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EXAMINING THE ASSOCIATION BETWEEN SELF-CONTROL AND MOBILE GAME ADDICTION: THE ROLE OF SMARTPHONE ADDICTION

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Abstract

Smartphones are seen as the primary source of mobile gaming's popularity and mobile game addiction. This study investigates the link between lack of self-control and addiction to mobile gaming, with a specific emphasis on the role that smartphone addiction plays in mediating this connection. Data were collected from a convenience sample consisting of 276 students registered in Technical and Vocational Education and Training (TVET) programmes at one college. Of the participants, 58% were female, and 42% were male. The primary data were collected using a cross-sectional survey and analysed using structural equation modelling. The structural equation modelling and mediation analysis revealed that addiction to mobile games and smartphone use is highly linked to a lack of self-control. The results also indicated that smartphone addiction partially explains the pervasiveness of gaming addiction among TVET students. The research emphasised how critical it is for students to have the capacity to exercise self-control, particularly in light of the fact that modern conveniences such as smartphones are essentially an extension of one's own hands. The study recommends that higher education institutions provide support to students who are caught up in excessive time spent on smartphones. It also recommends introducing control measures so as to foster a sense of awareness and self-regulation among students, therefore encouraging them to make well-informed choices regarding the allocation of their screen time.

Keywords: self-control, well-being, game addiction, smartphone addiction, students

1 INTRODUCTION

Mobile gaming is a ubiquitous form of entertainment that transcends cultural, age, and gender boundaries (Ciris, Baskonus, Kartal & Tasdemir, 2022). Some people turn to gaming to regulate their emotions and reduce negative feelings (Zhu, Zhuang, Lee, Li, & Wong, 2021). It offers entertainment at our fingertips. However, despite its benefits, gaming can also have been reported to have negative effects on individuals who engage in it excessively. It should not come as a surprise, then, that engaging in an excessive amount of gaming can have a substantial effect on an individual's well-being (Rasheed, Ahsan & Zaheer, 2021). Research has shown that prolonged gaming can lead to a range of negative consequences, from decreased social interaction to disrupted sleep patterns (André, Broman, Håkansson & Claesdotter-Knutsson, 2020). In fact, some studies have even suggested that gaming can be addictive, with individuals experiencing withdrawal symptoms and a loss of control over their gaming habits. This has a profound impact on well-being.

Researchers have documented the potential risks of excessive gaming to an individual's well-being. Symptoms such as anxiety, depression, social phobia, and low self-esteem have all been reported as potential consequences of prolonged gaming (André, Broman, Håkansson, & Claesdotter-Knutsson, 2020; Rasheed, Ahsan & Zaheer, 2021). In other instances, mobile gaming has been associated with some of the most severe cases of addiction in gaming

history (King & Delfabbro, 2020). It appears that excessive mobile gaming is the worst addiction of all time. Mobile gaming, specifically, refers to gaming on mobile devices such as smartphones and tablets (Jeong & Kim, 2011), highlighting that most people prefer playing games on phones.

One of the biggest culprits amplifying the negative effects of mobile gaming is the smartphone. Most students who play games on their smartphones were found to have lower GPAs, poor sleep quantity, decreased life satisfaction, and the manifestation of anxiety, loneliness, and depression thereby impacting their general well-being (Hartanto, Lua, Quek, Yong & Ng, 2021). This suggests that this situation may be completely detrimental, frequently inducing an emotional roller coaster in players, resulting in a feeling of disconnection and irritability. All of these outcomes contribute to an overall decline in well-being, leaving students struggling to balance the demands of digital lives with the needs of emotional health.

Despite the growing awareness of the potential risks of mobile gaming, there is currently a scarcity of information that may allow researchers to obtain a thorough knowledge of the detrimental health effects of mobile gaming among students in developing countries. The research mentioned has largely been confined to developed countries. This lack of evidence from individuals in other parts of the world leaves a gap in the understanding of the impact of mobile gaming on these individuals, leaving them vulnerable to the potential negative consequences of excessive play. According to Tangmunkongvorakul et al. (2020), it is important to understand the underlying reasons for addiction and the factors that contribute to it. Although scholars report an increase in mobile gaming, in South Africa, research into mobile game addiction is still in its infancy. Therefore, this study intends to find out the connection between self-control and addiction to mobile games, with a particular focus on how smartphone addiction mediates this relationship. Despite an increase in mobile gaming in South Africa, research into mobile game addiction is still limited, and the literature lacks clarity about the importance of self-control in this specific situation.

2 LITERATURE REVIEW

The prevalence of mobile gaming addiction has been studied in various countries and settings. The relevant literature is summarised below. Figure 1 serves as a conceptual framework that will assist in the formulation of the hypotheses in the present study.

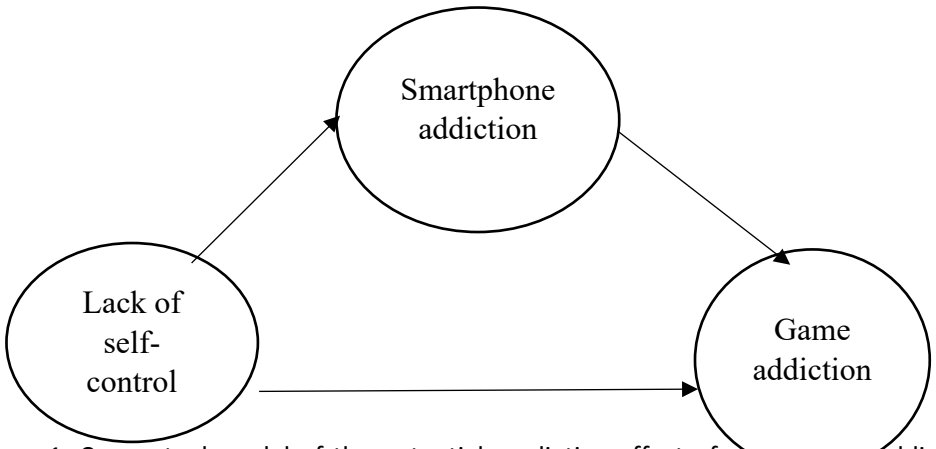

Figure 1. Conceptual model of the potential mediating effect of smartphone addiction on the relationship between a lack of self-control and gaming addiction.

2.1 Self-control literature

Self-control appears to be an important personality trait that influences a person's capacity to control smartphone use. In this regard, the continual monitoring of the phone, even when it is unneeded, worry, or restlessness when the phone is not available are some of the few indications of a lack of self-control mentioned in the literature. It has been known to contribute to excessive use of smartphones and is just as fundamental in promoting psychological and physiological situations such as withdrawal symptoms characterised by irritability, restlessness, performance or depression. In fact, it is believed that these factors contribute to smartphone addiction (Lu et al., 2021; Diotaiuti, Girelli, Mancone, Corrado, Valente, Cavicchiolo, 2022; Wang, Su & Li, 2022; Yang, Wang, Lee, Lin, Hsieh & Lin, 2022; Zhang et al., 2022). Self-control refers to a psychological process that empowers individuals to exert control over their impulses and emotions, facilitating their capacity to adjust their behaviour regularly. Setting boundaries and limits are examples of self-control. A person with self-control capacity

is capable of delaying activities that he or she considers pleasurable or enjoyable to focus on what needs to be accomplished. Self-control is anything but easy. It requires a conscious effort to choose behaviours or habits that bring positive results and do not have a detrimental effect on oneself (Afriwilda & Wibowo, 2020). The fact that people with self-control can regulate their behaviour and are not addicted should not surprise anyone (Ma, Huang & Ma, 2020; Pechorro et al., 2021; Wang, Su, & Li, 2021).

Contrary to what one might initially think, a person without self-control and excessively spending time on their smartphones may be susceptible to addiction (King, Delfabbro, Billieux & Potenza, 2020; Király et al., 2020). This behaviour is widely viewed as the primary cause of addiction to mobile gaming (Zhou & Xing, 2021). Several studies, such as Kwak, Cho & Kim (2022), have emphasised how important self-control is in effectively preventing addiction to smartphones. They studied 433 smartphone users, aged between 20 and 49. They concluded that a lack of self-control has a significant direct impact, as well as an overall influence, on addiction to smartphones. In line with Kwak et al., Li et al. (2021) conducted a study with 1078 college students, of which 772 (72%) were male and 306 (28%) were female and discovered an inverse relationship between self-control and smartphone addiction. The research that Kim and Lee (2022) carried out is extremely important for gaining an understanding of the relationship that exists between addiction to smartphones and self-control in young people, particularly students. Although it may be difficult to comprehend, the phenomenon of smartphone addiction could potentially be explained by a lack of self-control. Based on the research on smartphone addiction, the following hypothesis was developed:

H1: Individuals who lack self-control are more likely to develop an addiction to smartphones.

Self-control is also linked to game addiction. Self-control is a psychological trait that is frequently associated with online gaming addiction. Personal traits, such as self-control, can cause individuals to develop addictive behaviours linked to excessive gaming use. Research conducted by Fanny and Usman (2020) and Hasriandry and Wahyuni (2021) suggests that individuals who have difficulty controlling their emotions, which can lead to a lack of self-control, may be susceptible to developing an addiction to online gaming. Therefore, the following hypothesis can be formulated:

H2: Individuals who lack self-control have a high risk of developing game addiction.

2.2 Game addiction literature

Game addiction refers to the "excessive and compulsive use of computers and video games that results in social and/or emotional problems" (Lemmens et al., 2009). Safarina and Halimah (2019) suggested that many people play games to relieve fatigue and forget about real-world problems. This is the driving force behind gaming addiction, as individuals may neglect other activities in favour of gaming. Similarly, Afriwilda and Wibowo (2020) argue that playing games can prevent people from engaging in other activities, including studying. Unsurprisingly, Afriwilda and Wibowo added that people who play games excessively, obsessively, or compulsively are addicted to them. Research further notes that people who spend too much time gaming are more likely to use their devices to access these platforms. Lee, Ko, and Chou (2014) conducted a study that found a positive correlation between those who develop a reliance on mobile gaming and the subsequent development of mobile phone addiction. Accordingly, the following hypothesis is proposed:

H3: Individuals who access smartphones excessively are likely to be addicted to mobile games.

The remainder of the paper presents the research method, results, discussion, conclusion, and limitations of the study.

3 RESEARCH METHOD

Data was collected through the utilisation of a survey to investigate the connection between challenges about lack of self-control and the development of gaming addiction among students in South Africa.

3.1 Participants

The study sample comprised a total of 288 students registered at a Technical and Vocational Education and Training (TVET) college. However, a total of 12 individuals who did not submit complete replies were removed. Ultimately, the study concluded with a sample of 276 participants, yielding a response rate of 96%. The characteristics of the sample are presented in section 4.1.

3.2 Measures

For data collection, a paper-based, self-administered questionnaire was used. The questionnaire contained sections that asked for information about demographics, such as age, gender, and level of study. Concerning variables, several instruments were employed to measure them. Smetaniuk's (2014) self-report scale was employed to assess smartphone addiction. Sample items were as follows: "I feel restless or irritable when attempting to cut down on smartphone use" and "I am always preoccupied with my mobile phone." The respondents were asked to rate their responses on a 5-point scale (1 = strongly disagree and 5 = strongly agree). Lack of self-control included items adapted from Tangney et al. (2004). Participants rated themselves on a 5-point scale (1 = strongly disagree, 5 = strongly agree). Items included "I am unable to control myself with the way I am using the internet and social media platforms all the time" and "I always find myself opening other applications all the time, isolate myself from others." The game addiction scale consists of the following sample items: "I am so addicted to play games on my mobile phone because it is fun" and "I love playing games on my mobile phone even though I know it can affect my health, studies and social relations". Participants were asked to rate themselves on a 5-point scale (1 = strongly disagree and 5 = strongly agree). The game addiction scale was adapted from Lemmens et al. (2009).

3.4 Statistical analysis

The statistical analyses were conducted using SPSS 28 and SmartPLS version 4. Age, gender, and level of education were among the demographic characteristics that formed the results of the descriptive statistics. Cronbach's alpha coefficients were also computed as part of an internal consistency and reliability assessment. A partial least squares (PLS) technique was applied using SmartPLS 4 software to test the study's research hypotheses. An assessment of a measuring model was carried out after adopting the two-step analytical method that was suggested by Anderson and Gerbing (1988). For the measurement model, the validity of the measures and their reliability were assessed. The study concluded by testing the hypotheses. The researchers employed a bootstrapping method, specifically utilising 5000 resamples, to investigate the significance of the path coefficient and factor loadings (Hair, Hult, Ringle, Sarstedt & Thiele, 2017).

4 RESULTS

4.1 Respondent profile

The participants were of varying ages and were selected from different levels of study at TVET College. Regarding gender, 58% were female, and 42% were male. In terms of age, the majority (27.5%) were 21 years old, followed by 20 years old (15.6%). A total of 13% of the individuals who responded to the questionnaire were 22 years old, while 13% were 23 years old. The remaining percentage of the sample was spread among 19-year-olds (10.1%), 24-year-olds (6.5%), and 18-year-olds (3.6%). Regarding the academic year of study, the majority (59.4%) of students were classified as first-year students. Furthermore, it is worth noting that 18.5% of the student population was enrolled in their second academic year, while 14.1% were enrolled in the third year, 6.2% in the fourth year, 1.4% in the fifth year, and 4% were categorised as sixth-year students or beyond.

4.2 Assessment of a measurement model

Both the reliability and validity of the measurement methodology were evaluated.

4.2.1 Reliability testing

Considering the instrument in the present investigation was developed from earlier research, it was deemed necessary to assess its internal consistency and reliability to establish if the items are appropriate and reliable. The evaluation for reliability included evaluations of Cronbach's alpha and composite reliability. Table 1 displays the results of reliability analysis.

Table 1: Reliability and validity testing

	Cronbach's alpha	Composite reliability
Lack of self-control	0,818	0,88
Smartphone addiction	0,705	0,833
Game addiction	0,923	0,936

The reliability measure exceeded 0.70. Malhotra (2010) maintained that these values were acceptable. The composite reliability (CR) obtained for the various constructs returned values between 0.88 and 0.936, indicating that each construct within the model demonstrated reliability. The Cronbach's alpha values also exceeded the

conventional benchmark of 0.70, indicating high internal consistency. For example, scores of 0.923, 0.818, and 0.705 were obtained for game addiction, lack of self-control, and smartphone addiction, respectively.

4.2.2 Validity testing

The assessment of the measuring instrument's convergent validity and discriminant validity was conducted.

4.2.2.1 Convergent validity

An analysis of convergent validity was conducted utilising factor loadings and AVE. When the factor-loading method is used, factor loadings are expected to exceed 0.70 (Hair, Howard & Nitzl, 2020). Some of the item loadings for game addiction were below the recommended 0.70 value (game addiction 10 with a loading of 0.469 and game addiction 9 with a loading of 0.690). These items were removed to ensure convergent validity. As shown in Figure 1, after their removal, all factors exceeded this value, thereby confirming convergent validity.

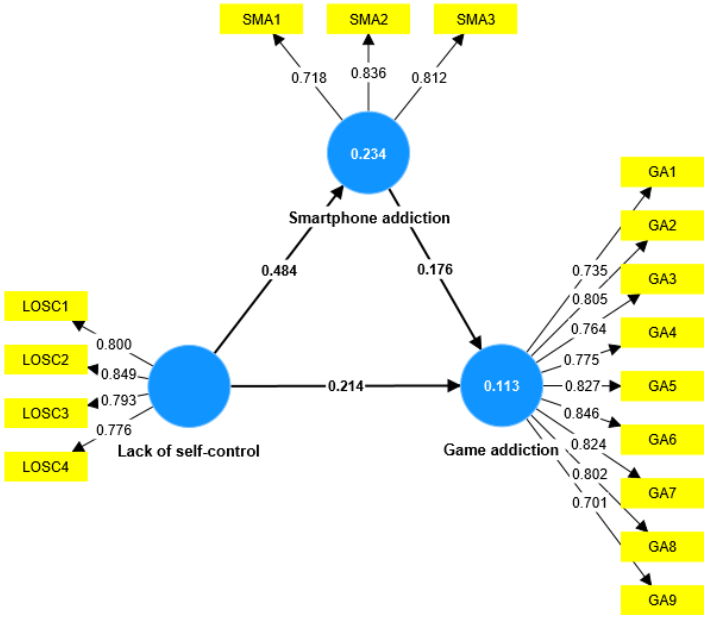

Figure 1: Measurement model

Table 2: Average variance extracted

	Average variance extracted
Game addiction	0,62
Lack of self-control	0,648
Smartphone addiction	0,625

Overall, based on the analysis results, the selected items were adequate for measuring their respective constructs. As such, convergence was achieved.

4.2.2.2 Discriminant validity

This study also assessed how well the constructs differed. Therefore, it is imperative to assess discriminant validity. A model's discriminant validity may be tested using a variety of methodologies, among them Fornell-Larcker and heterotrait-monotrait ratios (HTMT). HTMT determines the ratio of the variance explained by a construct to the average variance explained by the measures of that construct (Henseler, Ringle, & Sarstedt, 2015). A ratio greater than 0.7 indicates discriminant validity (Sarstedt, Ringle & Hair, 2021). Fornell and Larcker's (1981) method, discriminant validity is established when the AVE exceeds the correlations between constructs (Hair Jr, Howard & Nitzl, 2020).

Table 3: Results of discriminant validity analysis

	Game addiction	Lack of self-control	Smartphone addiction
Game addiction	0,788		
Lack of self-control	0,299	0,805	
Smartphone addiction	0,279	0,484	0,791

The fact that the square root of the AVEs is higher than the intercorrelations, as shown in the table, demonstrates that discriminant validity is present in the research. Hair et al. (2017) recommended that to evaluate the validity of the formative constructs, it is important to consider the relevance of the outer weights and the presence of collinearity among the indicators. Given this background, the variance inflation factor (VIF) was employed. Hair, et al. (2011) propose values less than 5, while values greater than 5 show collinearity issues. According to Hair et al. (2020), the presence of multicollinearity is improbable when the VIF is equal to or below 3.0. The results of a collinearity study are presented in Table 4.

Table 4: Testing for collinearity

	variance inflation factor (VIF)
Game addiction	1.155
Lack of self-control	1.306
Smartphone addiction	1.306

According to the findings shown in Table 4, it can be observed that all VIF values were below the threshold of five. This suggests that there were no significant issues regarding collinearity among the variables.

4.3 Assessment of the structural model

The hypotheses put forward in this study were examined using a structural model. After evaluating the possibility of collinearity, the subsequent stage involves examining the statistical significance and assessing the model's ability to explain and predict results (Hair, Hult, Ringle, Sarstedt & Thiele, 2017). During this step, the evaluation of the path coefficients is conducted to determine the strength and relevance of the hypothesised links between each factor. Path coefficients, t values, and significance levels were all evaluated using bootstrapping approaches. In accordance with prior studies (Hair et al., 2011; Hair et al., 2017), 5,000 subsamples were utilised. The statistical significance of the paths for the hypothesised relationships was determined using 5,000 resamples.

4.4 Hypothesis testing

Upon evaluating the reliability and validity of the construct measurements, the results of the structural model can be assessed. The following table shows the tested path coefficients and their corresponding significance levels.

Table 5: Results of hypothesis testing

	Path coefficient	T-statistics	P values
Game addiction -> Smartphone addiction	0,176	2,415	0,016
Lack of self-control -> Game addiction	0,299	4,788	0,000
Lack of self-control -> Smartphone addiction	0,484	9,445	0,000

Based on the analysis, the coefficient for the relationship between gaming addiction and smartphone addiction among TVET students is 0.176, with a statistically significant p-value of 0.016. The positive path coefficient observed in the analysis lends support to the notion that a correlation exists between smartphone addiction and the development of gaming addiction. As gaming addiction advances, so does smartphone addiction. A t-statistic of 2.415 with a p-value of 0.016 suggests a statistically significant link. As a result, excessive smartphone usage may lead to a rise in gaming addictive behaviours.

The positive path coefficient (0.301) between lack of self-control and gaming addiction suggests a direct association. This finding shows that as the lack of self-control grows, so does the risk of developing a gaming addiction. The significant t-statistics (4.788) indicate the statistical significance of this link with a p-value of less than 0.05. The positive path coefficient of 0.4788 indicates that there is likely to be a direct connection between a lack of self-control and an addiction to using smartphones.

The high t-statistic (9.445) and significant p-value (0.000) between lack of self-control and smartphone addiction indicate a statistically significant relationship between these constructs. This could imply that as the level of lack of self-control increases, the likelihood of smartphone addiction also tends to increase. The mediation analysis revealed that lack of self-control also had a significant indirect effect on game addiction, as mediated

through smartphone addiction (β0.085; $p < 0.05$). The indirect path between lack of self-control to game addiction through the mediating variable of smartphone addiction resulted in partial mediation as the variables were non-zero and were significant.

The examination of the coefficient of determination (R^2) is another crucial factor in evaluating the structural model. The range of R^2 values varies from 0 to 1, where a greater number signifies a greater level of explanatory capability (Hair et al., 2019). This study obtained an R^2 value of 0.347, meaning that the research model explained 34.7% of the variance in mobile game addiction. The effect size is the second measure of the structural model's capacity for accurately predicting the independent construct in the model's predictive power (Hair et al., 2020). The effect size, known as f^2, is divided into three categories: small, medium, and large. According to Cohen (1988), minor effects are those with values greater than 0.02 and ranging up to 0.15, while medium effects have values between 0.15 and 0.35 and large effects have values greater than 0.35. The link between a lack of self-control and addiction to smartphones was shown to have a significant path coefficient, as indicated by the large effect size (0.306). The relationships between lack of self-control and game addiction and the relationship between smartphone addiction and game addiction had weak effect sizes of 0.040 and 0.027, respectively.

The Q^2 score, often known as blindfolding, is a third measure used to test prediction (Geisser, 1974). When analysing Q^2, it is seen that values greater than zero have relevance, whereas values less than zero indicate a lack of predictive significance. According to Hair et al. (2020), a Q^2 value greater than zero signifies that the model has achieved predictive power for the variable. According to Hair et al. (2020), Q^2 values exceeding 0.25 and 0.50 suggest that the Partial Least Squares Structural Equation Modelling (PLS-SEM) method holds moderate to substantial predictive significance. To ascertain the predictive value (Q^2) of the structural models, the cross-validated redundancy was assessed using a blindfold technique with a predetermined omission distance of 8. The Q^2 results for gaming addiction (0.077) and smartphone addiction (0.225) suggest that the proposed model has strong predictive ability. All three indicators achieve Q^2 predictions greater than zero.

Table 6: Summary of research findings

	Decision
Game addiction -> Smartphone addiction	Supported
Lack of self-control -> Game addiction	Supported
Lack of self-control -> Smartphone addiction	Supported

The findings presented in the table appear to support the hypotheses of the investigation conducted for this study.

5 DISCUSSIONS

This study provides empirical evidence supporting the concerns mentioned in previous research. Overall, the results suggest that a lack of self-control is the best predictor of gaming and smartphone addiction. The observed correlation between a lack of self-control and the occurrence of gaming addiction implies that people with limited self-control are more prone to developing an addiction to gaming. They would most likely engage in games and struggle to manage their emotions (Kwak et al., 2022). They appear to be prone to addictive habits. Sumiyana, Pratiwi, Hadi and Utami (2022) revealed a link between a lack of self-control and game addiction. This may be partly due to the observation that individuals who become addicted to mobile games are more likely to display addictive behaviours and a lack of self-control. Thus, these findings suggest that people who lack self-control are more vulnerable to problematic digital technology use (Burnell, Andrade & Hoyle, 2023). This calls for the involvement of higher education institutions in providing support to students who are caught up in prolonged gaming sessions and excessive reliance on smartphones. By implementing control measures in this setting, institutions of higher learning can foster a sense of awareness and self-regulation among students, therefore encouraging them to make well-informed choices regarding the allocation of their screen time. Considering the prevalence of games across cultures, these findings add valuable knowledge that may be used to regulate the time spent on games.

Hypotheses about the relationship between gaming addiction and smartphone addiction have produced a direct relationship. This is consistent with previous studies. According to Liu et al. (2016), individuals who were exposed to game playing had a greater prevalence of smartphone addiction (32.4%) than those who were not (13.2%). In particular, researchers indicate that the following statements play an important role in game addiction: "I love playing games on my mobile phone even though I know it can affect my health, studies, and social relations"; "I delay sleeping hours when I play a game"; "I delay eating in order to finish the game I am playing" and "I am so addicted to play games on my mobile phone because it is fun". This effectively suggests that gaming

produces dangerous addictive behaviours, such as deteriorating one's health (Park & Tan, 2020). Essentially, being obsessive about smartphone gaming can be detrimental in class and to one's health (Huey & Giguere, 2023) because these nifty devices are like an extension of one's hands. Hence, the concept of self-control becomes important. The present study, along with other studies, has demonstrated that individuals with insufficient self-control exhibit a susceptibility to addiction. This study emphasises the significance of self-control in the context of gaming and smartphone usage.

6 LIMITATIONS AND FUTURE RESEARCH

The limitations of this research necessitate further investigation. First, the self-reported data used in this study were gathered from a single TVET college in a particular province of South Africa. In addition, the decision to focus solely on Technical and Vocational Education and Training (TVET) institutes located in the Gauteng Province of South Africa raises issues over the relevance of the results to different educational settings. To get a more thorough representation of the population, future research endeavours should encompass many Technical and Vocational Education and Training (TVET) colleges situated in diverse locations across South Africa. Second, a myriad of variables has been identified in past research. This study did not consider other variables that influence game addiction, thus potentially skewing the results. Further investigation is required in future studies to explore a wider array of factors to gain a more comprehensive understanding of the impact of self-control problems in TVET institutions on the development of smartphone-based gaming addiction. Despite these drawbacks, this research contributes to the literature in both theoretical and practical ways. This study contributes to the existing body of knowledge on game addiction by theoretically establishing a connection between smartphone addiction and self-control. In addition, the study investigated whether or not an addiction to smartphones may mediate an addiction to mobile games. The results obtained in this study provide support for the mediation hypothesis. Moreover, the findings of this study can provide valuable insights for TVET leaders and other higher education leaders on the factors that contribute to gaming addiction and strategies for its prevention.

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