Significance of Anxiety Levels (Measured by GAD-7, SPIN-5, and SPIN-10 Scores) and Gaming Playstyles in the Reliance on Gaming as a Coping Mechanism

Denise Liana P. Ho[1], Janyka Rochelle E. Mariano[2],
Sophia Pauline V. Sena[3], Christian Wesley D. Yu[4]

Department of Mathematics and Statistics, De La Salle University
2401 Taft Ave., Manila 0922, Philippines

[1]denise_liana_ho@dlsu.edu.ph
[2]janyka_rochelle_mariano@dlsu.edu.ph
[3]sophia_sena@dlsu.edu.ph
[4]christian_wesley_yu@dlsu.edu.ph

ABSTRACT

The growing trend of gaming as entertainment has seen a rise in its use as a coping mechanism for stress and anxiety. This study investigates the relationship between anxiety levels—measured by SPIN-5, SPIN-10, and the GAD-4 scores—and different gaming playstyles. Utilizing data from a global gamer survey, the study aims to estimate the proportion of gamers with multiplayer playstyles, assess differences in mean hours spent on singleplayer versus multiplayer games, analyze if the reason for playing correlates with playstyle, compare GAD-4 "Trouble relaxing" scores across reasons for playing, and explore the linear relationship between GAD-4 scores and SPIN-10 "Talking to strangers scares me" score and combined SPIN-5 "Being criticized scares me"scores. Findings indicate that gamers who play for fun have lower anxiety levels compared to those who use gaming as a relaxation tool, suggesting that the reason for playing significantly impacts gaming's effectiveness as a coping strategy. Additionally, a moderate positive correlation between social anxiety and overall anxiety levels highlights the need to address social fears to enhance relaxation and reduce anxiety. Despite its drawbacks, gaming shows considerable potential as a therapeutic tool for individuals with high anxiety, especially when combined with positive habits. This information could aid mental health professionals in developing interventions that blend social gaming with controlled recreational activities to effectively manage anxiety and promote overall well-being.

Keywords: anxiety, coping mechanism, gaming, mental health

INTRODUCTION

Background of the Study

In recent years, the prevalence of gaming as leisure has been notable in the entertainment industry, successfully targeting a diverse and global audience for their products. Studies have linked this prevalence to cognitive functions as a whole. Mental disorders affect many people around the world and influence one's well-being and behavior in social settings, which has possibly led to the development of gaming as a coping mechanism to manage stress and anxiety. Until today, people use gaming to alleviate their stress levels and distract themselves by using the immersive gameplay experience.

However, there are disadvantages to gaming as a coping mechanism as well. Research has been conducted to highlight the drawbacks of playing video games, with many being in interplay with the gamer's mental health and social relationships. One of the most common negative effects of too much of this leisure activity is that it can disrupt sleeping patterns and result in social isolation. This opens up a pitfall where gamers are caught between the thin line of wanting to interact with people in real life and relying on virtually interacting with them. This kind of dilemma affects a substantial number of gamers, which has increased during the pandemic where real-life interaction was nearly impossible due to imposed restrictions. It becomes progressively harder for people to remain stable when they are too dependent on this leisure, and they lose the balance between playing games and carrying on with their lives outside of gaming.

The Social Phobia Inventory (SPIN) and the Generalized Anxiety Disorder (GAD) scale are frequently used tools for assessing symptoms of anxiety. These measures provide insights into the severity and impact of one's symptoms, which are essential for understanding the relationship between daily habits and their consequences on one's mental health. SPIN and GAD scores have also been practical in analyzing an individual's ability to cope with challenges in life and suggesting healthier alternatives to enhance their overall well-being.

Statement of the Problem

Despite the growing interest in this field, there are still gaps in the understanding of how particular gaming playstyles, such as competitive multiplayer or casual gaming, may affect the association between anxiety levels and gaming as a coping mechanism. Examining these interrelations can help improve specialized therapies and support systems for people who might engage in harmful gaming habits or are experiencing heightened anxiety.

Objectives of the Study

This study aims to investigate the significant variations of anxiety levels in connection to various gaming playstyles using GAD-4, SPIN-5, and SPIN-10 scores. The possibility that individuals with increased levels of anxiety are more likely to use online gaming as an outlet to relieve stress will be analyzed. The research seeks to contribute knowledge of the

complex interplay between mental health, gaming behaviors, and coping strategies by examining how individuals with varied anxiety profiles engage with gaming and perceive it as a coping mechanism.

Various objectives are:

1. To determine/estimate the proportion of the population with multiplayer as a playstyle.
2. To determine if there is a significant difference in the mean hours spent playing games of gamers with playstyle singleplayer and gamers with playstyle multiplayer.
3. To determine if the reason for playing is related to the categorized playstyle.
4. To find out if the mean GAD-4: "Trouble relaxing" score is the same for all four reasons for playing.
5. To determine if there is a significant linear relationship between the GAD-4: "Trouble relaxing" score and the sum of SPIN10: "Talking to strangers scares me" score and SPIN-5: "Being criticized scares me."

Significance of the Study

This study is conducted to assist researchers in furthering the foundation of knowledge in the field of psychology as well as sociology. With the exponential growth of gaming as leisure, further research on its impact on players' interpersonal and intrapersonal relationships may be advantageous in implementing strategies and initiatives to encourage players to adopt healthy methods. Moreover, researchers and professionals alike can also become more driven to find appropriately inclined solutions, specific approaches, and technical ways to address the negative side effects that arise from gaming. They can also help players reaffirm better gaming experiences as well as manage their mental well-being as they adapt to the flexibility and unpredictability of the gaming industry. Even authorities that hold funding can be convinced to provide researchers and professionals with enough training and incentives so that they can utilize focused and disciplined treatments to enable players to play within their limits and identify and meet the needs of players who might be suffering from too much reliance on gaming as a form of relief.

Scope and Limitations

This study focuses on the anxiety levels of players concerning their preferred gaming playstyles. Defining and categorizing different playstyles that possibly influence coping mechanisms will be covered. Varied sets of hypothesis testing will be used to draw conclusions and findings. Measurement tools to be utilized are GAD-4, SPIN-5, and SPIN-10 scores to accurately assess anxiety levels. However, the measurement scale is limited to the scores as a whole and not as each individual part.

The research does not extend to the various factors influencing playstyles beyond gaming, namely other hobbies that may contribute to the severity of anxiety levels. This may narrow

the generalizability of the results, for such factors among individuals vary. The research does not intend to assess the causes, lifestyles, and other health problems potentially experienced by the players. Although the study covers the relation of the scores as factors of one another, the research does not delve into the cross-sectional nature of the psychological factors involved.

Review of Related Literature

Just as gaming is among the prevalent leisures, depression, and anxiety are known as the two most globally prevalent mental health disorders. According to a study entitled “Gaming Your Mental Health: A Narrative Review on Mitigating Symptoms of Depression and Anxiety Using Commercial Video Games” (Kowal et al., 2020), the treatment gap and stigma associated with such mental health disorders are common issues encountered worldwide. As a result, there is an increasing demand for accessible and cost-effective methods in reducing the occurrence of mental health illnesses and facilitating coping mechanisms. The study inferred that video games have been shown to present cognitive benefits to those playing regularly such as attention control, cognitive flexibility, and information processing. The study then concluded that video games are promising in the area of mitigation of mental health issues in addition to traditional treatments, for video games are readily accessible, internationally available, and effective resources.

In an article entitled “Tears of the Kingdom: 'Zelda's escapism helps us through tough times'” published for BBC Newsbeat, journalist Rogers (2023) gathered some players of the game to share their experiences and thoughts. According to player Amber Elphick, the game being played in any way people choose was therapeutic for her, and games helped her and others find meaningful connections through the community. In addition to that, Twitch streamer Derby Munns remarked, "If you're not necessarily finding people in real life that you want to hang out with, games can be a great way to find and meet people." Games are a way to start opening up and forming friendships when one might not otherwise be willing to engage in conversation. This could be helpful for people who find it difficult to make friends, start a conversation, and meet new people, especially for neurodivergent players who might need to feel more comfortable around other people. The article also highlighted another positive impact of gaming, which is immersing oneself in the sights and sounds of the game to manage the feelings of being stressed, upset, and burnout.

In a study about compulsive digital gaming as an emerging mental health disorder in children (Singh, 2018), it is said that youngsters are losing control of their lives by wasting their time indulging in online multiplayer games. Despite this, players can enjoy building relationships with other online people, which provides a virtual community feeling at the expense of one-to-one social interactions and real-life bonding. However, over the course of time, players could be too dependent on gaming that they start exhibiting mood swings like irritability, restlessness, and aggressive behavior when they are denied this particular leisure. This counts as a health hazard brought by digital gaming, and so the World Health Organization (WHO) has labeled it as a mental health disorder, allowing it to be granted state health benefits for its prevention and treatment.

A systematic review article by Marques et al. (2023) explored the surge of virtual gaming and its link to a desire to escape from real life, a phenomenon known as escapism. Escapism has been identified as a significant motivator, leading to adverse outcomes, including addiction. The association of engagement in virtual gaming with emotional, social, and mental health is then analyzed to find reasons behind such practices and their potential impact on mental and public health. The review reinforces the evidence linking escapism in the context of virtual games to poor mental health and non-adaptive social behavior. It examines the broad implications of virtual gaming practices on underlying motivations for escapism in the areas of social cognition, health promotion, and public health.

Another systematic review by Sachan, Chhabra, and Abraham, (2023) tackles the socio-relational outcomes for members of online gaming communities, setting up a critical comparison of social networking and social isolation in the context of the emergence of free-to-play multiplayer games contributing to the increase in the number of players subsequently becoming a part of gaming communities. Results showed a predominantly positive influence of community membership on socio-relational outcomes of friendship, social skills, and social capital. Community-related variables (community size, social interaction, aim of community formation) and game characteristics that interacted with the gaming community (collective play, cooperation, learning to achieve game objectives) impacted the relationship between community membership and social capital. For some players, however, online social capital increased at the expense of offline social capital.

Research on the impact of addiction to Player Unknown's Battlegrounds (PUBG) game on social isolation and narcissistic tendencies among gamers (Nawaz, Nadeem, Rao, Fatima, & Shoaib, 2020) conducted a correlation survey. The data was collected from players of the game with a population size of 101 and ages ranging from 13-30 years old. The instruments used for testing the hypothesis in the data analysis methodology included the Online Game Addiction Scale (Kim, Namkoong, Ku, & Kim, 2008), Narcissistic Personality Inventory (Raskin & Hall, 1981), and Measures of Social Isolation (Zavaleta, Samuel, & Mills, 2016). The yielded results indicated that online game addiction, social isolation, and narcissistic tendencies among PUBG game players are negatively correlated (<.05). The study concluded that online games do carry positive aspects of enhancing social skills and interactions among the players while helping them show behaviors and emotions that are not coherent with narcissistic tendencies. This study also carries implications for families, friends, teachers, and therapists of online gamers, who may use the findings to understand some of the positive aspects of playing online games.

A systematic review and meta-analysis published by Cambridge University Press in 2022 conducted a study on the effectiveness of games as a form of therapeutic intervention for depression and anxiety in young people, specifically individuals aged 12–25 years old. Gathering recent research during the time the study was conducted, randomized controlled trials and non-randomized studies were included. The randomized controlled trials showed that there was a statistically significant effect at the 95% confidence level favoring the therapeutic intervention when treating depression in youth. As for non-randomized studies, with the use of a design on repeated measures, the overall effect was strong as well on the same confidence interval of 95%, but it was not as statistically significant as the findings on

the performed RCTs. What made this collection of data interesting was that no statistically significant effect for treating anxiety in youth was found. There is preliminary evidence to suggest that gaming interventions are an effective treatment for depression in young individuals, but not anxiety. Further research is warranted to establish the utility, acceptability, and effectiveness of gaming interventions in treating young people's mental health problems.

According to the study, young individuals engage in various types of games, including single and multiplayer games, competitive games, strategy games, e-sports, exergames, and virtual reality. It was indicated that boys are more likely to play games than girls online, but the proportion of girls who play games increased from 38% in 2018 to 48% in 2019, whereas the proportion of boys who play games online has remained stable at 71%. Based on the systematic review, gaming interventions for mental health vary in methodological approach and have been categorized in the following ways:

- exergames (games that involve physical exertion as a form of exercise);
- virtual reality (games that use computer-generated simulations of a three-dimensional environment, allowing user interaction);
- CBT-based games (games integrating the principles of cognitive therapy);
- entertainment games (games aimed at giving the player a sense of pleasure, which could help with motivation and learning);
- biofeedback (electronic monitoring of a physiological function that is fed back to the individual, usually as a mini-game, for better voluntary control of the said physiological function);
- cognitive training games (games designed to improve certain cognitive functions, such as memory).

It is quite intriguing that in contrast to most commercial games designed for entertainment purposes, there are games designed for the sake of treatment, taking advantage of gaming principles to support mental health problems. Gaming interventions often feature a system of reward and are interactive and competitive. Due to the emergence of such interventions, practices for the development and implementation of treatment have been rising at a faster rate. In addition to this, gaming has also been recognized to help address key barriers, such as accessibility of treatment, long waiting times, and lack of motivation to participate in treatment. Evidence supporting this is that gaming can almost always be accessible as it is independent of time and location, and the global prevalence of digital content allows for easy distribution to masses of people largely irrespective of circumstance, giving gaming an advantage over traditional treatments (Townsend et al., 2022).

In contrast to all those positive lights, a systematic literature review concerning the relationship between problematic online gaming (POG) and social anxiety over the past ten years was conducted by Gioia, Colella, and Boursier (2022), taking into account the variables implicated in this relationship. The review included studies published between 2010 and 2020 that were indexed in major databases with the following keywords: Internet gaming, disorder, addiction, problematic, social phobia, and social anxiety. Several reviewed

studies found a strong association between social anxiety and online gaming disorder. To sum up, the review showed that socially anxious individuals might perceive online video games as safer social environments than face-to-face interactions, predisposing individuals to the POG. However, in a mutually reinforcing relationship, individuals with higher POG seem to show higher social anxiety. Therefore, despite online gaming might represent an activity able to alleviate psychopathological symptoms and/or negative emotional states, people might use online gaming to counterbalance distress or negative situations in everyday life, carrying out a maladaptive coping strategy.

In favor of the previously reviewed study, a preliminary cross-sectional study (Stavropoulos, Vassallo, Burleigh, Gomez, & Colder Carras, 2021) aimed to clarify the role of Internet gaming in the association between anxiety and depression. Moderate engagement with Internet games has also been suggested to provide relief, thus improving one's mood. Analysis such as regression, moderation, and moderated moderation accounted for the effects of gender on the relationship between disordered gaming, anxiety, and depression and found the following results:

- a significant effect for anxiety symptoms on depression symptoms;
- a significant interaction between anxiety and Internet gaming disorder on depression symptoms.

These findings support the theory that although anxious gamers bear a higher depression risk, this is buffered with lower and worsened with higher disordered gaming symptoms. Findings also suggest a dual role of Internet gaming in the association between anxiety and depression, depending on the intensity of one's disordered gaming symptoms. Protocols in depression prevention and intervention should be optimized by considering the effects of Internet gaming among gamers suffering from anxiety by focusing on the intensity of a gamer's involvement and any gaming disorder symptoms. Further research should include clinical samples to better understand this interaction.

Lastly, research was conducted to look into the role of motives and metacognitions in social anxiety and Internet gaming disorder (IGD). IGD has been defined as “a disorder characterized by persistent gaming and functional impairment in multiple areas of life” (King, Herd, & Delfabbro, 2017, p. 17). Multiple factors have been found to contribute to the development and maintenance of IGD, including individual characteristics (e.g., age, gender, psychological vulnerability, and comorbidity) as well as contextual factors (e.g., social influence processes) and game-related features (King, Herd, & Delfabbro, 2017; Przybylski, Weinstein, & Murayama, 2017).

The study mentioned that although research has found that social anxiety, motives, the preference for online social interactions (POSI), and metacognitions about online gaming are independent predictors of IGD, little is known about their relative contribution to IGD. The current study aimed to model the relationship between social anxiety, motives, POSI, metacognitions about online gaming, and IGD.

According to the results of the study, social anxiety was directly associated with four motives (escape, coping, fantasy, and recreation), POSI, positive and negative metacognitions about online gaming, and IGD. The Sobel test showed that negative metacognitions about online gaming played the strongest mediating role in the relationship between social anxiety and IGD followed by escape, POSI, and positive metacognitions. The model accounted for 54% of the variance for IGD. The findings show that along with motives and POSI, metacognitions about online gaming may play an important role in the association between social anxiety and IGD (Marino et al., 2020).

To encapsulate, there is still a stark and largely distinguished difference between the advantages and disadvantages of virtual gaming and memberships in gaming communities. There are plenty of coverages focusing on how titles, especially mainstream games, can improve people's moods and play a part in their overall health. These coverages have helped further research and applied studies in the areas of psychology, sociology, and even economics concerning the impact on the gaming industry by players' abilities and inclination to consume franchises categorized by genres. The literature underscores the importance of the concept of online gaming as a coping mechanism and way of "escapism" among gamers with intensified levels of anxiety, which this study aims to address. Relationships between certain factors and variables, both qualitative and quantitative, have been used to predict outcomes, describe patterns, and understand their causal connections.

However, despite the emerging presence of these rather positive findings, gaps can still be found due to the broad nature of psychological health and its complexity to be measured and scaled. While findings have been referenced by clinical practitioners in the upgraded prevention and implementation of reducing the risks of mental health disorders in gamers, they may not guarantee the most practical and economical procedures in treatment because of the heterogeneity in the variability in the ways individuals receive treatment. This is due to the fact that people may respond differently to the same intervention. Another notable factor is the ever-changing trends in today's society, and the variety and impact of games today might differ significantly from those of games several years from now. This may make it difficult for researchers to constantly keep up with the meticulous process of data collection and analysis as well as hypothesis testing and establishing validity.

Nonetheless, factual information drawn from a substantial number of studies has been used to verify foundational knowledge on related fields, and the related literature above has provided key insights on the current state of related studies which shall be useful in understanding the research problem. Through this synthesis of diverse perspectives, this review lays the grounds for performing an empirical investigation demonstrated in the succeeding sections of the study.

METHODOLOGY

Data

The data was sourced from the dataset "Online Gaming Anxiety Data" (Agrawal, 2020), which comprised of information gathered from a global survey of gamers concerning anxiety-related questions. The dataset consisted of 55 columns of quantitative and qualitative data and 13,465 rows of observations. However, this study focused only on specific quantitative variables: age, GAD-4 score ("Trouble relaxing"), SPIN-5 score ("Being criticized scares me a lot"), SPIN-10 score ("Talking to strangers scares me"), and average hours of playing per week. Additionally, the considered qualitative variables: birthplace, work, gender, reason for playing games (having fun, improving, relaxing, winning), platform, and playstyle (singleplayer, multiplayer - online - with strangers, multiplayer - online - with online acquaintances or teammates, multiplayer - online - with real-life friends, multiplayer - offline).

Responses that deviated from the set of choices for the qualitative data, specifically the reason for playing and playstyle were manually categorized into the default choices. Observations with answers "N/A" or "All" were disregarded. The primary reason for only choosing SPIN-5, SPIN-10, and GAD-4 scores was the direct relevance to measuring reliance on gaming as a coping mechanism. The frequency ratings for the SPIN variables related to the Social Phobia Inventory were measured as follows:

- 0 – Not at all
- 1 – A little bit
- 2 – Somewhat
- 3 – Very much
- 4 – Extremely

The frequency ratings for GAD-4 related to the GAD scales scale were determined by the following:

- 0 – Not at all
- 1 – Several days
- 2 – More than half the days
- 3 – Nearly every day

The SPIN-5 and SPIN-10 scores were combined and used as an aggregate measure, where a higher combined score (8 as the highest possible sum) indicated greater anxiety. This allowed for a more comprehensive assessment of social anxiety in the data analysis by considering the cumulative effect of both SPIN measures.

Statistical Analysis

The statistical tests and analysis for this study were aided by the PHStat add-in from Excel. The primary aim was to investigate significant variations in anxiety levels in relation

to the different playstyles and behavior, utilizing GAD-4, SPIN-5, and SPIN-10 scores. Additionally, the study explored whether respondents with higher anxiety levels were more inclined to use online gaming as a coping mechanism. All statistical tests were conducted with a significance level $\alpha = 0.05$. The statistical tests were as follows.

To estimate the proportion of the population that prefers "multiplayer" as their playstyle, a 95% confidence interval was constructed which provided a range in which the true population proportion falls. The interval was computed using the formula given below:

$$[\hat{p} - e,\ \hat{p} + e], \text{ where } e = z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

Where $\hat{p}$ is the population proportion point estimate (computed as x observations divided by n sample size), e is the margin of error, and z is the critical value from the standard normal distribution of $\alpha = 0.05$.

To determine whether there was a significant difference in the mean hours spent playing games per week between two populations whose playstyles are singleplayer and multiplayer, a hypothesis test on the two means was conducted using a two-tailed z-test. The z-test statistic was computed as follows:

$$z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where the $\bar{x}$ variables are the sample means of the two populations, the s^2 variables are the sample variances, and the n variables are the sample sizes of each population. The z-test statistic was compared to the corresponding critical value of the standard normal distribution at $\alpha = 0.05$ to determine whether to reject the null hypothesis, which was that the means of the two populations were equal.

To determine whether an individual's reason for playing was related to their playstyle, a Chi-square test for independence was done between the two variables. A contingency table with rows as the categories of reason for playing (explanatory variable) and columns as the categories of playstyle (response variable) was made in preparation for the hypothesis test. he hypothesis test involved computing the Chi-square statistic, which was then compared to the critical value to determine whether to reject the null hypothesis. The test used $(rows - 1) \times (columns - 1)$ degrees of freedom and a significance level of $\alpha = 0.05$. The Chi-square statistic was computed as follows:

$$\chi^2 = \sum_i \frac{(o_i - e_i)^2}{e_i} \quad \text{where} \quad e_i = \frac{(column\ total) \times (row\ total)}{grand\ total}$$

Where χ^2 is the chi-square statistic, o_i is the observed frequency in each category, e_i is the expected frequency in each category computed as column total times row total over grand total per i cells. The null hypothesis for this test was that the variables are independent of each other.

To find outwhether the mean GAD-4 score across all four categories of reported reasons for playing were equal, a one-way ANOVA test (analysis of variance) was conducted. This test evaluated if there were any statistically significant differences between the means of the population groups. The one-way ANOVA test involved the creation of an ANOVA table and computing for the f-test statistic, which was compared to the critical value at $\alpha = 0.05$ to determine whether to reject the null hypothesis. The null hypothesis stated that all group means were equal. The f-test statistic was calculated using the following formula:

$$f = \frac{s_1^2}{s_2^2} \qquad \text{where} \qquad s_1^2 = \frac{SSC}{k-1} \quad s_2^2 = \frac{SSE}{N-k}$$

Where f is the ratio of the estimates of common variances s_1 and s_2. The two estimates are then computed as SSC (sum of squares between groups) divided by $k - 1$ degrees of freedom and SSE (sum of squares within groups) divided by $N - k$, respectively, where k is the number of groups and N the total sample size.

If the f-statistic were to exceed the critical value, a post hoc test (Tukey-Kramer test) between pairs of all groups would be necessary to determine the specific significantly different groups. The two groups would be deemed different by the following equation (for unequal sample sizes):

$$\left|\bar{x}_i - \bar{x}_j\right| > \frac{q(\alpha,k,v)}{\sqrt{2}} \sqrt{MSE\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}$$

Where the absolute difference of the sample means $\bar{x}$ is tested against the critical range of error, computed using the q-statistic (determined by $\alpha = 0.05$, k, and $v = N - k$) and MSE (error mean sum of squares, within groups). Another hypothesis test, Levene's test, would also be necessary to test the ANOVA assumption of variance homogeneity between groups This would be done by performing an ANOVA on the absolute value of residuals computed as:

$$e_{ij} = x_{ij} - \bar{x}_i$$

Where the j-th observation from the i-th group is subtracted from the mean of the i-th column or group $\bar{x}_i$.

To determine whether there was a significant linear relationship between the GAD-4 score and the combined SPIN-5 and SPIN-10 scores, regression and correlation analysis was conducted. This analysis aimed to explore the relationship between GAD-4 scores (independent variable) and the sum of SPIN-5 and SPIN-10 scores (dependent variable). A scatterplot was created with GAD-4 scores on the X-axis and the sum of SPIN-5 and SPIN-10 scores on the Y-axis. A fitted linear regression line was then computed to model the relationship between these variables and to also predict the value of Y given X. The formula for the fitted regression line is given by:

$$\hat{y} = b_0 + b_1 x \qquad \text{where} \qquad b_1 = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2} \qquad b_0 = \bar{y} - b_1\bar{x}$$

where ŷ is the predicted value of the dependent variable (the sum of SPIN-5 and SPIN-10 scores) given is the independent variable x (GAD-4 score), b_0 and b_1 are the intercept and the slope, respectively. The Pearson correlation coefficient was calculated to assess the strength and direction of the linear relationship between GAD-4 scores and the combined SPIN scores.

Additionally, the coefficient of determination was computed to quantify the proportion of the total variation in the dependent variable that can be explained by the independent variable. This value indicates the extent to which changes in GAD-4 scores are associated with changes in the sum of SPIN-5 and SPIN-10 scores. A significance test for population correlation ρ was done to confirm the significance of the relationship between GAD-4 scores and the combined SPIN scores. The t-test statistic was compared to the critical value with $n - 2$ degrees of freedom at $\alpha = 0.05$, where the t-test statistic was calculated as:

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Where r is the computed correlation coefficient, with r^2 coefficient determination, and n as sample size. The null hypothesis, which stated that there is no significant linear relationship, would ideally be rejected to prove the linear regression was useful. Once all tests were concluded, the results of each of the tests were analyzed and interpreted, and subsequently presented in the results and discussion section of the study along with PHStat computation outputs.

RESULTS AND DISCUSSION

This study aims to investigate the significance of anxiety levels (measured by GAD-4, SPIN-5, and SPIN10 scores) and gaming play styles in the reliance on gaming as a coping mechanism. Specifically, this study sought to achieve specific objectives outlined below:

Objective 1: To estimate the proportion of the population with multiplayer as playstyle

This objective sought to estimate the proportion of the population that preferred a multiplayer playstyle more than a singleplayer playstyle, using a sample of 13,410 gamers.

Table 1. Estimating Proportion: Confidence Interval of Multiplayer Population

Data	
Sample Size	**13410**
Number of Successes	**12603**
Confidence Level	**95%**
Intermediate Calculations	
Sample Proportion	0.9398210291
Z Value	-1.9600
Standard Error of the Proportion	0.0021
Interval Half Width	0.0040
Confidence Interval	
Interval Lower Limit	**0.9358**
Interval Upper Limit	**0.9438**

In Table 1, a substantial majority of 12,603 gamers showed a preference for playing multiplayer games. The point estimate for the proportion of gamers with a preference for multiplayer was computed as 93.98%. The Z-value corresponding to a level of significance $\alpha = 0.05$ was -1.9600. With a 95% confidence level, the proportion of the population preferring a multiplayer playstyle was estimated to be between 93.58% and 94.38%, given a margin of error of 0.04%.

Given the high proportion of gamers who preferred multiplayer playstyles, this underscores a notable trend towards social and competitive gaming. This suggests that gaming may be increasingly used as an alternative to real-life social interactions and relationship building. This also indicates a larger preference for virtual communities and online friendships rather than face-to-face socialization, which, according to Singh (2018), may have drawbacks in mental health and overall behavior. While digital communities can provide significant emotional and social benefits, they may also lead to disrupted sleep patterns, social isolation, and a decreased ability to form and maintain real-life relationships. This potentially heightens the risk of increased anxiety and mental health disorders.

Objective 2: To determine if there is a significant difference in the mean hours spent playing games of gamers with playstyle singleplayer and gamers with playstyle multiplayer

This objective sought to determine whether there was a significant difference in the mean hours spent playing games between gamers with singleplayer and multiplayer playstyles. To achieve this, a *Z*-test between the two independent populations was utilized to compare the hours respondents had spent on games on average per week.

Table 2.1. Contingency Table: Playstyle Categories and Avg. Hours Per Week

Playstyle	Sum of Hours	Count
Multiplayer - offline (people in the same room)	707	47
Multiplayer - online - with online acquaintances or teammate	64635	2668
Multiplayer - online - with real life friends	118063	5696
Multiplayer - online - with strangers	89553	4165
Singleplayer	16214	805
Grand Total	289172	13381

Table 2.1 illustrates the cumulative hours spent by gamers across different playstyles and their corresponding counts. Notably, the group of online multiplayer with real-life friends had a significant sum of 118,063 hours. Multiplayer with strangers also had a high cumulative total of 89,553 hours. Additionally, Multiplayer with online acquaintances recorded 64,635 hours from 2,668 participants. In contrast, the Singleplayer category reported a sum of 16,214 hours. The grand total summed to 289,172 hours across all playstyles with 13,381 responses. With the preliminary data, the *Z*-test was conducted with all multiplayer categories combined.

The null hypothesis was that there was no difference in the mean hours spent playing games between the two groups (singleplayer and multiplayer). The alternative hypothesis stated that there was a significant difference in the mean hours spent playing games between the two groups. Given the large sample sizes (805 for singleplayer and 12,576 for multiplayer), the two-tailed Z-test was appropriate for comparing the two means.

Table 2.2. Z Test for Differences in Two Means: Playstyle Categories and Avg. Hours Per Week

Data	
Hypothesized Difference	**0**
Level of Significance	**0.05**
Population 1 Sample	
Sample Size	**12576**
Sample Mean	**21.7047**
Population Standard Deviation	**13.6131**
Population 2 Sample	
Sample Size	**805**
Sample Mean	**20.1416**
Population Standard Deviation	**15.977**

Intermediate Calculations	
Difference in Sample Means	1.5631
Standard Error of the Difference in Means	0.5761
Z Test Statistic	2.7135

Two-Tail Test	
Lower Critical Value	**-1.9600**
Upper Critical Value	**1.9600**
***p*-Value**	**0.0067**
Reject the null hypothesis	

With "Population 1 Sample" in Table 2.2 referring to the multiplayer population, the sample mean of hours was determined as 21.7045. For "Population 2 Sample" or the singleplayer population, a similar 20.1416 average hours was observed. However, since the Z-test statistic resulted in 2.7135 which exceeded the upper critical value of 1.9600, the null hypothesis was rejected. This indicated that there was a significant difference in the mean hours spent playing games between singleplayer and multiplayer gamers, with singleplayer gamers spending slightly more time on average.

Objective 3: To determine if the reason for playing is related to the categorized playstyle

This objective sought to determine whether an individual's reason for playing games and their preferred playstyle in gaming are independent of each other. A Chi-square test for independence was done between the two variables, which tested whether different playstyles are associated with specific reasons for gaming.

Table 3.1. Chi-Square Test for Independence: Observed Frequencies

	Multi offline	Multi w/ online acquaintances	Multi w/ real friends	Multi w/ strangers	Singleplayer	Grand Total

having fun	28	1195	3037	1563	398	6221
improving	14	975	1732	1576	204	4501
relaxing	3	124	202	215	101	645
winning	3	353	677	790	99	1922
Grand Total	48	2647	5648	4144	802	13289

Table 3.1 shows the contingency table utilized in the Chi-square test, with the rows as the categories of the reasons for playing, and the columns as the categories for playstyles. The table categorizes respondents based on their reasoning for playing games and their playstyles. Each cell represented the observed frequencies of respondents falling into the corresponding category. For the singleplayer group, "having fun" had the highest observed frequency, while "winning" was the least. Similarly, for the Multiplayer groups, "having fun" also had the highest observed frequency, though "relaxing" was the least chosen reason.

Table 3.2. Chi-Square Test for Independence: Expected Frequencies

Expected Frequencies						
	Playstyle					
Reason	Multiplayer - offline	Multiplayer - online - with online acquaintances or teammates	Multiplayer - online - with real life friends	Multiplayer - online - with strangers	Singleplayer	Total
having fun	22.47031379	1239.144179	2644.006923	1939.937091	375.441493	6221
improving	16.25765671	896.5420272	1912.984273	1403.577696	271.6383475	4501
relaxing	2.329746407	128.4758071	274.1334939	201.1347731	38.92617955	645
winning	6.942283091	382.8379863	816.8753104	599.3504402	115.99398	1922
Total	48	2647	5648	4144	802	13289

Table 3.2 presents the PHStat computation of expected frequencies for each observed frequency in Table 3.2. These expected frequencies were used in the computation for the Chi-square test.

In the hypothesis test conducted to determine if the reason for playing is related to the categorized playstyle, the null hypothesis states that the two variables—the reason for playing and the categorized playstyle—are independent. In contrast, the alternative hypothesis suggests that the variables are dependent on each other. Using a significance level = 0.05, the critical value was tested against the Chi-square test statistic, where the null hypothesis would be rejected if the test statistic was greater than the critical value.

Table 3.3. Chi-Square Test for Independence: PHStat Data & Results

Data	
Level of Significance	**0.05**
Number of Rows	4
Number of Columns	5
Degrees of Freedom	12
Results	
Critical Value	**21.02606982**
Chi-Square Test Statistic	**409.1883012**
***p*-Value**	**4.28416E-80**
Reject the null hypothesis	

Figure 3 shows the PHStat results of the Chi-square test for independence between the reason for playing and preferred playstyle. Using a significance level $\alpha = 0.05$, the critical value for the Chi-square statistic with 12 degrees of freedom was critical value = 21.0261. Then, the computed Chi-square statistic was $\chi^2 = 409.1883$ Since the Chi-square statistic was greater than the critical value, the null hypothesis was rejected. The alternative hypothesis was then accepted, which suggested that the reason for playing was not independent but related to the preferred playstyle of the respondents.

The results indicated that the reason for playing games was dependent on the preferred playstyle. This means there is a statistically significant relationship between why people play games and how they prefer to play them. "Having fun" is the most common reason across all playstyles, but its frequency varies significantly depending on the playstyle. "Winning" has the lowest frequency overall, but still shows a dependency on playstyle, especially in multiplayer settings.

Objective 4: To find out if the mean GAD-4: "Trouble relaxing" score is the same for all four reasons for playing

This objective sought to determine whether the mean GAD-4 score for the item "Trouble relaxing" varies significantly across the four reasons for playing. A one-way ANOVA test was performed to assess this.

Table 4.1. One-Way ANOVA: Summary of Data (Reasons for Playing and GAD-4 Score)

Groups	Count	Sum	Average	Variance
having fun	6245	4128	0.6610	0.7766
improving	4514	3326	0.7368	0.8676
relaxing	648	652	1.0062	1.0881
winning	1928	1553	0.8055	0.9248

Table 4.1 summarizes the data used in the one-way ANOVA test to analyze the variance in GAD-4 scores based on reasons for playing. Each row represents the categorized reasoning for playing, with the four rightmost columns representing the particular computations for GAD-4 scores within the reasons for playing groups.

Among the averages per group in the table, "relaxing" had a higher average for GAD-4 scores (1.0062), while the relatively lower average (0.6610) belonged to the "having fun" group. Similarly, a higher variance in scores (1.0881) was observed in "relaxing," whereas "having fun" had the lower variating scores (0.7766).

For the hypothesis test, the null hypothesis stated that the mean GAD-4 scores across the four reasons for playing were all equal, and the alternative hypothesis proposed that at least one of the means differed. At a level of significance $\alpha = 0.05$, the critical value was compared to the f-test statistics. The decision rule was to reject the null hypothesis if the f -test statistic was a larger value than the critical value.

Table 4.2. One-Way ANOVA: ANOVA Table Results

Source of Var.	SS	df	MS	f	p-value	Crit. value
Between groups	89.9201	3	29.9734	35.5154	7.48E-23	2.6056
Within groups	11250.7334	13331	0.8440			
Total	11340.6535	13334				$\alpha = 0.05$

In Table 4.2, the one-way ANOVA PHStat computation results exhibited a between-groups sum of squares SSC of 89.9201 with 3 degrees of freedom and a mean square MSC of 29.9734. The within-groups sum of squares SSE was 11,250.7334 with 13,331 degrees of freedom, resulting in a mean square MCE of 0.8440. The f-statistic was computed as $f = 35.5154$ with a substantially small p-value of 7.48E-23. The critical value for this test was 2.6056.

The p-value, significantly less than the alpha level of 0.05, indicated a strong likelihood that the differences in mean GAD-4 scores were statistically significant across the four reasons for playing. Since the f-test exceeded the critical value, the null hypothesis was rejected. Therefore, it was concluded that not all the mean GAD-4 scores among the categorized reasons for playing were equal.

Table 4.3. Post-Hoc Test: Tukey-Kramer Multiple Comparisons

Group	Sample Mean	Sample Size
1: having fun	0.661009	6245
2: improving	0.736819	4514
3: relaxing	1.006173	648
4: winning	0.805498	1928

Other Data	
Level of significance	0.05
Numerator d.f.	4
Denominator d.f.	13331
MSW	0.843953
Q Statistic	3.63

Comparison	Absolute Difference	Std. Error of Difference	Critical Range	Results
Group 1 to Group 2	0.07581	0.01269062	0.0461	Means are different
Group 1 to Group 3	0.345164	0.02680986	0.0973	Means are different
Group 1 to Group 4	0.144489	0.01692447	0.0614	Means are different
Group 2 to Group 3	0.269354	0.02728882	0.0991	Means are different
Group 2 to Group 4	0.068679	0.0176734	0.0642	Means are different
Group 3 to Group 4	0.200675	0.02949687	0.1071	Means are different

As observed in Table 4.3, the Q-statistic was used to determine if there were significant differences between group means. The Q-statistic of 3.63 (determined by 4 groups and 13,331 observations), compared against the critical value from the Q-distribution table, indicated that the group means were significantly different. The mean square within MSW value was 0.843953, representing the average of the within-group variances and used as part of the calculation of the standard error of the difference between means. All pairs of comparisons showed that the means were significantly different, indicating distinct reasons for playing among the groups. Specifically, "having fun" group was shown to be the mean with a comparatively smaller mean, with the "relaxing" group having a relatively higher mean.

Table 4.4. Levene's Test: Equality of Variances

Source of Var.	SS	df	MS	f	p-value	Crit. value
Between groups	37.5241	3	12.5080	17.1970	3.84E-11	2.6056
Within groups	9696.1469	13331	0.7273			
Total	9733.6711	13334				$\alpha = 0.05$

The null hypothesis was that the variances across four groups with different reasons for playing were equal. If the null hypothesis was rejected, it indicates that at least one variance was different from the others. Given a significance level $\alpha = 0.05$ reject the null hypothesis, if the test statistic f exceeds the critical value $f_{0,05}$ (3, 13331) = 2.6056. In this case, the computed f value is 12.1970. Since 12.1970 was greater than 2.6056, the null hypothesis was rejected. This indicated that the homogeneity of variance assumption required for ANOVA was not satisfied; the homogeneity of variance assumption was violated.

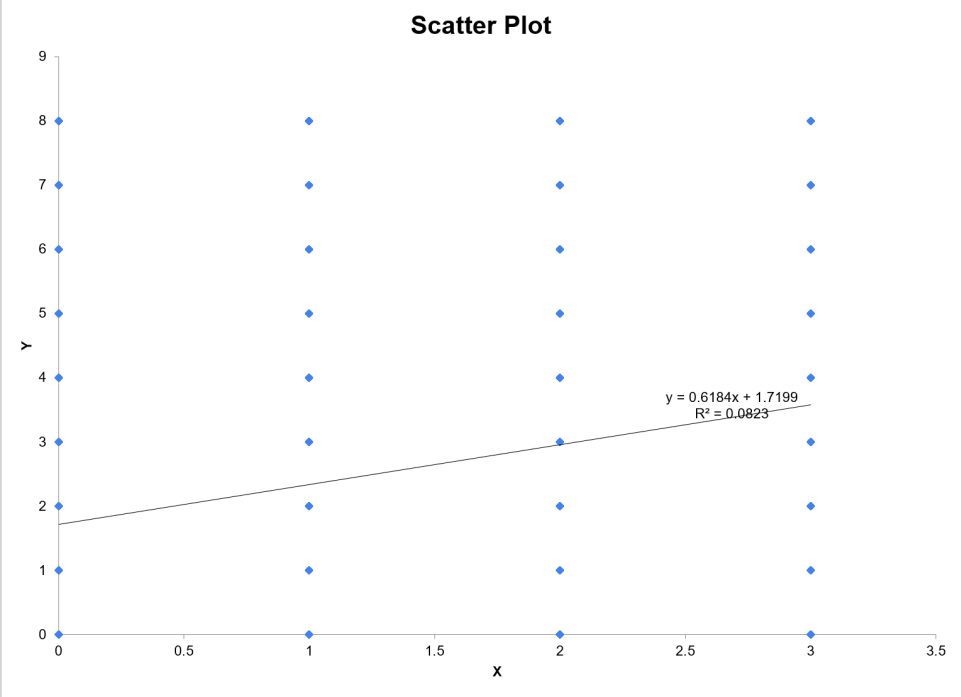
The violation of the ANOVA variance assumption suggested that the results of the ANOVA might be unreliable or inconclusive. Despite that, the observed connection between the reason "relaxing" and slightly higher GAD-4 scores suggests an intriguing relationship between the use of gaming as a way to cope or distract themselves. This somehow implies that those who struggle with relaxation in their daily lives may be turning to gaming as a means to manage their anxiety, and hence become a coping mechanism. It suggests that

these individuals might experience significant anxiety or stress that impairs their ability to relax through traditional means. Consequently, gaming becomes a crucial outlet for them, providing a temporary reprieve from their anxious thoughts and feelings. This is supported by Stavropoulos, Vassallo, Burleigh, Gomez, and Colder Carras (2021) in their study where the role of Internet games in the association between anxiety and depression. It supports tha moderate engagement with Internet games can provide mood relief, but the relationship between gaming, anxiety, and depression is complex.

Objective 5: To determine if there is a significant linear relationship between GAD-4: "Trouble relaxing" score and the sum of SPIN10: "Talking to strangers scares me" score and SPIN-5: "Being criticized scares me"

This objective sought to investigate whether a significant linear relationship existed between the GAD-4 score for "Trouble relaxing" and the combined scores of SPIN-10 ("Talking to strangers scares me") and SPIN-5 ("Being criticized scares me"). A simple linear regression analysis was conducted to assess this relationship, and the Pearson correlation coefficient was computed as well.

Figure 5.1. Linear Regression: Scatter Plot of Linear Relationship between GAD-4 and Combined SPIN-5 & SPIN-10 Scores



In Figure 5.1, a scatterplot visually represents the linear relationship between the two variables. The plotted data points, along with the fitted regression line, were used to predict the Y value (combined SPIN-5 and SPIN-10 scores) using the GAD-4 score as the X value, assessing the strength and direction of the linear relationship. The best-fitting regression equation was determined as $\hat{y} = 0.6193+1.7194x$.

The regression test of significance was conducted to determine whether the linear relationship between GAD-4 scores and the combined SPIN-5 and SPIN-10 scores was statistically significant. The null hypothesis stated that the slope of the regression line was equal to zero, indicating no relationship between the variables, while the alternative hypothesis stated otherwise. The regression equation used was $\hat{y} = 0.6193+1.7194x$.

The *t*-test statistic, calculated as the ratio of the estimated coefficient to its standard error, was found to be 34.5424. The critical value for the test, at a 0.05 significance level, was 1.9601. Since the *t*-test statistic exceeded the critical value, the null hypothesis was rejected. This indicated that there was a statistically significant linear relationship between GAD-4 scores and the combined SPIN-5 and SPIN-10 scores. This result supports the conclusion that social fears, as measured by SPIN-5 and SPIN-10 scores, have a significant impact on the ability to relax, as measured by GAD-4 scores.

The Pearson correlation coefficient posed a direct linear relationship between GAD-4 scores and the combined SPIN-5 and SPIN-10 scores, with a weak to moderate correlation $r = 0.290$. This suggested that higher social fears (SPIN scores) were associated with higher trouble-relaxing scores (GAD-4). This also indicated that the GAD-4 score explained 8.26% of the variance in combined SPIN scores $r^2 = 0.0826$. The analysis highlighted a weak-moderate positive relationship between GAD-4 and combined SPIN-5 and SPIN-10 scores, indicating that as social fears increase, trouble relaxing also increases. This suggests that individuals with higher social anxiety tend to have more difficulty relaxing.

CONCLUSION

The study explored the connection between different gaming play styles and anxiety levels as well as the use of gaming for coping purposes. The results indicated that people's tendency towards multiplayer games was overwhelming with 93.98% of respondents being in favor of the same, which signifies a shift towards more interactive and community-oriented gaming platforms. It was also noted that those gamers who prefer playing multiplayers tend to spend significantly more time on video games than single players do, implying varied gaming patterns controlled by social factors. Equally important, reasons given for playing are closely linked to preferred play styles although "having fun" is common across all forms of video game play. Furthermore, the study found out that there were significant differences in anxiety levels among various types of motivations in particular "trouble relaxing", with relaxation gamers experiencing higher levels of anxiety compared to other groups. A moderate positive correlation between social fears (as measured by SPIN scores) and trouble relaxing (GAD-4 score) indicates that individuals with higher social anxiety tend to have greater difficulty relaxing. These findings provide support for addressing social anxiety to enhance enjoyment and relaxation during gameplay; thus demonstrating how interventions targeted at social fears might help gamers using games as a defense tactic against anxieties associated with life stressors.

REFERENCES

Agrawal, D. (2020). Online Gaming Anxiety Data. Retrieved July 28, 2024, from Kaggle website: https://www.kaggle.com/datasets/divyansh22/online-gaming-anxiety-data/data

Gioia, F., Colella, G. M., & Boursier, V. (2022). Evidence on Problematic Online Gaming and Social Anxiety over the Past Ten Years: a Systematic Literature Review. Current Addiction Reports. https://doi.org/10.1007/s40429-021-00406-3

Kim, E. J., Namkoong, K., Ku, T., & Kim, S. J. (2008). The relationship between online game addiction and aggression, self-control and narcissistic personality traits. European Psychiatry, 23(3), 212–218. https://doi.org/10.1016/j.eurpsy.2007.10.010

King, D. L., Herd, M. C. E., & Delfabbro, P. H. (2017). Tolerance in Internet gaming disorder: A need for increasing gaming time or something else? Journal of Behavioral Addictions, 6(4), 525–533. https://doi.org/10.1556/2006.6.2017.072

Kowal, M., Conroy, E., Ramsbottom, N., Smithies, T., Toth, A., & Campbell, M. (2020). Gaming your mental health: A narrative review on mitigating depression and anxiety symptoms via commercial video games (Preprint). JMIR Serious Games, 9(2). https://doi.org/10.2196/26575

Marino, C., Canale, N., Vieno, A., Caselli, G., Scacchi, L., & Spada, M. M. (2020). Social anxiety and Internet gaming disorder: The role of motives and metacognitions. Journal of Behavioral Addictions, 9(3). https://doi.org/10.1556/2006.2020.00044

Marques, L. M., Uchida, P. M., Aguiar, F. O., Kadri, G., Santos, R. I., & Barbosa, S. P. (2023). Escaping through virtual gaming—what is the association with emotional, social, and mental health? A systematic review. Frontiers in Psychiatry, 14. https://doi.org/10.3389/fpsyt.2023.1257685

Nawaz, M. W., Nadeem, T., Rao, S. L., Fatima, T., & Shoaib, S. (2020). Impact of PUBG Game Addiction on Social Isolation and Narcissistic Tendencies among Gamers. Asian Journal of Social Sciences and Management Studies, 7(3), 166–172. https://doi.org/10.20448/journal.500.2020.73.166.172

Przybylski, A. K., Weinstein, N., & Murayama, K. (2017). Internet Gaming Disorder: Investigating the Clinical Relevance of a New Phenomenon. American Journal of Psychiatry, 174(3), 230–236. https://doi.org/10.1176/appi.ajp.2016.16020224

Raskin, R., & Hall, C. S. (1981). The Narcissistic Personality Inventory: Alternative Form Reliability and Further Evidence of Construct Validity. Journal of Personality Assessment, 45(2), 159–162. https://doi.org/10.1207/s15327752jpa4502_10

Rogers, A. (2023, May 19). Tears of the Kingdom: "Zelda's escapism helps us through tough times." BBC. Retrieved from https://www.bbc.com/news/newsbeat-65624539

Sachan, T., Chhabra, D., & Abraham, B. (2023). Social Networking or Social Isolation? A Systematic Review on Socio-Relational Outcomes for Members of Online Gaming Communities. Games and Culture. https://doi.org/10.1177/15554120231201760

Singh, M. (2018). Compulsive Digital Gaming: An Emerging Mental Health Disorder in Children. The Indian Journal of Pediatrics, 86(2), 171–173. https://doi.org/10.1007/s12098-018-2785-y

Stavropoulos, V., Vassallo, J., Burleigh, T. L., Gomez, R., & Colder Carras, M. (2021). The role of internet gaming in the association between anxiety and depression: A preliminary cross‐sectional study. Asia-Pacific Psychiatry. https://doi.org/10.1111/appy.12474

Townsend, C., Humpston, C., Rogers, J., Goodyear, V., Lavis, A., & Michail, M. (2022). The effectiveness of gaming interventions for depression and anxiety in young people: systematic review and meta-analysis. BJPsych Open, 8(1). https://doi.org/10.1192/bjo.2021.1078

Zavaleta, D., Samuel, K., & Mills, C. T. (2016). Measures of Social Isolation. Social Indicators Research, 131(1), 367–391. https://doi.org/10.1007/s11205-016-1252-2