Question 6

The Dual Impact of Active and Non-Active Gaming on Children's Behaviour and Lifestyle

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Introduction

When I was 4 years old, we got our first PC at our home I started playing a few 2D games back then, and then I moved onto some other genres such as Counter Strike etc, which remains a hobby for me to this date. Gaming used to be a way to pass time back then but now it is a multibillion-dollar industry with cultural, technological and health implications.

Gaming nowadays is a cultural phenomenon, having its role in entertainment industry, shaping careers and sometimes acts a medium for social interactions. The launching of active video games along with VR gaming systems and multiplayer competition, has allowed people to embrace gaming as a part of their identity and pay more attention to their health and life. The field has been changed not only by big data analytics but also by enabling experts to approach the development of gaming from the public health perspective as well. From the research conducted by Staiano et al., 2018 and Peng et al., 2021 we can deduce that Active Video Games improve motor skills sometimes it can help boost energy and help an individual build their self-confidence. However, they cannot replace traditional exercising but can work as an add on to physical activities like exercising, walk, running, biking etc (Mazurek & Wenstrup, 2020)

On the other side, there are more sedentary games, which involve sitting for long periods while immersing yourself in rich stories or competitive play. These games are great for their creativity and complexity, but they come with risks. Long hours of sedentary gaming have been linked to obesity, mental health issues, and even physical strain (Ramos-Diaz et al., 2022). For many young people, competitive games like Counterstrike or Dota 2 are exciting and help build skills and social connections, but they can also lead to problems like Internet Gaming Disorder (IGD). IGD, recognized by the World Health Organization, affects a significant number of young adults, especially those who play highly competitive or immersive games (Rahayu et al., 2023).

The pandemic made this issue even clearer. Gaming became a lifeline for many of us during lockdowns, helping us stay connected and giving us a way to escape or maintain routines (Park et al., 2023). But at the same time, it blurred the lines between healthy habits and addiction. I saw it in myself and in others how gaming could be both a comfort and a source of tension, especially when it took time away from family or other responsibilities.

Big data analytics offers a powerful way to understand gaming's impact. By studying player behaviour on a large scale, researchers can identify patterns, like what leads to gaming addiction or how active gamers differ from sedentary ones (Egliston, 2016). In my own analysis, I found trends that matched global research, particularly around sedentary gaming habits. But using big data also comes with challenges, like respecting players' privacy and getting their consent. It's crucial to use this data responsibly, focusing on helping players rather than just making a profit (Christin, 2020).

In our essay we explore the role gaming plays in shaping the behaviour of adolescents and analysing the dual impact of active and non-active gaming through the lens of big data . We will examine the active and sedentary gaming and how it relates to physical activity. For me this research topic was eye opening, me being a gamer myself can relate to and understand what and why needs to be changed and what needs to be focused on since it has shaped my life and many others as well.

Literature Review

The video gaming industry has evolved. What used to be a thing for timepass it has now become a cultural force, having a huge impact on young adults and adolescents alike. For many people it is something that transcends entertainment and has become a core part of their identity and is a thing they use for their social interactions as well. With the rise of AVGs, multiplayer platforms, and VR emphasizes how gaming has evolving and impact it has on behaviour, health, and lifestyle. Big data analytics has been the cornerstone of this revolution. It has enabled the researchers to delve into the nuances of gaming habits, their psychological impacts, and their implications for public health.

In what could be the most important cultural shift in the world today, every two out of five people in the world identify themselves as gamers. There were three billion active gamers across the globe in 2021 alone. That represents a staggering growth considering gaming only consoles and pc gaming back in the time would reach not more than a billion users combined. In terms of population, Southeast Asia remains the biggest region for gaming with 82 percent being classified as gamers (Rahayu et al., 2023). There were signs of a massive consumer base, but this growth unfolded faster than anyone ever predicting leading to casuals and hardcore gamers with diverse gaming behaviours.

The accelerated role gaming has played during the pandemic in different cultures and how it acted as a coping mechanism, specifically in isolated young adults is something that needs attention. Sitting in isolation for what seems like an eternity while the rest of the world continues to move was tough, but college students with the aid of video games were able to escape reality with temporarily. Consequently, games became easily accessible during college with remote learning being the only option available. And in turn, games became an easy source of entertainment and connection among students (Park et al., 2023).

But it all begs the question, where is the line, the balance? Over time it has become daunting and quite difficult to build barriers. Too much dependence on gaming led to a dip in interaction with the family which in turn stimulated social withdrawal along with unwanted anxiety (Park et al., 2023; Ramos-Diaz et al., 2022).

AVGs have completely changed the way we can integrate gaming with physical exercise. The use of motion sensors in these games has been effective in encouraging teenagers and young adults to be physically active during game play. For overweight and sedentary adolescents and teenagers, AVGs offer a fun and enjoyable way to enhance their motor functions, lose weight and enhance their self-efficacy (Staiano et al, 2018; Mazurek & Wenstrup, 2020). In addition, some of the randomized

controlled studies conducted at schools have corroborated this evidence showing AVGs to increase physical activity levels during PE classes and decrease the time the students spent on during the lessons on the computer (do Carmo et al, 2020).

Nonetheless, there are some concerns about the use of AVGs. They are not as fun as standard video games, but they do lead to higher energy expenditure than conventional video games. The intensity and duration of energy spent is lower than what one would expect during exercise. Motivation for these activities tends to fade in the long term, particularly when performed at home, making the use of AVGs for gaming deficient and requiring the administration of AVGs together with other types of physical activity (Mazurek & Wenstrup, 2020). At the same time, sedentary gaming continues to be the main form of gaming, exposing individuals to possible obesity and mental health problems. As a result, engaging game designs only add to the props as they promote extended periods of inactivity (Ramos-Diaz et al, 2022).

AVGs main concern is the aspect of physical inactivity, non-active games feature rich in cognitive, innovative and interpersonal skills. Thanks to these games, players can support and solve problems as well as make decisions and work in teams. For instance, Counter-Strike and Dota 2 games make more focus on cooperation because they force players to think and organize themselves in order to solve problems as fast as possible. All the things created on the field enhance essential skills such as leadership, flexibility, and negotiation.

Plot-oriented video games, such as Red Dead Redemption 2 and The Witcher prove that the video games educate empathy, morality and cultural competence. These games take players into some amazingly designed locations where they get to live through various time zones, cultures and even worldview. The scholars Rahayu et al. (2023) also back these observations with insight about how gaming facilitates collaboration, adaptability, and critical thinking.

Big data analytics has been a transformative tool for understanding gaming behaviours of active gamers/users. Researchers can use clustering and predictive modelling techniques to make groupings of players tracking their activity patterns, their preferences and health outcomes. In multiplayer games like Dota 2 big data can be utilised to map player interactions and the cultural differences (Egliston, 2016). These things can help with the game design while also addressing broader issues like toxic gaming behaviours and environments and their gaming community health.

Even though big data has a lot of potential, its application and use in game analysis does raise some ethical issues. As always, data protection and data informed consent as well as sale of data on the players continues to be an issue. Researchers and developers must deal with these concerns appropriately to avoid any problems and ensure that the data-centric methods adopted are ethical and prioritize player welfare (Christin, 2020).

The psychological damage incurred by gaming can be classified into various factors like the type of game played, the length of exposure and the context of the game. For instance, active gaming has been shown to improve mental health in particular contexts such as rehabilitation (Peng et al., 2021). In contrast, games like Ingress that are designed with mindfulness in mind: 'how can I place this feature in the environment so that it can encourage people to get outside?

Severe social exclusion is now the most feared aspect of gaming. Many studies have found a close relationship between excessive use of games and depression or anxiety disorders. For example, Park et al. (2023) add that young males who turned to gaming to relieve stress instead of socializing during the pandemic were at risk of having less family contact and feeling lonelier. There is a need for

more emphasis on moderation of gaming and family and social support in reducing some of the adverse effects of excessive play

Methodology

In this study we investigate the influence due to active and non-active gaming time on children's physical activity and sedentary behaviour. To achieve this, we analyse a dataset from a dataset provided by the United States government (Agricultural Research Service, n.d.) which includes details of daily activities. We wanted to understand how the behaviour of children changed during and after an intervention to develop healthier habits. We took the 24-hour recall dataset which included details about a children's daily activities such as time spent on gaming, sports, watching tv, chores etc. basically time spend on sedentary and active activities. The data was collected at different phases during different time of the year which also affects the behaviour, the phases were defined as: baseline, weeks 2 and 4 during the intervention and week 6 at the end of intervention and then week 10 the washout period.

The next step was to clean and preprocess our data for analysis. We replaced missing values with zero. There are numerous Columns representing different activities in both hours and minutes, the minutes columns were converted to hours and then merged with the columns representing hours for the same activity to maintain consistency.
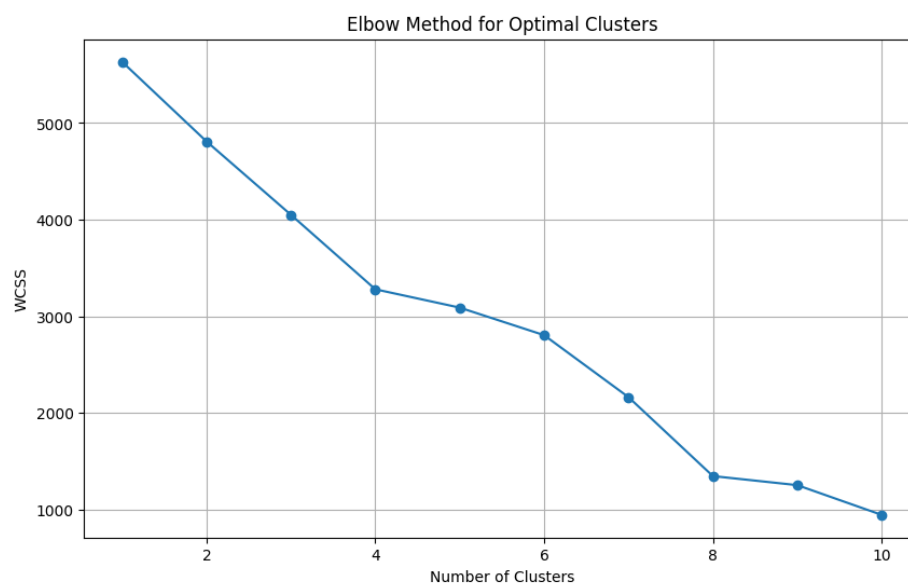

Figure 1: Elbow method graph to understand the optimum number of clusters

The key features of our analysis were: Active_Video_Game_Hours, Non_Active_Video_Game_Hours, Sports_Hours, Walking_Biking_Hours, Household_Chores_Hours, and Physical_Education_Hours. These features provided us with a diverse mix of different activities such as sedentary gaming, active gaming and time spent on physical activities. We then standardized the data just in case which would help in our clustering. We used K-Means for our clustering and before that we utilized Elbow Method as given in figure 1 to determine the optimum number of clusters.
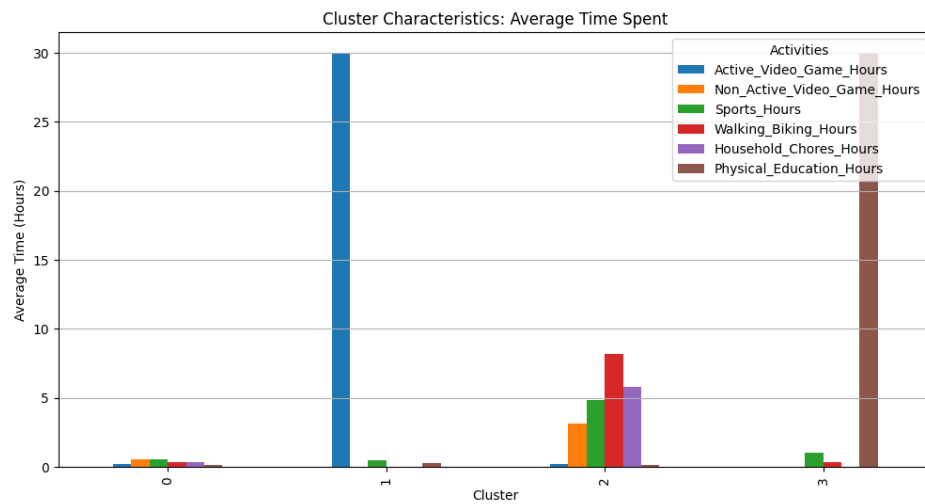
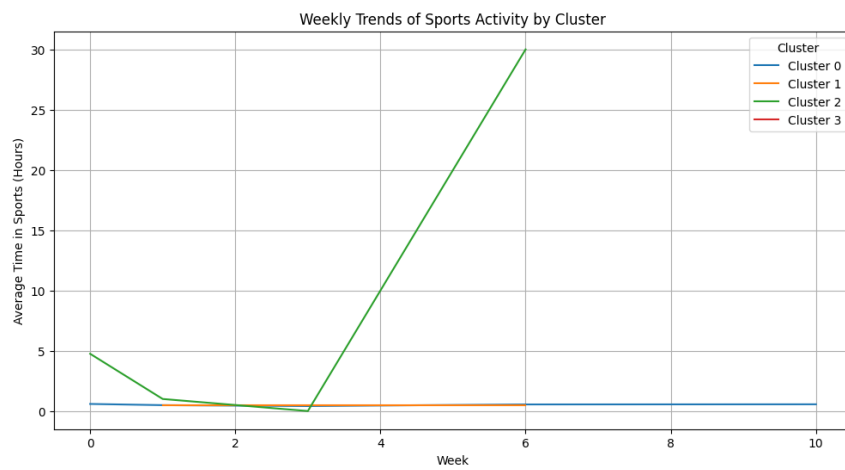**Figure 2**: Cluster characteristics (average time spent on activities).

Figure 3: Weekly trends in sports activity by cluster.
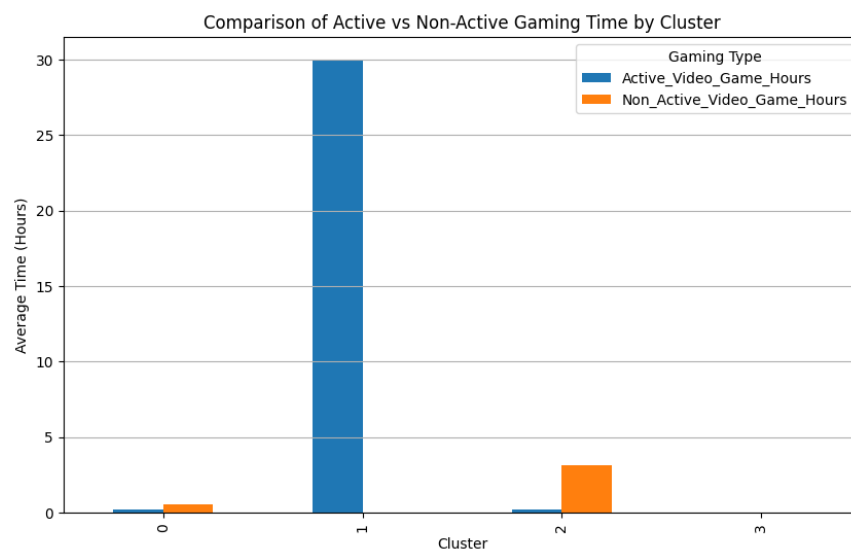

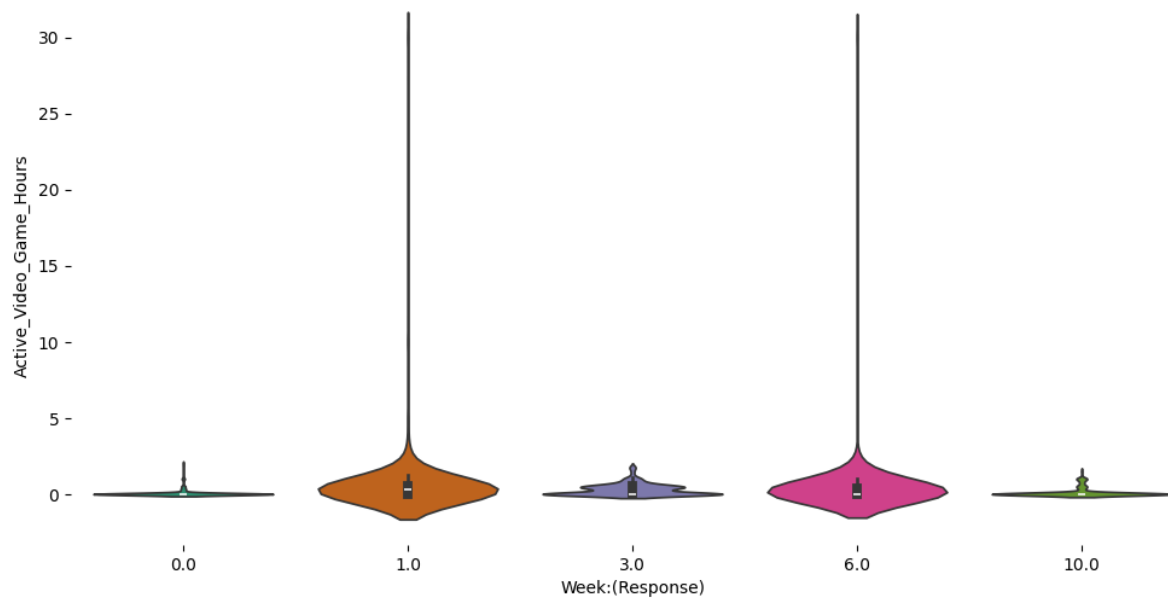**Figure 4**: Comparison of active vs. non-active gaming across clusters.

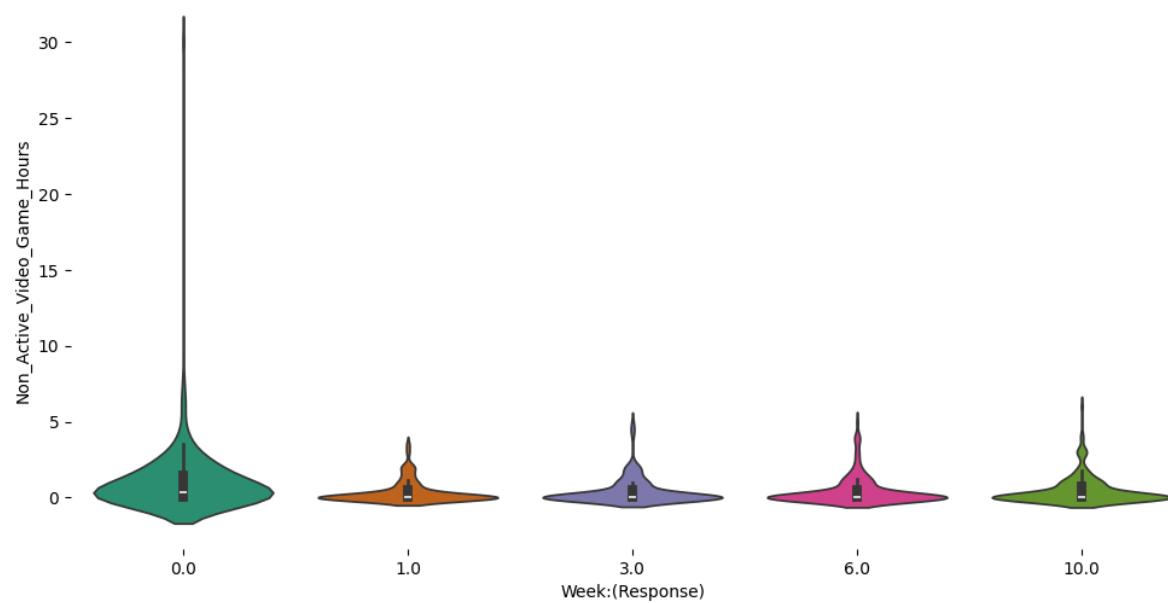**Figure 5**: Violin plot for active video game hours across phases.

Figure 6: Violin plot for non-active video game hours across phases.
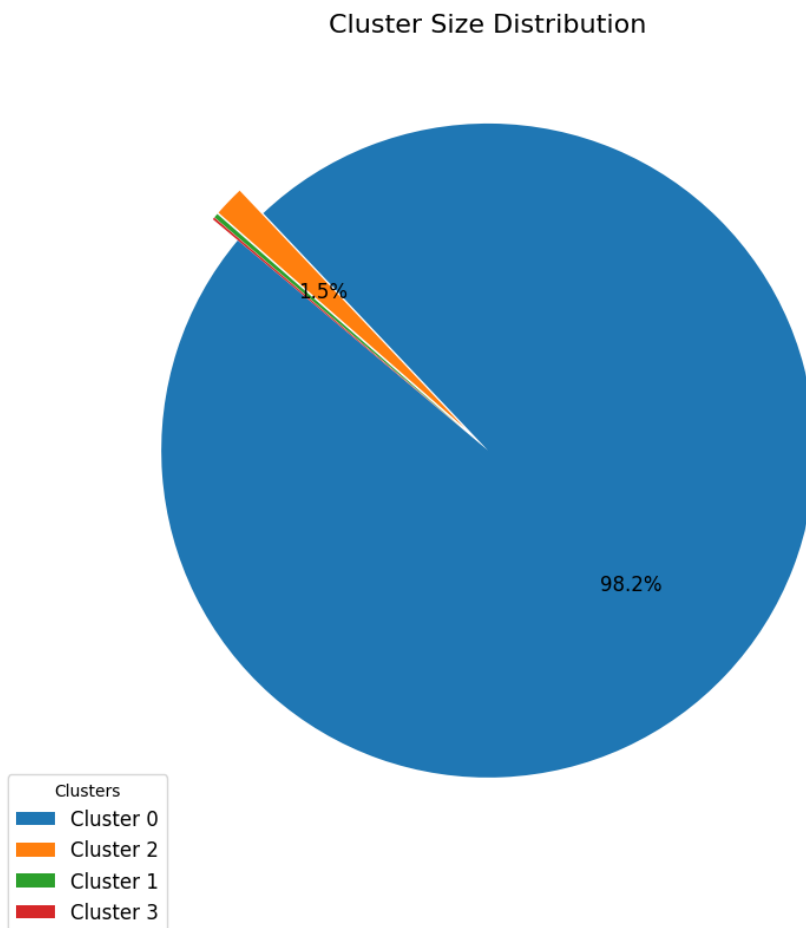
Cluster Size Distribution

Figure 7: Cluster size distribution.

Now first we visualized the Cluster specific activity pattern (Figure 2), comparing the weekly trends of physical activities and gaming. After the cluster analysis we investigate the changes due to changes from baseline to intervention to washout by tracking weekly sports activity by clusters in Figure 3. In Figure 4 we compare the average time spent on the two different gaming types active and non-active video games. We use violin plots to see the differences between different clusters and their gaming habits one for AVG (Figure 5) and another for Non-AVG (Figure 6). Lastly, we see the distribution of participant numbers according to the clusters via a pie chart in Figure 7.

We did these visualisations to see the underlying pattern among children and track the change over time with the interventions. These form our basis for some part of our results and discussion sections. They also facilitated comparisons with existing literature on gaming behaviour and physical activity.

Results

In our analysis we have examined the relationship between gaming behaviour and children's physical activity and then comparing our findings with existing research.

From Figure 5 we can see an increase in active gaming hours from weeks 2–6, which indicates successful engagement in physical activities for cluster 1. This outcome of our analysis is like a study

by Graves et al. (2008) where they found that AVGs help improve energy expenditure, which shows us how it can be a tool to reduce sedentary behaviours.

The severe decrease in active gaming hours in week 10 i.e. the washout phase tells us about the challenges with integration in the routine of daily activities. Without a proper structure for the intervention most children went back to their old habits. Which is what we can see from the findings of Staiano et al. (2013) and Baranowski et al. (2012), using AVGs for sustainable behavioural changes depend on the context and individual identities, the differences and the need for additional support and motivation in children. From these findings we do understand how AVGs can be promising in influencing an active lifestyle while also they are influenced by external factors that needs to be integrated into a child's daily routine in a thoughtful manner.

Non-active gaming hours remained stable as seen in Figure 6, which shows its appealing nature due to minimal physical effort and high entertainment value. Some research (ERIC, 2015) shows how traditional gaming i.e. non active gaming are the most sought-after form of entertainment amongst children which is due to the nature of these games and the immersive experience they provide which in turn leads to prolonged periods of inactivity. In cluster 2 we can see how the children in that cluster are more inclined towards non-active gaming which would suggest a need for a better understanding of motivation for children.

To reduce sedentary behaviour, we should promote a balanced approach to gaming which involves encouraging active play alongside physical activities.

In Figure 3 we can see the peaking of physical activity for cluster 2 in week 6, which was then followed by a decline during the washout phase i.e. week 10. Which is like the findings of Li et al. (2021) where it was seen even though interventions can help boost physical activity for a short period of time, it is difficult to inculcate this in the long term without external motivating factors.

The limited data we have on other clusters highlights the need for us to design interventions in a way that it caters to motivation of individuals and the environment around them. Research done by Staiano et al. (2018) supports our argument here by showing the role external factors such as motivation, social support and influence by their parents play a vital role in sustaining the behavioural changes for the long term

The cluster-based analysis done by us exposed some shades of behavioural patterns which were overlooked previously. For example, in cluster 2 we can see more participants involved in household chores and non-active gaming whereas in cluster 3 sports and physical education were given more priority. These findings highlight the changes required on how to approach interventions and frame strategies according to individual differences, the circumstances and their preferences for different group of children.

We can look at several key takeaways combining our analysis with past research work to promote healthier behaviours amongst children/adolescents in future:

Sustainability is Key: To ensure long term sustainability children require community support, motivation, and gamified reinforcement methods for its success.

Personalisation Matters: We cannot have a one size fits all approach to this, since we have a diverse set of clusters. The interventions designed should be considerate towards individual preferences, socio-economic factors, and motivation for a lasting impact.

Balancing Technology and Tradition: Traditional physical activities cannot be replaced but introducing AVGs with physical activities can help give a balance between fun and health. It would give a more balanced approach to promoting better health.

On comparing our findings with past research, we can understand what the limitations are of interventions designed today trying to promote the balance gaming habits with physical activities. AVGs can act as a bridge between these two, it still requires other factors to build the aimed sustainable habits for better health. The factors such as motivation, support systems, and individual differences needs more attention. Our study shows how behavioural interventions need to evolve to cater to the changing landscape of technology and youth engagement, to ensure that these habits become sustainable in the long term.

Limitations

Our study gives way to further consideration of the implications of active and non-active gaming, but we had several limitations that need be considered.

The dataset we used was relatively small and therefore the conclusions that can be drawn from it does not apply larger and diverse populations, it cannot be used as a baseline for generalisation. We have not considered factors that also influence the results such as socio-economic, cultural and environmental differences.

The intervention timeline was short from week 2 to week 6 with a single washout phase in week 10. It is not a good way to understand long term sustainability.

Information on whether our participants had access to outdoor spaces, parental guidance are also things that need to be considered which is further another limitation for our study.

The data is based on self-reporting which would always be more susceptible to participants likely to under or over report their activity levels which would cause further inaccuracies.

The time limitation takes away from a more in-depth analysis that could have been done on this and more extensive research on our part was affected by the time limitation as well.

Even though with all the limitations mentioned above it can still act as a good platform for future research. Combining the above recommendations with large datasets, extended study periods, and contextual information will help to better understand how gaming contributes to behavioural changes in adolescents.

Discussion

The mindset of an average gaming enthusiast has changed a lot since a few decades. Nowadays games are much more than entertainment. When we combine our findings with real-life research, we can test the scope of gaming while identifying its challenges and from education, exercise, appreciation of culture, socialization, gaming comes in a lot of forms. Through active video games (AVGs) and non-active games, players can experience a wide range of benefits, from improved physical health to enhanced cognitive and teamwork skills.

Opportunities for Advancement with Active Video Games Actively working video games are a revolutionary innovation in the gaming world that fuses physical activities with gaming. It's very simple, just as how typical consoles work, kids blind themselves with using a console and using an AVG aids them to keep moving. There are different studies that support the hypothesis that AVGs particularly increases fitness levels in children which agrees with our research that states AVGs steadily raised physical activity in children to target levels during the intervention phase. One such example is Peng et al. (2021).

For instance, games such as Ring Fit Adventure and Just Dance transform exercise into a fun and interactive activity, encouraging users to move. These games integrate physical activity with entertainment and can therefore be used to facilitate the promotion of healthy lifestyles. The study by Graves et al. (2008) highlighted similarly AVGs offer an opportunity for sedentary children to engage in physical activity.

Despite their potential, AVGs have limitations. Our results show that although AVGs promoted PA during the intervention weeks, this change was not always maintained during washout weeks. Staiano et al. (2013) also found that the effects of AVG active video gaming intervention tend to wane over time if it is not followed up with support or reinforcement. To fully exploit their potential benefits, these games should be incorporated within a multi-component approach comprising traditional modes of physical activities and long-term strategies for sustainability.

Our results show that not-active games can add to a balanced life when mixed with other tasks. For instance, people in Cluster 2, while playing not-active games, also took part in home chores and some physical tasks. It shows that not-active games, if done smartly, can make players' lives better without taking away from their body or social skills.

A key idea that comes from both what we found, and past studies is the need for balance. While AVGs help to boost physical action, they cannot take the place of regular outside fun or organized sports. Also, non-active games, even with their thinking and social perks, must be mixed with real-life talks and physical action.

Moderation makes a point that gaming becomes more of a contribution than always being a contributor. By having a fixed pattern to the day, the encroachment of the one type of play on the other hand, to be restricted and the services of the parents can come in handy together with play breaks occasionally. Staiano et al. (2018) stressed the importance of using AVGs as part of other activities, Christin (2020) the danger of oxytocin addiction and a decrease in live communications with friends and family.

Since the spread of gaming is gradually increasing, its effects in policymaking must also be considered. AVGs can for example be incorporated in school programme to make physical education more fun. The review by Staiano et al. (2012) indicated that AVGs enhance both, the enrolment, as well as the fitness, when integrated into school programmes. Same to this, community programme can give means of gaming technology to families who cannot afford it so that as many people as possible would benefit from it.

For non-active games the potential target campaigns could stress cognitive and educational effects of the game, to change parents and other educators' perception of games as educational tools for developing creative thinking. But these criticisms are valid regarding the role of gaming, particularly with concerns to video game addiction, and the overburdened time spent using screens. Time limited playing or playing of different games has also been depicted to lower such risks that are associated with Gameplay minutes. The gaming industry also has an active role in dictation of how

the games must be designed and how they must be played. It is possible for developers to integrate elements within games which makes it possible to have players have a break, do active game modes and even learn while playing collaboratively. Situation like the one with Ring Fit Adventure have already proved that gaming can be a great way of promoting physical activity while having fun, opening doors to many more such innovations.

They show that societal gaming effects are not just related to the two primary individual gamers but reach out to different groups of people. In the COVID-19 crisis, for instance, informed that games are an effective means of social interaction and emotional support during restrictions. This insight is well represented in our findings as to how on one hand gaming brings about creative thinking and interconnectivity and on the other how it results in negativity when moderate use is not possible.

Gaming is a complex and ever evolving medium that can elicit change in behaviour, inform skill development and foster community. Physical interactive games involve the player moving round, while non-physical games enhance problem solving, creativity and cooperation. Altogether we can see that these solutions provide a diverse environment that can be useful for players in so many ways.

The challenge here is that, to get the best out of these benefits, other important factors must be balanced. The excessive involvement in games should be discouraged while good and relative policies, and well-designed games should be encouraged to enhance the positive impacts that games have towards the grown-ups. Used correctly, there is no telling what kind of positive impact games can have on everyday life, from increased exercise and brain development to a growing realization of cultural heritage. The integration, therefore, must be done beautifully so that gaming remains to be the powerful tool that it is in the future generations.

Conclusion

In our study we explored the various impacts that gaming has on the behaviour of children. We see how gaming can be a bridge between technology and traditional exercises using the AVG gaming sector and even for sedentary gaming what kind of measures we can apply to help inculcate how children should take some time to do exercise as well. From the research and our own analysis, we can see the dual nature of gaming. We analysed the change in children's behaviour due to active and non-active gaming and how interventions can affect these habits.

We observed that AVGs can be a tool to increase physical activity particularly during the intervention phase. They can offer enjoyable diversion making an alternative to traditional exercise, making them more appealing to the children who are less interested in sports. However, as our study and others have shown, these benefits last for short a short period without sustained support or reinforcement. For a full-length impact, AVGs must be a part of long-term strategy that includes a systematic engagement and traditional physical activity.

A recurring theme in our findings is the importance of moderation. Gaming should be a part of diverse and balanced lifestyle. This includes a properly structured schedule, play time and breaks. Things must be combined with outdoor play, academics and social interactions. Proper time management ensures that gaming remains a positive and enriching feeder, rather than a destructive dominant factor.

Looking ahead, policymakers, educators and the gaming industry, all must play a meaningful role to shape the future of gaming. We need to encourage gaming in a healthy way such as introducing ABGs in schools and teaching about the potential of non-active games but with moderation and having a balanced social and physically active life, this in turn would help curb gaming addiction in a better way. The industry also needs to play their role by designing games which are educational, involve physical activities and create a balance between entertainment and promoting healthy habits

Gaming has the potential to be a transformative tool, fostering physical engagement, cognitive growth, and cultural appreciation. Its impact extends beyond individual players, shaping communities and providing new ways to connect and learn. As our world becomes increasingly digital, it is essential to harness the positive aspects of gaming while addressing its challenges. By promoting balance, innovation, and thoughtful integration, gaming can continue to enrich lives and serve as a powerful force for good.

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