

# *Predictive Influence of Internet Gaming Addiction on Severities of Attention Deficit Hyperactivity Disorder Among Nigerian Adolescents*

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## Abstract

**Background:** The predictive influence of gaming addiction on attention deficit hyperactive disorder among adolescents was examined in this study.

**Materials and Methods:** A survey research design utilizing an ex-post facto design was used in a population sample of 338 adolescents purposively selected from a secondary school in Benin City, Edo state, Nigeria. The age range of the students was 10-19 years old, with mean  $\pm$  standard deviation of  $13.60 \pm 1.867$  years. The 14 year olds (18.6%) were the highest population. Most were females (55.9%), while 44.1% were males, giving a male to female ratio of 1:1.27. All 338 students were administered the Game Addiction Questionnaire and the self-report ADHD scale.

**Result:** The prevalence of Internet Gaming Addiction (IGA) was 51% while ADHD prevalence was 9%. There was a significant influence of gaming disorder on ADHD ( $R^2 = .122, p = .001$ ), which indicated that gaming disorder explains a 12.2% variance in manifestation of ADHD symptoms. There was also a significant and positive correlation between age and severity of ADHD [ $R_{xy} = 0.133; p = 0.01$ ], but there was no significant difference in the level of ADHD symptoms of the participants across sex, though females obtained higher mean scores than males.

**Conclusion:** There is a high prevalence of IGA and ADHD. Also, Internet Gaming Addiction is a significant predictor of the severities of ADHD among Nigerian adolescents. While sex does not significantly influence ADHD, age of the adolescents is significantly linked with its severities.

**Keywords –** Gaming Addiction, ADHD, Adolescents, Nigeria.

## I. INTRODUCTION

It is great for one to do things one enjoys. However, a hobby can be taken too far to a point of it becoming an addiction. The World Health Organization (WHO, 2006) added "gaming disorder" to the International Classification of Diseases (ICD), but the American Psychiatric Association's (APA) Manual, DSM-5, did not (APA, 2013). The DSM-5 however, does include a section to help people know the warning signs of problem video gaming. These

problems can happen whether played online or offline. Gaming disorder or internet gaming disorder is generally defined as the problematic, compulsive use of video games that results in significant impairment to an individual's ability to function in various life domains over a prolonged period of time. Such disorders can be diagnosed when an individual engages in gaming activities at the cost of fulfilling daily responsibilities or pursuing other interests without regard for the negative consequences.

Video game addiction is a broader concept than internet gaming addiction, but most video game addiction are associated with internet gaming. APA suggests, (Khan, 2006) the effects (or symptoms) of video game addiction may be similar to those of other proposed psychological addictions. Video game addiction may be an impulse control disorder, similar to compulsive gambling (Brown, 2004). Gaming disorder is defined as characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences (APA, 2013).

For gaming disorder to be diagnosed, the behaviour pattern must be of sufficient severity to result in significant impairment in personal, family, social, educational, occupational or other important areas of functioning and would normally have been evident for at least 12 months. The

Excessive use of video games may have some or all of the symptoms of drug addiction or other proposed psychological addictions. Some players become more concerned with their interactions in the game than in their broader lives. Players may play many hours per day, neglect personal hygiene, gain or lose significant weight, disrupt sleep patterns resulting in sleep deprivation, play at work, avoid phone calls from friends, or lie about how much time they spend playing video games.

The APA has developed nine criteria for characterizing the proposed Internet Gaming Disorder: these are pre-occupation, withdrawal, tolerance, reduce/stop, giving up other activities, continuing despite problems, Deceive/cover up, Escape adverse moods, and Risk/lose relationships/opportunities (Pontes & Griffiths, 2014). In May 2013, the DSM-5 included for the first time "Internet Gaming Disorder" (IGD) as a condition warranting further study before being fully recognized as a genuine mental health problem. Therefore according to the APA, IGD remains an unofficial and non-recognized potential health problem (Pontes & Griffiths, 2014; APA, 2013).

There is considerable disagreement among researchers about the concept of "game addiction." Although the term addiction is not used by clinical psychologists, game addiction is the most prevalent term among researchers to describe excessive, obsessive, compulsive, and generally problematic use of videogames (Charlton & Danforth, 2007; Chiu, Lee, & Huang, 2004; Chou & Ting, 2003; Griffiths & Davies, 2005; Grüsser, Thalemann, & Griffiths, 2007; Hauge

& Gentile, 2003; Ko, Yen, Chen, Chen, & Yen, 2005; Ng & Wiemer-Hastings, 2005; Wan & Chiou, 2006). Other terms used to describe excessive or problematic gaming include "videogame dependence" (Griffiths & Hunt, 1995, 1998), "problematic game playing" (Salguero & Moran, 2002; Seay & Kraut, 2007), and "pathological gaming" (Johansson & Gotestam, 2004; Keepers, 1990). Irrespective of the terminology used, researchers generally agree that computer and videogame overuse can lead to a behavioral addiction (Griffiths, 2005).

Addictive behavior refers to behavior that is excessive, compulsive, uncontrollable, and psychologically or physically destructive (Mendelson & Mello, 1986). In accordance with this behavioral definition, we define game addiction as excessive and compulsive use of computer or videogames that results in social and/or emotional problems; despite these problems, the gamer is unable to control this excessive use. However, Internet addiction critics disagree with the view of Internet addiction as a distinct disorder, emphasizing that the internet is not a substance but a medium of information exchange (Chakraborty, Basu, & Kumar, 2010). They generally emphasize that Internet addiction may have a link to internet user's psychiatric history, which entails attention deficit/hyperactivity disorder (ADHD), depression, impulse control disorders (ICDs), substance overuse, social loneliness and anxiety (Adiele & Olatokun, 2014).

Attention-Deficit/Hyperactivity Disorder (ADHD) is the current diagnostic label for children presenting with significant problems with attention, and typically with impulsiveness and excessive activity as well. Children with ADHD represent a rather heterogeneous population who display considerable variation in the degree of their symptoms, in the age of onset, in the cross-situational pervasiveness of those symptoms, and in the extent to which other disorders occur in association with ADHD. The disorder represents one of the most common reasons children are referred for behavioral problems to medical and mental health practitioners in the United States and is one of the most prevalent childhood psychiatric disorders (Barkley, 2006).

Its impact on society is enormous in terms of financial cost, stress to families, disruption in schools, and the potential for leading to criminality and substance abuse (Biederman et al., 1991). In recent years, evidence has been accumulating regarding high levels of comorbidity of attention deficit hyperactivity disorder with a number of disorders, including mood and anxiety disorders, conduct disorder as well as gaming disorder. ADHD seems to be a factor predicting loss of self-control associated with excessive internet game play,

which may disturb an individual's daily life (Park, Hong, Han, Min, Lee, Lee, & Kim, 2017). Problematic gaming may lead to several negative psychosocial consequences and mental health problems affecting available time, work, education, family, friends, social life, psychosocial well-being, social competence, leisure activities, self-esteem, and loneliness. Professional and academic problems may include poor grades, academic failure, and financial problems (Paulus, Ohmann, Gontard, & Popow, 2018).

There is a negative relationship between academic performance and pathological gaming, affecting self-esteem and self-confidence (Chou, et al., 2005). A minority of gamers reported that gaming resulted in an overall negative effect on quality of life. Furthermore, Andreassen, Billieux, Griffiths, Kuss, Demetrovics, Mazzolini, and Pallesen (2016) emphasized the relationship between psychiatric disorders such as anxiety and depression and gaming addiction.

In recent years, evidence has accumulated regarding high levels of comorbidity of ADHD with a number of disorders, including mood and anxiety disorders, conduct disorder as well as gaming disorder. ADHD seems to be a factor predicting loss of self-control associated with excessive internet game play, which may disturb an individual's daily life (Park et al., 2017). Gaming and its interaction with ADHD has not been adequately investigated in Nigeria. The possibility that children are getting addicted to gaming and its possible effect on the occurrence of childhood psychopathology, particularly attention deficit hyperactivity disorder has also not been well investigated.

The present state of insufficient information on the prevalence and determinants of gaming addiction in the Nigerian context form the major justification for this study. Adolescents may become preoccupied with internet gaming and can get addicted if left unchecked. To this end, our study can provide objective assessment to determine the extent to which internet gaming addiction can predict psychopathology especially ADHD. Oke, Oseni, Adejuyigbe and Mosaku, (2019) reported a rise in the cases of ADHD in Nigeria. Evidence has shown that research on childhood psychopathology can prevent psychopathology in adulthood. There is crevice of study in Nigeria that exam the relationship between gaming and ADHD. This study will help to bridge that gap and thus facilitate the understanding and development of preventive programmes for adolescents as well as also guide the formulation of appropriate evidence-based therapeutic interventions.

### ***1.1 Objectives of the Study***

1. To examine the predictive influence of internet gaming addiction on the level of ADHD symptoms among the adolescents.
2. To examine the influence of sex on ADHD symptoms among the adolescents.
3. To examine the relationship between age and ADHD symptoms among the adolescents.

### ***1.2 Research Questions***

1. What is the predictive influence of IGA on ADHD symptoms among the adolescents?
2. Is there a sex difference in the occurrence of ADHD symptoms among the adolescents?
3. Will age be a significant correlate of ADHD symptoms among the participants?

### ***1.3 Research Hypotheses***

1. Internet gaming addiction will significantly predict the severity of manifested attention deficit hyperactivity disorder among adolescents.
2. There will be a significant sex difference in the severity of manifested attention deficit hyperactivity disorder.
3. Age will significantly positively correlate with severity of attention deficit hyperactivity disorder.

## **II. MATERIALS AND METHODS**

### ***2.1 Participants***

This study was carried out among secondary school students between the ages of 10 and 19 years in Nosakhare Model Education Center, Oredo Local Government Area, Benin City, Edo State Nigeria. These students were selected using the purposive and convenient sampling technique. The questionnaire was administered to all the students present in school on the day of the survey.

The school has two arms for each class. The head teachers of each class were briefed on how to administer the questionnaire, after which they helped in administering the questionnaire to all students in their various classes. This was done during their 1-hour long break. It took about 20 minutes for the students to fill and return the questionnaire. A total of 338 students participated in the study.

### ***2.2 Sample size determination***

The sample size for this study was all secondary school students at Nosakhare Model Education Center.

### **2.3 Inclusion / Exclusion criteria**

All students from junior secondary school to senior secondary school present in school on the days of data collection, who agreed to participate in the study, were included. The total number of students in the school was 341. Students who were not in school premises on the day the study was conducted or refused to participate were excluded from the study.

### **2.4 Measures**

Two research instruments were used in this study. The Game Addiction Scale (GAS) (Lemmens, Valkenburg & Peter, 2011) a 21-item scale developed for adolescents was used to screen for internet game addiction. Each item of the GAS is preceded by a statement “during the last six months, how often...” and is scored on a 5-point likert scale ranging from 1= never to 5 = very often. Lemmens et al, (2011) suggested two scoring formats to assess the presence of game addiction: A monothetic format (all items scoring above 3) and a polythetic format (at least half of the items scoring 3 or above). The Polythetic format was used in this study. Previous psychometric properties reported high reliabilities with Cronbach’s alpha=0.82 to 0.87. a pilot study was carried out to validate the Game Addiction Scale (GAS) on Nigerian samples. In doing this the Game Addiction Scale was administered alongside the Gaming Disorder Test (GDT) which is a 4 item scale examining gaming activities over a 12 month period. All four items are rated on a 5-point Likert scale: 1= never to 5=very often. Answers given as 4 (often) or 5(very often) are regarded as endorsement of that criterion (Pontes, et al., 2019). Both instruments (GAS and GDT) were administered to 50 secondary school students from National Staff Secondary School, Oredo LGA in Benin City, Edo State Nigeria. Concurrent validity was fair and significant ( $r=0.459$ ,  $p =.000$ ), and reliability of the GAS was good (Cronbach’s alpha: 0.83).

The ADHD Self-Report Questionnaire (Nadeau & Quinn 2000), is a 35-item scale intended to be completed by the adolescent. According to the authors when a majority of items are checked, a professional evaluation for ADD (ADHD) may be advisable. Some psychometric properties of the ADHD scale from this study include a Cronbach’s alpha reliability coefficient = 0.89, Split half (Gottman) =0.84 and Item total correlation ranged from 0.36 to 0.56 ( $p = .000$ ).

### **2.5 Data Collection Technique**

Copies of the questionnaires were administered to each student in a class setting. Areas of ambiguity were addressed by teachers who had been briefed. Returned (338) questionnaires were coded into an electronic spreadsheet.

### **2.6 Data Analysis**

All data (socio-demographic and clinical characteristics) of the students were entered into SPSS version 25. Descriptive statistics was used to summarize socio-demographic variables; Comparison of continuous data was done using the Student t-test. Other inferential statistics were used as appropriate. A P-value of  $<0.05$  was regarded as statistically significant. Inferential statistics was used for testing hypotheses which included Pearson correlation analysis, t-test for independent samples, Linear regression. Regression was used to test hypothesis 1, t-test was used to test hypothesis 2, while Pearson Correlation was used for hypothesis 3. The predictor was gaming addiction (independent variable) while the dependent variable was ADHD symptoms. Linear regression was used to determine whether or not gaming addiction can predict levels of ADHD.

## **III. RESULTS**

### **3.1 Age and sex distribution of participants**

In total, 338 students participated in this study. The age range of the students was 10-19 years, with mean  $\pm$  standard deviation of  $13.60 \pm 1.867$  years. A minority (5.3%) of the students were 10 years old, while 0.3% was 19 years old. The 14 year olds (18.6%) were the highest population. Most were female (55.9%), while 44.1% were males, giving a male to female ratio of 1:1.27. The sex and age distribution are shown in Table 1

Table 1: Sex and age distribution of participants

| Variable   | Frequency (n=338) | Percentage |
|------------|-------------------|------------|
| <b>Sex</b> |                   |            |
| Male       | 149               | 44.1       |
| Female     | 189               | 55.9       |
| <b>Age</b> |                   |            |
| 10         | 18                | 5.3        |
| 11         | 31                | 9.2        |
| 12         | 52                | 15.4       |
| 13         | 58                | 17.2       |
| 14         | 63                | 18.6       |
| 15         | 59                | 17.5       |
| 16         | 40                | 11.8       |
| 17         | 15                | 4.4        |
| 18         | 1                 | 0.3        |
| 19         | 1                 | 0.3        |

### **3.2 Prevalence of gaming addiction among participants**

Table 2 and Fig. 1 summarize the reported prevalence of Gaming Addiction among the participants. they show that

gaming addiction was present in 174 (51%) of the adolescents.

Table 2: Prevalence of probable IGA among the participants

| Gaming addiction | Frequency (N =338) | Percentage |
|------------------|--------------------|------------|
| Present          | 174                | 51         |
| Not present      | 164                | 49         |

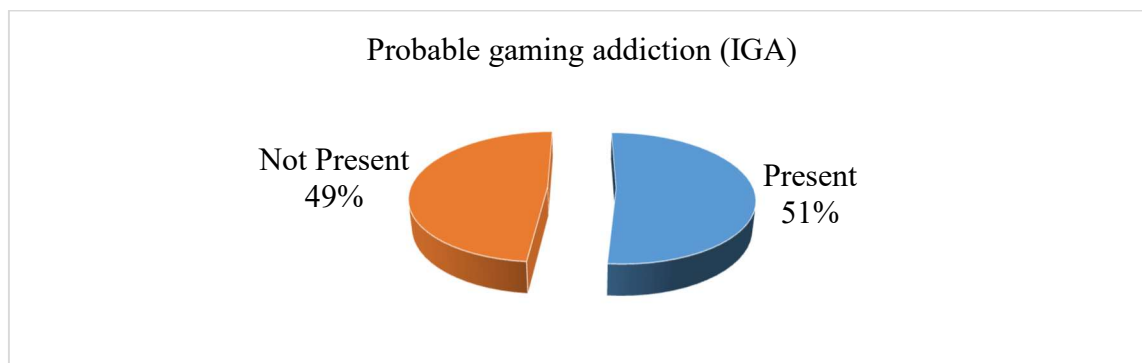


Figure 1: Prevalence of probable gaming addiction (IGA)

### 3.3 Prevalence of probable ADHD among the Participants

Table 3 and Fig. 2 summarize the reported prevalence of self-reported ADHD among the participants. The prevalence of probable ADHD among the students using the self-report ADHD scale was 29 (8.6%).

Table 3: Prevalence of probable ADHD among Nigerian adolescents.

| ADHD        | Frequency (n=338) | Percentage |
|-------------|-------------------|------------|
| Present     | 29                | 8.6        |
| Not present | 309               | 91.4       |

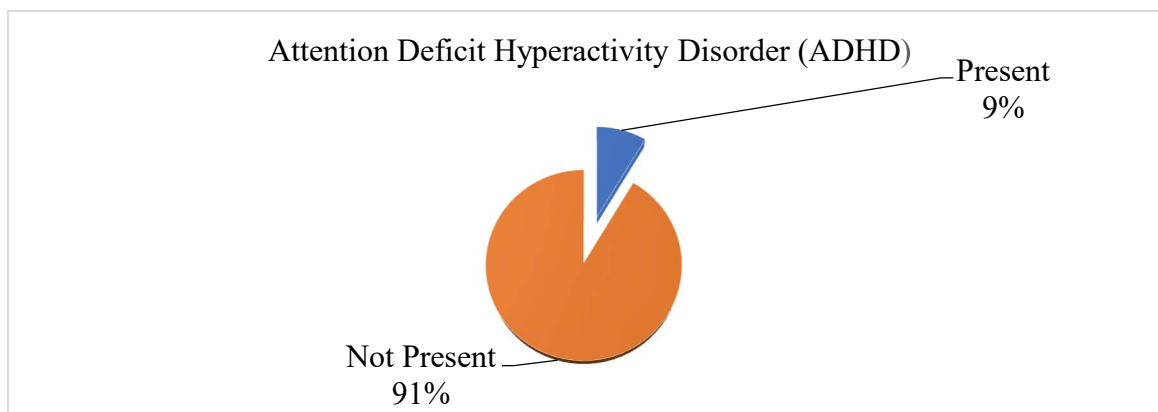


Figure 2: Prevalence of probable ADHD among Nigerian adolescents

### 3.4 Test of Hypotheses

**Hypothesis 1:** Internet gaming disorder will significantly predict the level of manifested attention deficit hyperactivity disorder among adolescents.

Linear regression analysis was carried out to determine the degree to which the Internet Gaming Addiction (IGA)

significantly predicted the severity of Attention Deficit Hyperactivity Disorder (ADHD) among the participants. The summary in Table 4 shows that IGA significantly predicted the severity of ADHD ( $R^2 = .122, p = .001$ ). This indicates that IGA explains a 12.2% variance in manifestation of ADHD among the adolescents.

Table 4: Regression model (Internet Gaming Addiction and ADHD)

| Model                     | R    | R <sup>2</sup> | Adjusted R <sup>2</sup> | SE of estimate | F     | p     |
|---------------------------|------|----------------|-------------------------|----------------|-------|-------|
| Internet Gaming Addiction | 0.35 | 0.122          | 0.120                   | 16.034         | 46.86 | 0.001 |

#### IV. DISCUSSIONS

**Hypothesis 2:** There will be a significant difference in the levels of ADHD symptoms across sex.

An independent sample t- test was carried out to determine the influence of sex on the ADHD among the participants. The t-Test scores showed that there were 149 male and 189 female participants. The observed mean ( $\pm$  SD) scores of male and female adolescents were  $32.21 \pm 16.21$ ; and  $34.26 \pm 17.73$ . The significant 2-tailed P value associated with this test was .000. There was no significant difference in the level of ADHD symptoms of the participants across sex, though females obtain higher mean scores than males. See Table 5.

Table 5: Comparison of ADHD across sex

| Variable | Sex             |                   | Statistic |     |      |
|----------|-----------------|-------------------|-----------|-----|------|
|          | Male: Mean (SD) | Female: Mean (SD) | t         | Df  | p    |
| ADHD     | 32.21 (16.21)   | 34.26 (17.73)     | -1.096    | 336 | 0.36 |

**Hypothesis 3.** Age will significantly positively correlate with level of attention deficit hyperactivity disorder.

Pearson's R was used to analyze the relationship between age and ADHD among the adolescents. As summarized in Table 6, there was a statistically significant and positive correlation between age and manifestation of ADHD among the adolescents [ $R_{xy} = 0.133$ ;  $p = 0.01$ ]. This implies that the higher the age the more the manifestation of ADHD among the adolescents.

Table 6: Correlation between ADHD and age of adolescents.

| Variable | ADHD                    |       |
|----------|-------------------------|-------|
| Age      | Pearson correlation (R) | 0.133 |
|          | p                       | 0.01  |
|          | n                       | 338   |

Gaming addiction predicted severities of manifested ADHD symptoms among the adolescents. There is no evidence that internet gaming can cause ADHD but adolescents who game more often are more likely to develop symptoms later in life. Ra, et al., (2018), reported that high-frequency use of multiple forms of modern digital media was associated with increased odds of ADHD symptoms occurrence over a 24-month period of mid adolescence. Our study found internet gaming addiction to be common (51.5%) among school going adolescents in Benin City, Nigeria, an indication that a large number of adolescents are experiencing problems as a result of internet use (Demirci, Akgönül & Akpinar, 2015; Elhai, Dvorak, Levine & Hall, 2016; Kim, Seo & David, 2015; Smetaniuk, 2014; Akpunne & Akinnawo, 2019).

ADHD symptoms were significantly present in nearly 2 out of 10 school going adolescents. The prevalence of 8.6% found in this study is greater than 8.0% and 7.6% reported among a similar population in Benin, Midwestern Nigeria by Ofovwle, Ofovwle and Meyer (2006), but greater than 4.7% reported by Oke, Oseni, Adejuyigbe and Mosaku (2019) at Ile-Ife, southwestern Nigeria, but is slightly less than 8.7% reported from Osun State Southwestern Nigeria by Adewuya and Famuyiwa (2007). This finding supports previous findings on the high prevalence of psychopathological symptoms among adolescents globally (WHO, 2008; Storrie, Ahern & Tuckett, 2010; Kessler, Avenevoli & Merikangas 2005; Akpunne & Akinnawo, 2019; Ramli, Adlina, Suthahar, Edariah, Ariff, Narimah, Nuraliza, Fauzi & Karuthan, 2017; Jha, Singh & Aggrawal, 2017; Kumar & Akoijam, 2018; Akpunne, Opadere, Babatunde, Ogunsemi & Ndubisi, 2020).

There was no sex difference in the severity of ADHD symptoms of the participants, though females obtain higher mean scores than males. This is can be accounted for by the higher number of female participants in the study. This finding is in support of previous literature (Graetz, Sawyer, & Baghurst 2005; Biederman, Kwon, Aleardi, et al 2005; Rucklidge, 2008; Ramtekkar, Reiersen, Todorov, & Todd, 2010) who reported that males and females with ADHD are more similar than different. Generally, symptoms of ADHD are reported as not being sex specific (Rucklidge, 2008).

Our research finding showed that age is positively linked with ADHD. According to ADHD Institute (2020), ADHD affects people of all ages with varying prevalence between children, adolescents and adults. As in other parts of the world, ADHD is as common in school age children in Nigeria. The prevalence obtained in this study is higher than the world wide prevalence of 5.0% reported by Polanczyk, Willcutt, Salum, Kieling, and Rohde, (2014). Our finding also showed that ADHD symptoms is higher among the 12 to 16 year old adolescents than in the lower (10/11 years) and higher (17-19 years) ages. There is scarcity of studies on the existence of ADHD among children of six years and below (ADHD Institute, 2020), however there a reported 2.2% prevalence of ADHD among those eighteen years old and less (Fayyad, Sampson, Hwang, et al 2017). This thus is in agreement with our finding showing that among adolescents the higher the age the more the manifestation of the symptoms of ADHD. In line with this, ADHD has been reported to persevere into adulthood with an estimated prevalence of between 50% to 65% (Faraone, Biederman & Mick, 2006; Ebejer, Medland, van der Werf, et al., 2012).

## **V. CONCLUSIONS AND RECOMMENDATIONS**

There is a high prevalence of internet gaming addiction and ADHD among the Nigerian secondary school adolescents. Also IGA as well age is significant predictors of the severities of ADHD. While gaming does not cause ADHD, they can exacerbate the symptoms. Adolescents with ADHD may be more susceptible to developing a gaming addiction as a coping mechanism to better deal with their disorder. Parents, however should discourage children from excessive time spent on gaming.

Teachers should teach appropriate use of devices/gadgets. The parents can be informed through the Parents Teachers Association on the dangerous effect of internet gaming, in order for them to set rules intended to reduce time spent on gaming by their children. Government may put policy in place to regulate the age at which gaming facilities can be used, and promote laws to curb the type of applications that can be installed in the devices. Government may assist in planning appropriate preventive programs for vulnerable children and adolescents.

Government, working together with parents and their children to address the issue of gaming addiction can lead to positive results, but creating programs on technology use and bringing them to classrooms and parents, working with families to set up realistic goals and teach children to see the possible problems associated with excessive gaming.

## **ACKNOWLEDGEMENT**

The procedures followed were in accordance with the ethical standards of Nosakhare Model Education Center. Approval for the study was obtained from the Principal of the school. Permission was also taken from the parents and teachers during a parents' teachers' association meeting. On the said day, all students were addressed at the assembly where confidentiality was assured and they all agreed to participate in the study.

## **DECLARATION**

Author(s) declare that no conflict of interest exists.

## **AUTHORS' CONTRIBUTION**

Author 1: Wrote the first draft of the manuscript and managed the literature searches for the study,

Author 2: Designed the study and wrote the protocol of the study,

Author 3: Managed the data analyses as well as the literature review of the study.

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