Play | 0.28 | 0.06 | 4.75 | <0.001 |
| Types of Video Games Played (Action) | 0.95 | 0.12 | 7.92 | <0.001 |
| Types of Video Games Played (RPGs) | 0.72 | 0.10 | 6.84 | <0.001 |
| Duration of Game Play (hrs) | -0.12 | 0.05 | -2.40 | 0.020 |
| Gender (Female) | 1.84 | 0.34 | 5.38 | <0.001 |

The research found a significant positive connection (β = 0.28, p 0.001) between the amount of time spent playing video games and attention levels. It seems that people who played games more often also had better attention performance. The research indicated that playing action games (β = 0.95, p 0.001) and role-playing games (β = 0.72, p 0.001) had a statistically significant positive effect on attention evaluations. This shows that those who engage in this kind of gaming have better attention skills. Ratings of attention were negatively affected by how much time was spent playing the game (β = -0.12, p = 0.020), showing that longer gaming sessions were associated with a modest decline in attention. A statistically

significant and positive correlation was found between female gender and attentiveness evaluations (β = 1.84, p 0.001). Females, on average, outperformed males in attention tasks shows that this advantage may be genetic.

**Table 6: Multiple Regression Analysis for Problem-Solving Assessment**

| Predictor Variable | Beta Coefficient | Standard Error | t-Value | p-Value |
|---|---|---|---|---|
| Frequency of Game Play | 0.21 | 0.07 | 3.00 | 0.003 |
| Types of Video Games Played (Action) | 0.88 | 0.14 | 6.29 | <0.001 |
| Types of Video Games Played (RPGs) | 0.64 | 0.11 | 5.82 | <0.001 |
| Duration of Game Play (hrs) | -0.10 | 0.04 | -2.25 | 0.027 |
| Gender (Female) | 1.62 | 0.30 | 5.40 | <0.001 |

A favourable and statistically significant correlation was found between gameplay frequency and problem-solving test scores. More frequent gaming is associated with higher levels of problem-solving skills, as shown by a beta coefficient of 0.21 (p = 0.003). Action games (β = 0.88, p 0.001) and role-playing games (β = 0.64, p 0.001) were shown to have the greatest positive effect on problem-solving scores (p 0.001). Playing games of this kind seems to improve problem-solving skills. The longer one plays the game, the more negative an effect it has on problem-solving skills (-0.10 beta coefficient, p = 0.027). This shows that longer gaming sessions are associated with a modest decline in problem-solving performance. There was a statistically significant and positive correlation between female gender and problem-solving scores (β = 1.62, p 0.001). This indicates that, on average, women are more capable than men of resolving complex issues.

## 4. Discussion

Findings from this study are consistent with a growing body of research in the fields of educational psychology and gaming, which has found a correlation between students' involvement in video games and their cognitive development, especially among those with learning disabilities in Saudi Arabia. When designed and used with care, video games are an effective tool for the improvement of cognitive abilities (Boot et al., 2011; Green & Bavelier, 2003), and a large body of research supports this claim. The findings of this study shed light on the critical function of gaming frequency, elucidating a strong link between increased frequencies and the enhancement of cognitive capacities, especially in areas comprising memory, attention, and problem-solving skills. It's clear from this finding that using video games in the classroom is a promising strategy for stimulating the brains of children with learning impairments.

Blumberg et al. (2013) and Green & Bavelier (2012) are only two examples of the current corpus of research that provide credence to the idea that some types of video games, such as action games and role-playing games, have a positive link with cognitive development outcomes, that virtual environments support

students' cognition and learning (Anjos et al., 2020a, 2020b, 2021). Based on the available data, it seems that some types of gaming may provide distinct cognitive benefits. Action games are known for their fast pace and high demand for cognitive processing and motor precision; playing them has been linked to significant improvements in attention and reaction time (Green & Bavelier, 2003). In contrast, role-playing games (RPGs) commonly involve players in complex problem-solving attempts and storytelling-based gaming, which may improve cognitive abilities related to planning and strategic cognition (Blumberg et al., 2013). Therefore, teachers and game designers may take advantage of the unique cognitive advantages offered by different genres by selecting or creating educational games that are tailored to the unique cognitive needs of children with learning difficulties.

The benefits of playing video games are obvious, but the aforementioned research also highlights a possible drawback: the tendency for excessive length of engagement. Because of the negative association between prolonged gaming and cognitive development results, moderation and responsible gaming are crucial. The current finding is consistent with the recommendations made by respected organizations like the American Academy of Pediatrics (2016). These groups push for limits on how much time kids may spend in front of screens to encourage healthy brain development in young people. Educators and parents must work together to strike a balance between the benefits of video games and the risks connected with too much screen time.

The study's focus on gender as a modulator of the link between gaming and cognitive results is especially noteworthy. There has been a rising recognition in modern literature of the need to include gender-specific components within educational settings (Hyde, 2014). Since females consistently performed better than males did, this study's findings suggest that gender may play a significant role in determining cognitive outcomes. The gender gap in cognitive development is consistent with previou' research on sex differences in cognition (Gur et al., 2012). If teachers and policymakers could better understand these gender differences, they could better tailor their approaches to meet the needs of male and female students with learning disabilities who exhibit distinct cognitive profiles.

An important part of this research is devoted to discovering the reasons for the observed gender gap in cognitive growth among students with learning difficulties, specifically in the context of gaming. There has been a lot of focus on the possible cognitive benefits of playing video games, but there needs to be more investigation into the differences between the sexes that have been found. There is a growing body of research that emphasizes the significance of gender in educational settings, and our inquiry is in line with that research (Hyde, 2014). Extensive academic studies have shown that females have a penchant for excelling in various cognitive regions, and the results of these assessments corroborate the extraordinary and persistent advantage demonstrated by female people in memory, attention, and problem-solving. Gur et al. (2012) provide an excellent illustration of the common occurrence of enhanced skills in verbal memory and social cognition among women. The current study's findings suggest that this may

be the reason for the subjects' exceptional performance in memory and problem-solving activities. These findings stress the need to recognize and address the differences in cognitive capacities and challenges between the sexes among those who struggle academically. Better learning results are possible thanks to the use of individualized educational practices.

Furthermore, the results of this research show how complex cognitive development is and how advanced pedagogical strategies that account for gender differences are necessary. To name just a few examples, genetic predispositions, hormone fluctuations, and societal dynamics may all have an impact on how people of different sexes think and reason (Giedd, 2015). Educators and policymakers must account for the complex web of variables at play when developing treatments and pedagogical approaches that meet the unique cognitive needs of male and female children with learning impairments. If they take into account all of these factors, they will be able to create well-rounded plans that cater to the individual requirements of each of these pupils.

Ingrained gender stereotypes and cultural expectations may influence how people of different sexes evaluate their intelligence. It's crucial to recognize that gender differences in cognitive development are not inevitable but may be exacerbated or alleviated by environmental factors including culture and upbringing (Carter et al., 2019). Educators can effectively address gender-related cognitive disparities and facilitate the enhancement of cognitive abilities among students of both sexes by encouraging the cultivation of a growth mindset, as proposed by Dweck (2006), and establishing an inclusive educational milieu.

The importance of fostering a welcoming and egalitarian classroom setting has been further underscored by these results. Memory, focus, and problem-solving tests all showed that women performed better than men in this study. However, these findings need caution in making inferences so as not to promote detrimental gender stereotypes. Schools must implement gender-inclusive policies and practices to offer equal educational opportunities for students of all gender identities (Hill et al., 2010). To be successful, these measures must go beyond narrow gender norms to take into account each student's particular mental make-up and educational requirements.

## 5. Conclusion

Mention your objective here as your first statement. The results of this research underline the need for both frequent play and variety in game genres to reap the potential cognitive advantages of gaming. The discovery that more gaming time was associated with better memory, focus, and problem-solving abilities further supported the potential of video games as cognitive development aids, especially for those with learning challenges. While the research did reveal some positive effects of gaming on cognitive function, it emphasized the need for moderation and cautioned against excessive gaming.

Furthermore, this research has shed light on the cognitive disparities between male and female students with learning impairments by investigating gender variations in development. Memory, focus, and problem-solving tests

consistently showed that women outperformed males. Because of these variances, classroom practices must be developed that recognize and build upon the natural variations in learning patterns between the sexes.

## 6. Recommendations

This study, like any other academic inquiry, has caveats that should be carefully considered. The inability to draw firm conclusions about cause and effect stems from the study's cross-sectional nature. It would be helpful to undertake longitudinal studies that carefully track cognitive growth and video game participation over lengthy periods to create more thorough and supported data on the causal links shown here. Such research would provide a firmer footing on which to draw conclusions and make well-informed judgments. It's also important to note that the participants in the current research reported their video gaming habits. However, to improve the accuracy and completeness of the data collected on people's gaming activity, future studies must seriously consider the addition of objective measures, such as gameplay logs or monitoring software. This study helps fill in the gaps in our knowledge of the relationship between video game use, cognitive growth, and gender disparities in the classroom. If educators, parents, and policymakers are contemplating using video games as a teaching tool but are concerned about the potential for these tools to reinforce problematic gender stereotypes, this book is an excellent resource. Students with learning disabilities in the modern day stand to benefit greatly from the expanding use of technology in the classroom.

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## 7. References

Abu Talib, R. I., Nikolic, P. K., Sunar, M. S., & Prada, R. (2020). In-visible island: Inclusive storytelling platform for visually impaired children. *Mobile Networks and Applications*, *25*, 913-924.

Alashram, A. R., Annino, G., Padua, E., Romagnoli, C., & Mercuri, N. B. (2019). Cognitive rehabilitation post traumatic brain injury: A systematic review for emerging use of virtual reality technology. *Journal of Clinical Neuroscience*, *66*, 209-219.

Al-Jarrah, R. S. (2016). A suggested model of corrective feedback provision. *Ampersand*, *3*, 98-107. https://doi.org/10.1016/j.amper.2016.06.003

Alqahtani, M. (2015). The importance of vocabulary in language learning and how to be taught. *International journal of teaching and education*, *3*(3), 21-34. https://doi.org/10.20472/TE.2015.3.3.002

Al-Seghayer, K. (2015). Salient Key Features of Actual English Instructional Practices in Saudi Arabia. *English Language Teaching*, *8*(6), 89-99.

Anjos, F. E. V. dos, Rocha, L. A. O., Pacheco, R., & da Silva, D. O. (2021). Teaching-Learning Strategies to Production Planning and Control Concepts: Application of Scenarios to Sequencing Production with Virtual Reality Support. International Journal of Learning, Teaching and Educational Research, 20(8), 108–125. https://doi.org/10.26803/ijlter.20.8.7

Anjos, F. E. V. dos, Rocha, L. A. O., Silva, D. O. da, & Pacheco, R. (2020a). Virtual and augmented reality application in production engineering teaching-learning processes. Production, 30, 1–16. https://doi.org/10.1590/0103-6513.20190088

Anjos, F. E. V. dos, Rocha, L. A. O., Silva, D. O. da, & Pacheco, R. (2020b). Virtual and augmented reality application in production engineering teaching-learning processes. Production, 30(THEMATIC SECTION-PRESENT AND FUTURE OF PRODUCTION ENGINEERING). https://doi.org/10.1590/0103-6513.20190088

Blundon, G., & Smits, E. (2000). Cognitive rehabilitation: A pilot survey of therapeutic modalities used by Canadian occupational therapists with survivors of traumatic brain injury. *The Canadian Journal of Occupational Therapy*, *67*(3), 184.

Blumberg, S. J., Bramlett, M. D., Kogan, M. D., Schieve, L. A., Jones, J. R., & Lu, M. C. (2013). *Changes in prevalence of parent-reported autism spectrum disorder in school-aged US children: 2007 to 2011-2012* (No. 65). US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.

Boot, W. R., Blakely, D. P., & Simons, D. J. (2011). Do action video games improve perception and cognition?. *Frontiers in psychology*, *2*, 226. https://doi.org/10.3389/fpsyg.2011.00226

Calleja, G. (2011). *In-game: From immersion to incorporation*. mit Press.

Carter, D. F., Razo Dueñas, J. E., & Mendoza, R. (2019). Critical examination of the role of STEM in propagating and maintaining race and gender disparities. *Higher Education: Handbook of Theory and Research: Volume 34*, 39-97.

Conners C. K., Epstein J. N., Angold A., Klaric J. (2003). Continuous performance test performance in a normative epidemiological sample. *J. Abnorm. Child Psychol.* 31, 555–562. doi: 10.1023/a:1025457300409, PMID

Games, T. (2012). The Walking Dead. *Telltale Games*.

Giedd, J. N., Raznahan, A., Alexander-Bloch, A., Schmitt, E., Gogtay, N., & Rapoport, J. L. (2015). Child psychiatry branch of the National Institute of Mental Health longitudinal structural magnetic resonance imaging study of human brain development. *Neuropsychopharmacology*, *40*(1), 43-49. https://doi.org/10.1038/npp.2014.236

Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature*, *423*(6939), 534-537. https://doi.org/10.1038/nature01647

Gur, R. C., Richard, J., Calkins, M. E., Chiavacci, R., Hansen, J. A., Bilker, W. B., ... & Gur, R. E. (2012). Age group and sex differences in performance on a computerized neurocognitive battery in children age 8− 21. *Neuropsychology*, *26*(2), 251. https://doi.org/10.1037/a0026712

Hill, D. (2010). *Emotionomics: Leveraging emotions for business success*. Kogan Page Publishers.

Hyde, K. D., Nilsson, R. H., Alias, S. A., Ariyawansa, H. A., Blair, J. E., Cai, L., ... & Zhou, N. (2014). One stop shop: backbones trees for important phytopathogenic genera: I (2014). *Fungal Diversity*, *67*, 21-125. https://doi.org/10.1007/s13225-014-0298-1

Juul-Kristensen, B., Hansson, G. Å., Fallentin, N., Andersen, J. H., & Ekdahl, C. (2001). Assessment of work postures and movements using a video-based observation method and direct technical measurements. *Applied ergonomics*, *32*(5), 517-524. https://doi.org/10.1016/S0003-6870(01)00017-5

Krath, J., Schürmann, L., & Von Korflesch, H. F. (2021). Revealing the theoretical basis of gamification: A systematic review and analysis of theory in research on gamification, serious games and game-based learning. *Computers in Human Behavior*, *125*, 106963.

Pelham Jr, W. E., & Fabiano, G. A. (2008). Evidence-based psychosocial treatments for attention-deficit/hyperactivity disorder. *Journal of Clinical Child & Adolescent Psychology*, *37*(1), 184-214. https://doi.org/10.1080/15374410701818681

Rahimi, S., Walker, J. T., Lin-Lipsmeyer, L., & Shin, J. (2023). Toward defining and assessing creativity in sandbox games. *Creativity Research Journal*, 1-19. https://doi.org/10.1080/10400419.2022.2156477

Shaywitz, S. E., Shaywitz, B. A., Fulbright, R. K., Skudlarski, P., Mencl, W. E., Constable, R. T., ... & Gore, J. C. (2003). Neural systems for compensation and persistence: young adult outcome of childhood reading disability. *Biological psychiatry*, *54*(1), 25-33. https://doi.org/10.1016/S0006-3223(02)01836-X

Wechsler, D. (2009). Wechsler Memory Scale—Fourth Edition (WMS–IV) technical and interpretive manual. San Antonio, TX: Pearson

Winter, J. (2022). *BioWare's Mass Effect*. Springer Nature.

Zagal, J. P., Björk, S., & Lewis, C. (2013). Dark patterns in the design of games. In *Foundations of Digital Games 2013*.