

Using Video Games for the Treatment of Symptoms of Autism

Pranay Thatikonda¹, Josthna Kethar[#] and Dr. Rajagopal Appavu, Ph.D.[#]

¹Great Valley High School

[#]Advisor

ABSTRACT

Autism spectrum disorder is a disorder that has a growing prevalence in children and with traditional methods of treatment being ineffective, expensive, or scarce, new methods of intervention must be found. Using video games for the treatment of ASD, and other disorders, is a novel field that has promising results. Early studies show that video games are beneficial for typically developing kids and even children with ADHD. Newer studies have shown that those benefits can be translated to children with ASD as well. The purpose of this paper is to show that using video games for the treatment of autism is a promising field that should be studied more in-depth.

Introduction

Autism spectrum disorder, or ASD, is a developmental disorder that is becoming increasingly common in children. The prevalence of autism has increased from the Centers for Disease Control in the United States estimating a rate of 1 in 88 children in 2008, up from 1 in 110 children in 2006. This increased prevalence is a result of more attention being placed on children with ASD, more efforts to diagnose them, and the actual definition of ASD being expanded upon (Chaste & Leboyer, 2012). Due to the Covid-19 pandemic, treatment for children with ASD has been harder and harder for people to find. The “telemedicine” which is being offered to children is not as effective, mainly because children with ASD find it hard to interact with people remotely (Al-Beltagi et al., 2022). The shortcomings of treatments combined with the increasing demand for treatment due to the larger population with ASD means that a new solution must be found. That solution can be video games. Video games have been proven to help children that are typically developing, or TD, (Kovess-Masfety et al., 2016), and even children with other disorders such as ADHD (Tiitto & Lodder, 2017). This begs the question, to what extent can video games help children with ASD?

What is autism spectrum disorder?

The meaning of the word autism has changed a lot since it was initially conceived as a symptom of schizophrenia by the German psychiatrist Eugen Bleuler. He said that autism was a kind of coping method that replaced unsavory reality with ‘fantasies and hallucinations’. This definition originated in 1911 and was used until the 1950s (Evans, 2013). Leo Kanner had come up with a similar meaning to the modern one in 1943 when he defined autism as the lack of the ability to make emotional connections with others and having a lack of social skills (Chaste & Leboyer, 2012). In the 1960s and 1970s, mental institutions meant to keep people with autism or other disorders out of society were rejected in favor of therapy services. This represented a shift in how autism and other disorders were treated and it allowed for a deeper understanding of what autism really is (Evans, 2013). The currently accepted definition of autism is a developmental disorder that causes people to have difficulty communicating with people, have repetitive behaviors, and other symptoms that can affect their life (Autism spectrum disorder). Autism is also now seen as a spectrum, hence

the name autism spectrum disorder, instead of a single disorder. The cause of autism can be traced to many different origins, from genetic to environmental.

What are the causes of autism?

There are a myriad of causes for autism spectrum disorder that have been found. Many studies have substantial evidence for ASD being inherited genetically. There are around 234 loci on the genome that can contribute to ASD and some studies show that even that estimate is a little low (Chaste & Leboyer, 2012). It has been linked to certain genes on chromosomes, such as 2q, 7q, 16p, and 19p. (Baird, 2003). The method with which it is inherited is likely polygenic and not Mendelian. This means that it is caused by a multitude of genetic alterations. Studies show, however, that having one gene that contributes to autism does not mean that one is more or less likely to have another. This is because evidence points to genes for symptoms of autism are not linked. (Chaste & Leboyer, 2012). However, autism is not only caused by genetic factors. It can be caused by environmental, epigenetic, or even prenatal factors. For example, similar genotypes in people can lead to different phenotypes, like one person having autism while the other doesn't. There are many hypotheses for this, one is that a secondary external factor is required for the phenotype to occur. Another hypothesis is that environmental factors cause the phenotype to occur (Chaste & Leboyer, 2012). There is also evidence to show that there are several prenatal factors that contribute to the rates of autism in children. Maternal gestational diabetes and maternal bleeding during pregnancy can contribute to autism in the child. A large factor is if the mother has a gestational viral infection during pregnancy which can trigger an immune response in the mother that hinders brain development in the fetus (Chaste & Leboyer, 2012).

How is autism diagnosed?

Despite the fact that ASD is a genetic disorder, there are no genetic tests that can diagnose a child with autism. Diagnosing autism is usually done when the person is a child and by the child's parents or by a teacher. Though it is usually diagnosed when the child is more than 18 months old, prior to 18 months there are a few symptoms that can be found. A big sign is the lack of communication of the child. This can either be through speaking single words, which is common by 18 months, or using other ways to communicate. The lack of communication can point to the child having autism or even to the child having a different developmental disorder. Communication can also mean gestures or facial expressions. Another sign is when a child is socially impaired and likes to be alone rather than interacting with other babies. Oversensitivity to stimuli like touch and sound can also be a sign. These signs can also mean nothing which is why autism is so difficult to diagnose when a child is young (Baird, 2003). A diagnosis is much more reliable once a child is 2 years old (Screening and Diagnosis of autism spectrum disorder 2022). Once a child is two years old, many more signs can be used for a reliable diagnosis. Lack of speaking is a much bigger deal at this age. Especially lack of spontaneous phrases which is where a child talks without being prompted to speak. The same hindered social development from earlier applies here. Echolalia is the repetition of nonsense words and sounds during speech which is common in children with autism. There can also be signs of autism in the classroom. Not engaging in classroom activities, having extreme reactions to violations of personal space, lack of awareness, and not reacting to social cues are all examples of hindered social development which is a sign of autism (Baird, 2003). The American Academy of Pediatrics recommends that parents take their children to be screened for ASD when they are 18 months old and 24 months old. Many people are not even diagnosed until adolescence or even adulthood (Screening and Diagnosis of autism spectrum disorder 2022).

What are the symptoms of autism?

There are many symptoms of autism but the most common one is the lack of social development. Learning disabilities are also common, occurring in more than 75% of children with autism (Baird, 2003). Another study proposes two models to explain why this is the case. The first model is that the genes that cause intellectual disabilities and autism are related. The second model is that individuals with a higher level of intelligence can more easily mask some defining characteristics of autism, especially the lack of social development. This would mean that people that don't have intellectual disabilities but have autism are not being diagnosed correctly. There is evidence to support both models (Chaste & Leboyer, 2012). Many children with autism also suffer from a variety of different anxiety disorders such as various phobias, obsessive-compulsive disorder, separation anxiety disorder, and more. This anxiety can result in distress with social relationships, with teachers, parents, family, and fellow peers. Autism can also cause irregular behavior like depression or aggressiveness (Wijnhoven et al., 2015). Children with autism can also experience a higher risk of epilepsy. Some studies show that about a third of children with autism will get epilepsy sometime in their lifetime. Children with high-functioning autism are also above average in rates of attention deficit hyperactivity disorder (Baird, 2003).

How prevalent is autism?

Studies that try to estimate the prevalence of autism in a population are hard to compare as they use vastly different methods of diagnosis. For example, a recent study estimated that 1 in 38 children have autism. Previous studies, however, have estimated much lower numbers. But when adult populations were compared to older populations in the same study, the rates were comparable which wouldn't support the data (Chaste & Leboyer, 2012). Another explanation for the change in prevalence is that the actual definition of ASD has changed a lot. Changing the definition from a single disorder to a spectrum of disorders has meant that more children can be diagnosed with autism. The spectrum has also gotten larger over time (Baird, 2003). This increase in prevalence calls for better methods of treatment.

Current Methods of Treatment for Autism

Current methods of treatment for autism can be expensive or ineffective. One method of treatment for autism, specifically for the anxiety caused by autism, is cognitive behavioral therapy. CBT is used to alleviate symptoms of autism and anxiety in children with or without ASD. The problem with CBT for children with ASD is that it was designed with typically developed children in mind. CBT is administered through face-to-face sessions which are not useful for children with autism. They have problems with social contact, and even more so if it's online. Another limitation is that children are expected to utilize what they've learned during sessions in their everyday life. This is already challenging for children without ASD but the lack of context and generalization of situations can cause children with ASD to not be able to implement what they're learned in real situations. Lastly, CBT is hard to get access to and so children might receive the treatment they require, or they might not receive it as often as needed (Wijnhoven et al., 2015). The treatment that a child with ASD receives is based on their symptoms. CBT is usually for children with anxiety. There are therapies and support systems available for children with learning disabilities, lack of social skills, and even physical therapy. If a child has a lot of problems with personal space and is oversensitive to sensory input, there is sensory integration therapy (*Treatment and intervention services for autism spectrum disorder* 2022). Pharmacological treatment can also be used. Drugs such as haloperidol, risperidone, and aripiprazole are some antipsychotics used in the treatment of autism (Silva et al., 2021).

Benefits of video games

The reason video games can be used as a treatment for autism is that they are beneficial for many people without autism. One study on children in European countries found that children who played video games had cognitive and mental health benefits. High usage of video games in a kid was associated with 1.75 times the odds of high intellectual functioning. School achievement was also higher as children played more video games. Their teachers reported intellectual functioning and school achievement.

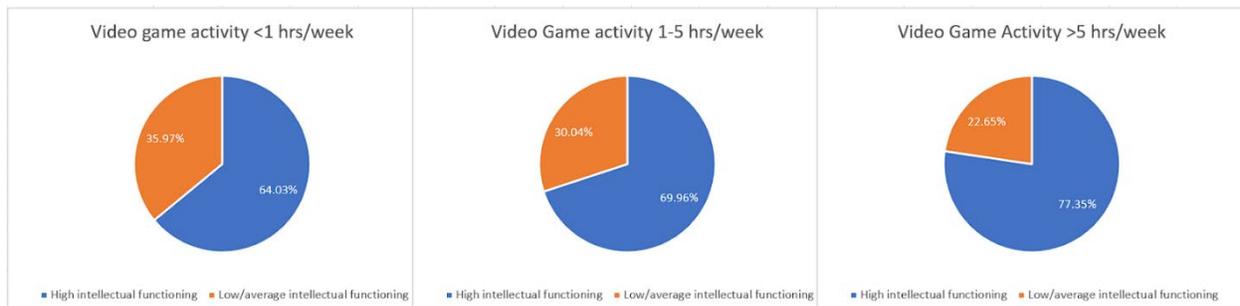


Figure 1: Graphical representation of the findings of this study. The students were classified into 3 groups, ones who played <1 hr/week, ones who played 1-5 hrs/week, and ones who played >5 hrs/week. The blue represents the percentage of students with high intellectual functioning and the orange represents low/average intellectual functioning. This shows that as kids played more video games, they had higher intellectual functioning.

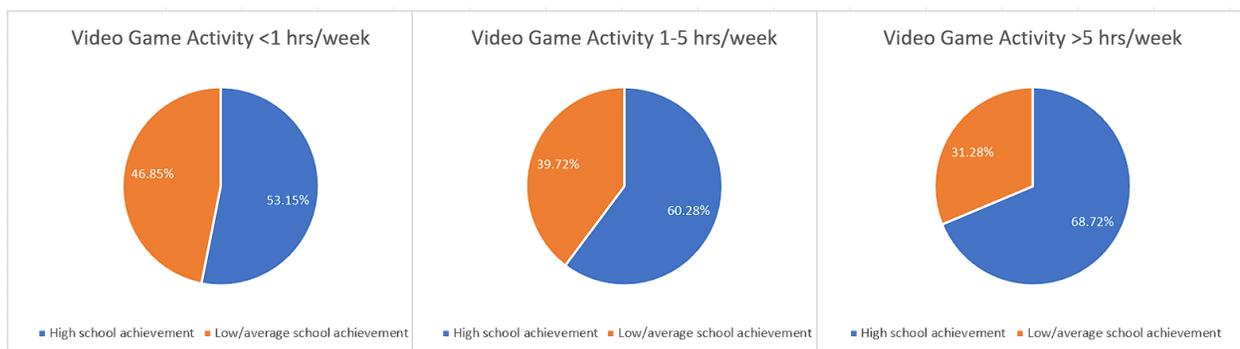


Figure 2: Graphical representation of the findings of this study. The students were classified into 3 groups, ones who played <1 hr/week, ones who played 1-5 hrs/week, and ones who played >5 hrs/week. The blue represents the percentage of students with high achievement in school and the orange represents low/average achievement in school. This shows that as kids played more video games, they had more achievements in school.

A Japanese study mentioned in this study found that children who played video games were more likely to have more friends and be more outgoing (Kovess-Masfety et al., 2016). Video games can also help children with other disorders such as attention deficit hyperactivity disorder. One study found that adding aspects of video games to training tasks for children with ADHD caused an improvement in working memory. Video game players also did better than non-players in cognitive performance measures. Lastly, it proposed that video game-based cognitive training could be supplemented with typical drug treatment, to increase the efficacy of the drugs or to reduce the dosage of drugs needed. Some drug companies like Pfizer and Shire Pharmaceuticals see this as promising and are funding research in video games (Tiitto & Lodder, 2017).

How can video games help children with autism?

Video games are associated with better cognitive performance and higher achievement in school (Kovess-Masfety et al., 2016). They are also already being used and developed for children with ADHD (Tiitto & Lodder, 2017). There have been many studies done on how video games affect children with autism and whether or not they can help them. One systematic review of studies that looked at the effect of video games on children with ASD found that 93.5% of the studies found improvements in whatever condition was evaluated. It organized the studies by what aspect of autism they were focusing on and what kind of game they were testing.

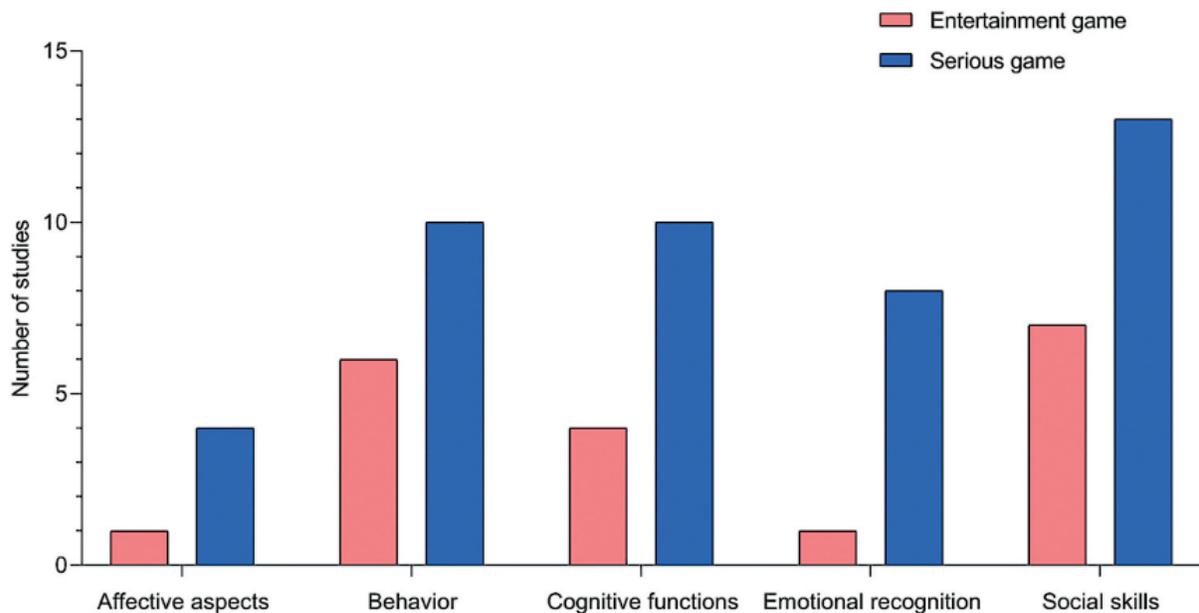


Figure 3: Graphical representation of how the different studies in this review were organized. Each study was either categorized as testing with an entertainment game or a serious game, and they were all testing different aspects of autism. These were affective aspects, behavior, cognitive functions, emotional recognition, and social skills.

Some of these studies focused on serious games and tested the child’s recognition of emotions before and after playing the game. They found that the recognition was increased. When children played entertainment games, improved aspects were eye contact, more positive interactions with peers, and decreased stress and anxiety (Silva et al., 2021). These are games that weren’t created specifically for the treatment of autism but there are a few cases of that too. One game that shows promise to the field is Mindlight which was made to help treat anxiety in children with or without autism. A study on children with ASD was made to see how Mindlight affected them and the results are expected to show that the children who played this game will have decreased symptoms of autism (Wijnhoven et al., 2015).

Along with Mindlight, another example of a game that was created to help treat autism is a mobile game called GuessWhat. The study looked at the effect that playing the game had on 72 children. Each child had ASD and they were asked to play the game for three 1.5-minute sessions a day, 3 days a week, for 4 weeks. The game had different features that focused on different areas of treatment. For example, one of the challenges was an emotion challenge where a human face or emoji would be shown to the player. This targeted the recognition of emotions which is difficult for children with ASD. If the player guessed correctly, they would receive virtual coins which helped the children stay motivated. Another aspect of the game was charades. This targeted many areas such as hand-eye coordination, abstract reasoning, and creative thinking. The player would be shown an image and have to act out the image.

The study concluded that GuessWhat was a useful tool for treatment, as the children who reported active usage improved on the SRS-2 scale and VABS-II scale which are ways of measuring social responsiveness and behavior respectively (Penev et al., 2021).

There is yet another category of games that are beneficial for children with autism, and that is exergames. Described as video games that are also a form of exercise, many studies show that they can help children with autism. One study that was outlined in this systematic review focused on improving the balance of ASD children. They played the exergame for 60 minutes, 3 times a week, for 6 weeks and their balance with one foot and two feet improved significantly. A different exergame study was outlined in which the aim was to reduce repetitive behavior. With just one 20-minute session, there was a significant decrease in repetitive behaviors. This could be amplified by having regular sessions (Jiménez-Muñoz et al., 2021).

Discussion

Whether serious games, games made for entertainment, games made for children with ASD, or exergames, video games prove to be a useful method to help treat different aspects of autism. The data shows that there are many benefits, for both children with ASD and without and that this is a promising field of study. Hopefully, more research will be done in this field, allowing it to become a real treatment.

Conclusion

Video games are seen as a waste of time but they have real benefits for people of all ages, afflictions, and genders. Children who play video games do better in school and have better social lives. These benefits can be seen in children with and without ASD. They are a much cheaper alternative or supplement to regular treatment and can be used to help many children worldwide. Children who can't receive treatment will one day be playing video games.

Bibliography

- Al-Beltagi, M., Saeed, N. K., Bediwy, A. S., Alhawamdeh, R., & Qaraghuli, S. (2022). Effects of COVID-19 on children with autism. *World journal of virology*, 11(6), 411–425. <https://doi.org/10.5501/wjv.v11.i6.411>
- Baird, G., Cass, H., & Slonims, V. (2003). Diagnosis of autism. *BMJ (Clinical research ed.)*, 327(7413), 488–493. <https://doi.org/10.1136/bmj.327.7413.488>
- Centers for Disease Control and Prevention. (2022, March 31). *Screening and diagnosis of autism spectrum disorder*. Centers for Disease Control and Prevention. <https://www.cdc.gov/ncbddd/autism/screening.html>
- Centers for Disease Control and Prevention. (2022a, March 9). *Treatment and intervention services for autism spectrum disorder*. Centers for Disease Control and Prevention. <https://www.cdc.gov/ncbddd/autism/treatment.html>
- Chaste, P., & Leboyer, M. (2012). Autism risk factors: genes, environment, and gene-environment interactions. *Dialogues in clinical neuroscience*, 14(3), 281–292. <https://doi.org/10.31887/DCNS.2012.14.3/pchaste>
- Evans B. (2013). How autism became autism: The radical transformation of a central concept of child development in Britain. *History of the human sciences*, 26(3), 3–31. <https://doi.org/10.1177/0952695113484320>
- Jiménez-Muñoz, L., Peñuelas-Calvo, I., Calvo-Rivera, P., Díaz-Oliván, I., Moreno, M., Baca-García, E., & Porrás-Segovia, A. (2021). Video games for the treatment of autism spectrum disorder: A systematic review. *Journal of Autism and Developmental Disorders*, 52(1), 169–188. <https://doi.org/10.1007/s10803-021-04934-9>

- Kovess-Masfety, V., Keyes, K., Hamilton, A., Hanson, G., Bitfoi, A., Golitz, D., Koç, C., Kuijpers, R., Lesinskiene, S., Mihova, Z., Otten, R., Fermanian, C., & Pez, O. (2016). Is time spent playing video games associated with mental health, cognitive and social skills in young children?. *Social psychiatry and psychiatric epidemiology*, 51(3), 349–357. <https://doi.org/10.1007/s00127-016-1179-6>
- Penev, Y., Dunlap, K., Husic, A., Hou, C., Washington, P., Leblanc, E., Kline, A., Kent, J., Ng-Thow-Hing, A., Liu, B., Harjadi, C., Tsou, M., Desai, M., & Wall, D. P. (2021). A mobile game platform for improving social communication in children with autism: A feasibility study. *Applied Clinical Informatics*, 12(05), 1030–1040. <https://doi.org/10.1055/s-0041-1736626>
- Silva, G. M., Souto, J. J., Fernandes, T. P., Bolis, I., & Santos, N. A. (2021). Interventions with serious games and entertainment games in autism spectrum disorder: A systematic review. *Developmental Neuropsychology*, 46(7), 463–485. <https://doi.org/10.1080/87565641.2021.1981905>
- Tiitto, M. V., & Lodder, R. A. (2017). Therapeutic Video Games for Attention Deficit Hyperactivity Disorder (ADHD). *WebmedCentral*, 8(11), WMC005330. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9426294/>
- U.S. Department of Health and Human Services. (n.d.). *Autism spectrum disorder*. National Institute of Mental Health. <https://www.nimh.nih.gov/health/topics/autism-spectrum-disorders-asd>
- Wijnhoven, L. A., Creemers, D. H., Engels, R. C., & Granic, I. (2015). The effect of the video game Mindlight on anxiety symptoms in children with an Autism Spectrum Disorder. *BMC psychiatry*, 15, 138. <https://doi.org/10.1186/s12888-015-0522-x>