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Digital Game Addiction and Empathy Levels in Primary School Children: A Cross-Sectional Study Using Mediation and Hierarchical Regression Analysis

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Abstract

Introduction:

Digital game addiction has emerged as a growing public health concern due to its potential implications for children's psychosocial development. Empathy, a key component of socio-emotional functioning, may be associated with patterns of digital gaming; however, the nature of this relationship remains complex and may involve multiple interacting factors. This study aimed to examine the association between digital game addiction and empathy levels among primary school children and to investigate the potential mediating role of digital game addiction in the relationship between gender and empathy.

Methods

A cross-sectional study was conducted between April 15 and May 24, 2024, among 400 fourth-grade students in Mardin, Türkiye. A two-stage sampling approach was used, involving purposive selection of schools followed by random sampling of students within schools. Data were collected using a descriptive characteristics form, the Digital Game Addiction Scale for Children, and the Empathy Scale for Children and Adolescents. Analyses included non-parametric tests, Spearman correlation, hierarchical multiple regression, and mediation analysis with 5,000 bootstrap resamples.

Results

The mean digital game addiction score was 10.58 ± 4.61 (range: 6–30), indicating scores toward the lower end of the scale, while the mean empathy score was 14.41 ± 3.44 (range: 0–21), indicating relatively higher levels within the scale range. A moderate, negative, and statistically significant correlation was found between digital game addiction and empathy ($r = -0.328$, $p < 0.001$). In regression analysis, digital game addiction emerged as the strongest predictor of empathy ($\beta = -0.314$, $p < 0.001$), explaining additional variance beyond sociodemographic factors ($\Delta R^2 = 0.092$). Gender was also a significant predictor, with males showing higher addiction scores and lower empathy. Mediation analysis indicated that digital game addiction partially mediated the association between gender and empathy, accounting for 27.6% of the total effect.

Conclusion

Digital game addiction was significantly associated with lower empathy levels among children; however, given the cross-sectional design, these findings should be interpreted as associative rather than causal. The results suggest that digital gaming behaviours may represent one pathway linked to socio-emotional functioning, while also highlighting the potential influence of gender. Early identification of problematic

gaming patterns may support interventions aimed at promoting healthy emotional development in children.

1. Introduction

Globally, digital gaming addiction among children and adolescents is a growing concern due to the increasing rate of users and its negative impacts, including on personal health and social life [1]. Digital game addiction, a type of behavioural addiction, is defined as the irregular or obsessive use of computer games. It causes unhealthy daily life behaviours such as loss of self-control, psychological distress when not playing, loneliness, aggression and depression [2, 3]. The increasing prevalence of digital game addiction among children has raised significant concerns regarding its potential implications for their mental health and social development. Digital game addiction, often characterized by compulsive gaming behaviour, can impact various dimensions of psychological well-being, including empathy, aggression, and interpersonal relationships [4–6]. As children engage more with digital platforms, the distinction between healthy gaming habits and addictive behaviours becomes critical, prompting a deeper examination of the underlying psychological variables that mediate these relationships.

Disordered use of games and social media negatively impacts adolescents' life satisfaction and social competence, while heavy use positively affects social competence but decreases school performance [7]. Gaming disorder significantly impacts adolescent emotional intelligence, particularly affecting self-regulation, self-awareness, self-empathy, self-motivation, and social skills [8]. In addition, certain personality traits, can predispose individuals to excessive gaming, thereby highlighting the psychological vulnerabilities that may exacerbate addiction [9]. Moreover, a correlation between increased aggressive tendencies and high levels of game addiction, which underlines the necessity of exploring these behaviours in the context of children's developing empathy levels [10]. The question of how these variables interact is particularly pertinent in understanding the psychosocial environment influencing children's responses to digital gaming.

Empathy, a crucial component of emotional intelligence, is significantly affected by the nature of children's interactions within gaming environments. Digital games often lack real-world emotional cues that facilitate empathetic engagement, potentially lowering levels of empathy among habitual gamers. As social dynamics shift increasingly toward virtual engagements, the ramifications of gaming addiction extend beyond mere behavioural manifestations, encompassing broader implications for empathy and social adaptation. The existing literature illustrates that excessive engagement with social media may negatively impact both social interaction and empathy, with other variables potentially contributing to decreased social connectedness and sensitivity [11].

While a substantial body of research has documented the potential negative psychosocial consequences of excessive gaming, it is important to note that the literature is not uniformly consistent. A growing number of studies have highlighted potential benefits of digital gaming, including improvements in problem-solving abilities, attention, and cognitive flexibility [12]. In addition, certain

types of games, particularly those involving cooperation or prosocial narratives, have been associated with enhanced prosocial behaviour and social connectedness [13]. Appropriate and measured use of digital technology may support functioning in a connected global context [14]. These results suggest that digital gaming is not inherently harmful; rather, its impact depends on multiple factors, including game content, duration of use, context of play, and individual differences. Accordingly, recent theoretical frameworks emphasize the importance of distinguishing between adaptive gaming behaviours and problematic or addictive patterns of use. In this context, the present study focuses specifically on digital game addiction, which represents a maladaptive form of engagement characterized by loss of control and functional impairment. This distinction is critical for avoiding overgeneralization and for situating the study within a more balanced and nuanced understanding of digital gaming.

The General Aggression Model (GAM) is one of the most widely accepted frameworks for understanding the effects of media exposure on social and emotional outcomes. According to GAM, repeated exposure to media stimuli influences individuals' internal states, cognition, affect, and arousal, which in turn shape behavioural responses over time [15, 16]. Importantly, GAM posits that repeated exposure to emotionally attenuated or stimulus-driven environments, such as certain digital games, may lead to desensitization to emotional cues, reduced empathic responsiveness, and alterations in social information processing. Within this framework, frequent engagement in digital gaming, particularly when it displaces real-world social interactions, may limit opportunities to practice perspective-taking and emotional attunement, thereby contributing to lower levels of empathy.

Complementing this perspective, the Interaction of Person-Affect-Cognition-Execution (I-PACE) model provides a comprehensive framework for understanding the development and maintenance of behavioural addictions, including digital game addiction [17, 18]. The model proposes that addictive behaviours emerge through interactions between predisposing factors (e.g., gender, personality), affective and cognitive responses, and executive functioning processes, reinforced over time through rewarding experiences. Within this model, individual characteristics such as gender may influence susceptibility to gaming addiction, while excessive engagement in gaming may subsequently impact psychosocial outcomes. Thus, digital game addiction can be conceptualized as a proximal behavioural mechanism through which distal factors influence emotional and social functioning.

Despite the growing body of literature documenting the negative effects of digital game addiction on children's social-emotional development, few studies have comprehensively examined the specific relationship between digital game addiction and empathy levels using advanced statistical methods to identify mediating pathways. Understanding the mechanisms through which game addiction affects empathy has important implications for developing targeted prevention and intervention programs. Moreover, hierarchical regression analysis can help clarify the relative contribution of various factors in predicting empathy levels, while mediation analysis can elucidate the pathways through which digital game addiction influences empathic development.

This cross-sectional study aims to fill this gap by examining the relationship between digital game addiction and empathy levels among children, while simultaneously investigating potential mediating mechanisms through hierarchical regression and mediation analysis. By identifying these pathways, the study could provide valuable insights for parents, educators, and mental health professionals seeking to support healthy child development in an increasingly digital world.

Based on the theoretical frameworks and existing literature, the following hypotheses were formulated:

H1: Digital game addiction is negatively associated with empathy levels among children.

H2: Gender is associated with digital game addiction, with male children exhibiting higher levels of digital game addiction than female children.

H3: Gender is associated with empathy levels, with female children exhibiting higher empathy than male children.

H4: Digital game addiction mediates the relationship between gender and empathy, such that gender differences in empathy are partially explained by differences in digital game addiction.

2. Methods

2.1. Study design

This study employed a cross-sectional design using mediation and hierarchical regression analyses.

2.2. Settings, participants, and sampling

The study was conducted between 15 April and 24 May 2024 in the central district of Mardin, a province located in southeastern Turkey. The study population comprised 3,680 fourth-grade primary school students enrolled in the 2023–2024 academic year in four public primary schools within the district centre. The study population consisted of 3,680 fourth-grade students enrolled in four public primary schools located in the central district of Mardin. These schools were selected purposively based on having the highest student density within the district. Within the selected schools, participants were identified using a simple random sampling procedure based on official student lists, ensuring that each eligible student within these schools had an equal probability of selection. Accordingly, the sampling approach can be characterized as a two-stage procedure involving purposive cluster selection followed by random sampling at the individual level. Accordingly, a total of 400 students constituted the study sample.

2.3. Data collection

The data were collected face-to-face between April 15, 2024 and May 24, 2024 by distributing the data collection tools: (1) descriptive characteristics form, (2) digital game addiction scale for children, and (3) empathy scale for children and adolescents to children.

2.3.1. Descriptive characteristics form

It consists of a total of 7 questions developed by the researchers and questioning the socio-demographic characteristics of the participants.

2.3.2. Digital game addiction scale for children

This scale was developed by Şahin et al. [19], which consists of 6 items. In order to examine the statements in the scale in terms of language and content validity for primary school 4th grade students, the scale was given to three experts, who are classroom teachers, to get their opinions. It was concluded that the statements in the scale were understandable and sufficient. The scale form is a 5-point Likert scale ranging from “Not at all suitable for me” to “Completely suitable for me”. A maximum score of 30 and a minimum score of 6 is obtained from the scale. A high score indicates a high level of perception of digital game addiction. The Cronbach Alpha reliability coefficient of the scale is greater than 0.70 [19]. In this study, Cronbach Alpha was calculated as 0.73.

2.3.3. Empathy scale for children and adolescents

This scale was developed by Bryant [20], and adapted into Turkish by Gürtunca [21]. Although the Turkish adaptation study of the scale is based on a graduate thesis, the original instrument is well-established in the literature, and its reliability has been supported in multiple studies. In the present study, internal consistency was confirmed using the KR-20 coefficient. The scale consists of 21 items, has a binary answer form (yes-no), can be applied to children and adolescents between the ages of 8–14, and measures empathy skills. The scale consists of a single form that is the same for both children and adolescents. The lowest score that can be obtained from the scale is 0 and the highest score is 21. If an item is answered “yes”, the score for that item is 1; if an item is answered “no”, the score for that item is 0. Some items in the scale are reverse scored. Cronbach’s Alpha coefficient of the scale is .91 [21]. Since the scale has dichotomous response options, it is more appropriate to use the Kuder–Richardson 20 (KR-20) coefficient instead of Cronbach’s Alpha when evaluating internal consistency. Accordingly, in the study, the internal consistency coefficient of the scale was calculated as KR-20 = 0.71.

2.4. Data analysis

Data were analysed using SPSS 27.0 package and jamovi (Version 2.7.23.0). It was determined that the data did not show a normal distribution when skewness and kurtosis values were taken into account using the Kolmogorov–Smirnov test, and therefore non-parametric statistical methods were used. Accordingly, the data were analysed using the Mann–Whitney U test, Kruskal–Wallis test, Spearman correlation analysis, as well as mean and percentage distributions. For all statistically significant results, the r effect size for Mann-Whitney U and η^2 for Kruskal-Wallis were calculated to determine the practical significance of the findings. The effect size values were interpreted as 0.10 indicates a small effect, 0.30 indicates a medium effect, and 0.50 or higher indicates a large effect.

In the study, hierarchical multiple linear regression analysis was conducted to determine the variables predicting the level of empathy. In the first block, sociodemographic variables were added to the model as control variables. In the second block, the total score of digital game addiction, the main independent variable of the study, was included in the model, and the specific contribution of this variable to the level of empathy (ΔR^2) was evaluated. Before proceeding with the regression analysis, the assumptions of multiple linear regression were tested. First, multicollinearity was assessed using Variance Inflation Factor (VIF) and tolerance values. The assumption was fully met, as all VIF values were well below the critical threshold of 10 and tolerance values were strictly above 0.10, indicating no problematic collinearity among the predictor variables. Second, the normality of the residuals was evaluated. Although test results indicated a non-normal distribution ($p = 0.012$), a visual inspection of the Q-Q plot showed that the residuals closely followed the theoretical diagonal line, with no severe distortions, making the minor deviation acceptable. Third, the assumption of independent errors was examined using the Durbin-Watson statistic, which yielded a value of 1.67, indicating positive autocorrelation. Furthermore, the assumption of homoscedasticity was violated, as the Breusch-Pagan test was statistically significant ($p = 0.003$), and the residuals-versus-fitted-values plot showed a non-random, clustered pattern in the variance. To rigorously address these methodological limitations, specifically the heteroscedasticity, the autocorrelation, and the discrete nature of the survey scale scores, the subsequent analyses were conducted using a 5000-resample bootstrapping technique. By utilizing this advanced, non-parametric resampling strategy, the reliance on strict parametric distributional assumptions was entirely eliminated.

In accordance with theoretical and logical frameworks, the mediation model was structured to examine digital gaming addiction as a mediator in the relationship between gender and empathy. Specifically, gender was specified as the independent variable (X), digital gaming addiction as the mediating variable (M), and empathy as the dependent variable (Y). To test the mediation hypotheses, the 5000-resample bootstrapping technique was employed to calculate the 95% confidence intervals (CI) for the indirect effects. Cases with missing data on any variable in the model were excluded using listwise deletion, yielding an effective sample size of 397.

2.5. Ethical consideration

Ethical approval

was obtained from the Non-Interventional Clinical Research Ethics Committee of Mardin Artuklu University (Date: 13/02/2024, Reference number: 2024/02–18). Institutional approval was also obtained from the Provincial Directorate of National Education (Date: 29/03/2024 Reference number: E-63050228-605.01-99851931). Written informed consents were obtained from all individual participants and the parents or legal guardians of any participant under the age of 16. The present study was conducted according to the principles of the Declaration of Helsinki.

3. Results

Table 1 showed sociodemographic characteristics of the participants. When the sociodemographic characteristics of the children were analysed, 50.20% were female students, 70.50% of the mothers were housewives, 53.00% of the fathers worked in the private sector, and 98.30% of the parents were married. In addition, 72.00% of the children have tablets at home, 75.50% do not have their own mobile phones, and 33.80% have 3 siblings (Table 1).

Analysis of sociodemographic characteristics revealed a statistically significant difference in both Digital Game Addiction Scale and Empathy Scale total scores based on gender ($p < 0.001$). Male students reported higher mean scores for digital game addiction (11.60 ± 5.12) compared to female students (9.58 ± 3.78) representing a small effect size ($r = 0.24$). Conversely, female students exhibited significantly higher mean empathy scores (15.30 ± 2.94) than their male counterparts (13.51 ± 3.67) with a small effect size ($r = -0.28$). Furthermore, a statistically significant difference was observed in empathy scores regarding mobile phone ownership ($p = 0.02$); students who did not own a mobile phone had higher empathy scores than those who did, although the effect size for this difference was small ($r = -0.16$) (Table 1).

Table 2 presented the total mean score of digital game addiction scale for children and empathy scale for children and adolescents. The mean score on the Digital Game Addiction Scale for Children was 10.58 ± 4.61 within a possible range of 6–30, indicating that scores were positioned toward the lower end of the scale. In contrast, the mean empathy score was 14.41 ± 3.44 within a possible range of 0–21, suggesting that empathy levels were relatively higher within the scale range (Table 2).

Table 2
Total Mean Score of Digital Game Addiction Scale for Children and Empathy Scale for Children and Adolescents

Scale	Min-Max Score/Median	Mean ± SD
Digital Game Addiction Scale for Children	6–30/9.00	10.58 ± 4.61
Empathy Scale for Children and Adolescents	2–21/15.00	14.41 ± 3.44

Table 3 showed the correlation between the total scores of the digital game addiction scale for children and the total scores of the empathy scale for children and adolescents. A moderate, negative, and statistically significant correlation was found between digital game addiction and empathy level ($r = -0.328$, $p < 0.001$) (Table 3). This result higher levels of digital game addiction are associated with lower empathy scores.

Table 3
Correlation Between the Total Scores of the Digital Game Addiction Scale for Children and the Total Scores of the Empathy Scale for Children and Adolescents

		Empathy Scale for Children and Adolescents
Digital Game Addiction Scale for Children	r_s	-0.328
	p	**< 0.001***

*p < 0.001. r_s: Spearman correlation coefficient

A hierarchical multiple regression analysis was conducted to examine the predictors of empathy levels, and the results are presented in Table 4. In Model 1, demographic and background variables were entered into the model. The overall model was statistically significant, $F(10, 386) = 4.01$, $p < 0.001$, explaining 9.4% of the variance in empathy scores ($R^2 = 0.094$, Adj. $R^2 = 0.071$). In this model, gender ($\beta = -0.260$, $p < 0.001$) and mobile phone ownership ($\beta = -0.098$, $p = 0.046$) emerged as significant predictors. Specifically, being male and owning a mobile phone were associated with lower empathy scores. However, bootstrap analyses indicated that the effect of mobile phone ownership was not robust, as the 95% BCa CI included zero.

In Model 2, digital game addiction was added to the model. The overall model remained significant, $F(11, 385) = 8.02$, $p < 0.001$, and explained a greater proportion of variance ($R^2 = 0.186$, Adj. $R^2 = 0.163$), with a significant increase in explained variance ($\Delta R^2 = 0.092$), indicating that digital game addiction contributed substantially to the prediction of empathy beyond the variables included in Model 1.

In the final model, digital game addiction emerged as the strongest predictor of empathy ($\beta = -0.314$, $p < 0.001$), indicating that higher levels of digital game addiction were associated with lower empathy. A one-unit increase in digital game addiction was associated with an approximate 0.24-point decrease in empathy scores, holding other variables constant. Gender also remained a significant predictor ($\beta = -0.189$, $p < 0.001$), indicating that males had significantly lower empathy scores compared to females, even after controlling for digital game addiction and other covariates. None of the other variables, including parental occupation, tablet and mobile phone ownership, and number of children, was found to be a significant predictor. Bootstrap analyses confirmed the robustness of the findings for gender and digital game addiction, as their 95% CIs did not include zero.

Table 4
Hierarchical Multiple Regression Analysis Results Regarding Predictors of Empathy Level

Variable	B	SE	β	t	p	SE (Boot)	p (Boot)	95% CI
Model 1								
Constant	14.494	0.939	—	15.433	< 0.001*	1.017	< 0.001*	[12.593, 16.404]
Gender (Ref. Female)								
Male	-1.785	0.339	-0.260	-5.271	< 0.001*	0.342	< 0.001*	[-2.468, -1.095]
Mother's occupation (Ref. Public employee)								
Housewife	-0.469	0.412	-0.068	-1.139	0.256	0.396	0.236	[-1.296, 0.320]
Other	-0.055	0.693	-0.004	-0.079	0.937	0.658	0.939	[-1.408, 1.297]
Father's occupation (Ref. Public employee)								
Private Sector	0.006	0.420	0.001	0.014	0.989	0.417	0.989	[-0.789, 0.816]
Other	-0.548	0.667	-0.047	-0.821	0.412	0.691	0.427	[-1.883, 0.712]
Tablet ownership (Ref. No)								
Yes	0.096	0.376	0.012	0.254	0.799	0.394	0.819	[-0.692, 0.893]
Mobile phone ownership (Ref. No)								
Yes	-0.784	0.391	-0.098	-2.004	0.046*	0.426	0.062	[-1.604, -0.019]
Number of Children (Ref. 1)								
2	1.406	0.788	0.189	1.784	0.075	0.898	0.112	[-0.333, 3.236]

Variable	B	SE	β	t	p	SE (Boot)	p (Boot)	95% CI
3	1.436	0.789	0.198	1.820	0.070	0.890	0.099	[-0.201, 3.204]
4 and more	0.921	0.806	0.123	1.144	0.254	0.920	0.309	[-0.885, 2.795]
Model 2								
Constant	17.049	0.971	—	17.550	< 0.001	1.101	< 0.001*	[14.902, 19.103]
Gender (Ref. Female)								
Male	-1.300	0.330	-0.189	-3.946	< 0.001*	0.333	< 0.001*	[-1.979, -0.615]
Mother's occupation (Ref. Public employee)								
Housewife	-0.505	0.391	-0.073	-1.291	.197	0.375	0.177	[-1.257, 0.260]
Other	-0.317	0.659	-0.024	-0.481	0.631	0.623	0.610	[-1.599, 0.969]
Father's occupation (Ref. Public employee)								
Private Sector	-0.076	0.398	-0.011	-0.191	0.849	0.388	0.846	[-0.817, 0.674]
Other	-0.563	0.633	-0.048	-0.889	0.375	0.641	0.376	[-1.834, 0.657]
Tablet ownership (Ref. No)								
Yes	-0.030	0.358	-0.004	-0.084	0.933	0.378	0.939	[-0.789, 0.739]
Mobile phone ownership (Ref. No)								
Yes	-0.701	0.371	-0.088	-1.890	0.060	0.404	0.079	[-1.450, 0.021]
Number of Children (Ref. 1)								

Variable	B	SE	β	t	p	SE (Boot)	p (Boot)	95% CI
2	1.140	0.749	0.153	1.522	0.129	0.854	0.176	[-0.506, 2.911]
3	1.302	0.749	0.179	1.738	0.083	0.839	0.112	[-0.182, 2.959]
4 and more	0.781	0.765	0.104	1.022	0.308	0.866	0.351	[-0.860, 2.568]
Digital game addiction	-0.235	0.036	-0.314	-6.609	< 0.001*	0.045	< 0.001*	[-0.327, -0.141]

*p < 0.05

Model 1: $R^2 = 0.094$, Adj. $R^2 = 0.071$, $F(10, 386) = 4.01$, $p < 0.001$

Model 2: $R^2 = 0.186$, Adj. $R^2 = 0.163$, $\Delta R^2 = 0.092$, $F(11, 385) = 8.02$, $p < 0.001$

Note: The effective sample size for this analysis was 397, as three cases were excluded due to missing data. Missing data were handled using listwise deletion.

To investigate whether digital gaming addiction helps explain the relationship between gender and empathy, a mediation analysis was conducted. Because gender is an immutable demographic characteristic rather than a manipulable variable, this model is interpreted as an explanatory framework rather than a strict causal one. A 5000-resample bootstrapping technique was utilized to generate 95% robust CI for the indirect pathway. The conceptual model and path estimates are illustrated in Fig. 1.

The analysis revealed a statistically significant overall association between gender and empathy (total effect, c = -1.796, SE = 0.342, z = -5.25, $p < 0.001$, 95% CI [-2.462, -1.115]). Furthermore, gender was significantly associated with the proposed mediator, digital gaming addiction (path a; B = 2.078, SE = 0.456, z = 4.55, $p < 0.001$, 95% CI [1.180, 2.984]), indicating higher addiction scores among males. In turn, higher digital gaming addiction was significantly associated with lower empathy scores, even when controlling for gender (path b; B = -0.239, SE = 0.044, z = -5.41, $p < 0.001$, 95% CI [-0.325, -0.151]). Upon including digital gaming addiction in the model, the direct association between gender and empathy remained statistically significant but was noticeably reduced in magnitude (direct effect, c' = -1.300, SE = 0.334, z = -3.90, $p < 0.001$, 95% CI [-1.951, -0.642]). Crucially, the indirect pathway linking gender to empathy through digital gaming addiction ($a \times b$) was calculated as -0.497 (SE = 0.154, z = -3.21, p = 0.001). Because the 95% bootstrapped CI for this indirect estimate did not include zero [-0.830, -0.232], the mediating role of digital gaming addiction is supported. Taken together, these findings suggest that the observed gender differences in empathy are partially explained (27.6%) by differences in digital gaming addiction between genders, while the remaining 72.4% reflects the direct association between gender and empathy independent of gaming addiction, as well as other factors not included in the model.

4. Discussion

This study aimed to examine the relationship between digital game addiction and empathy levels among fourth-grade primary school students. Although digital game use among children has been widely investigated, studies simultaneously addressing digital game addiction and empathy levels in this age group remain limited in the existing literature. The results of the present study indicated that male students exhibited significantly higher levels of digital game addiction than female students. This result is consistent with previous research. Some studies have reported a statistically significant gender-based difference in digital game addiction, with male students demonstrating higher addiction levels compared to their female counterparts [22–24].

This study revealed critical insights into the relationship between digital game addiction and empathy levels among children, demonstrating contrasting mean scores on both measurement scales. The mean total score for the Digital Game Addiction Scale for Children was recorded at 10.58 ± 4.61, indicative of a score that approaches the medium level of addiction. This result aligns with previous research indicating that a significant proportion of youth may exhibit traits associated with problematic gaming, such as increased screen time and potential academic declines, particularly noting that children with higher digital game addiction scores have exhibited lower academic achievement [25, 26]. In contrast, the mean total score of the Empathy Scale for Children and Adolescents stood at a low level of 14.41 ± 3.44. This finding suggests that children with higher digital game addiction scores tend to exhibit lower levels of empathy, indicating a negative association between problematic gaming behaviours and empathic tendencies [27, 28]. An observational study of 52 children over 30 days found that excessive online gaming could be linked to emotional disengagement and reduced empathy, though some teamwork and social skills also improved [29]. However, several studies show neutral or positive associations. In Italian adolescents, empathy predicted lower problematic gaming/internet use, and relationships differed by age; empathy did not uniformly decline with gaming [30]. Thus, these results establish a foundation for understanding the psychological landscape affecting children in the digital age, highlighting the necessity for interventions that address these interconnected facets of adolescent behaviour.

An important consideration when interpreting the present findings is the potential for reverse or bidirectional associations between digital game addiction and empathy. While the results are consistent with the interpretation that higher levels of digital game addiction are associated with lower empathy, it is also plausible that children with lower baseline empathy may be more likely to engage intensively in digital gaming. Such children may experience difficulties in real-world social interactions and may therefore gravitate toward digital environments that require fewer complex interpersonal skills. This interpretation is consistent with theoretical perspectives such as the I-PACE model, which highlights the role of individual predispositions in shaping engagement in potentially addictive behaviours [18]. Accordingly, the observed associations may reflect a dynamic interplay between behavioural patterns and socio-emotional characteristics rather than a single causal pathway.

The hierarchical multiple regression analysis provides insights into the predictors of empathy levels among children. The initial model, which included sociodemographic variables, was statistically significant, accounting for 7.1% of the variance in empathy levels. This highlights the basic

understanding of expected variances before examining additional influencing factors. When digital game addiction was included in the regression model, there was a significant increase in explained variance (16.3%), with the total variance in empathy levels. This indicates the role that digital game addiction may play in empathy, though interpretations require caution as negative associations between video game addiction and empathy levels have been noted in the literature [31, 32]. Specifically, for every one-unit increase in digital game addiction, there is a reported decrease in empathy scores, requiring attention to how gaming behaviours may influence emotional development. Furthermore, among the sociodemographic variables, gender emerged as a significant predictor with male showing lower empathy levels compared to female students. These results accentuate the importance of addressing digital game addiction as a factor influencing the emotional and social development of children, which may necessitate further exploration into interventions to mitigate these effects and enhance empathy [31, 32].

The model illustrated in Fig. 1 indicates that digital gaming addiction partially explains the association between gender and empathy levels among children. The total association between gender and empathy was statistically significant, indicating that males showed lower empathy scores overall. Importantly, even after accounting for the mediating role of digital gaming addiction, the direct association between gender and empathy remained significant, suggesting that gaming addiction does not fully account for gender differences in empathy but represents one relevant pathway through which these differences may operate.

The analysis also revealed a significant indirect pathway through digital gaming addiction, which accounted for approximately 27.6% of the total association between gender and empathy. Consistent with recent methodological discussions, findings from mediation models estimated using cross-sectional data should be interpreted as a statistical decomposition of associations rather than evidence of a causal mediating mechanism [33]. In this context, the observed indirect association suggests that higher levels of digital gaming addiction among males may be one factor relevant to the observed gender differences in empathy. This finding is broadly consistent with previous research indicating gender differences in emotional processing and vulnerability to addictive behaviours, where males often report higher levels of gaming addiction alongside lower levels of empathy [34]. Taken together, these findings suggest that gender-related differences in gaming behaviour may be important when considering empathy development in children. Accordingly, interventions aiming to support empathy in children may benefit from taking potential gender differences in gaming behaviours and emotional responses into account [28, 35].

4.1. Implication for practice and recommendations

The results of this study highlight implications for practice regarding the management of digital game addiction and the nurturing of empathy in children. First, educators and mental health professionals should be alerted to the observed relationship between heightened levels of digital game addiction and decreased empathy. Given the evidence that digital game addiction can negatively influence children's

emotional development, it is crucial to implement educational programs that raise awareness among parents, teachers, and children about the emotional implications of excessive gaming.

In addition, parents play a significant role in moderating children's technology usage. Practical training for parents in digital parenting strategies can be invaluable in managing their children's gaming habits. Workshops that equip parents with skills to monitor and set boundaries around digital gaming can help mitigate the potential negative effects of addiction while promoting healthier emotional and social development. It is recommended to provide awareness trainings on digital game addiction in schools and to prepare public service announcements about it, to prepare the trainings not only for students but also for teachers and parents, to make plans in coordination with community mental health centres and schools.

Moreover, encouraging physical activities, face-to-face interactions, and developing hobbies outside of gaming can also reduce the risk of empathy decline. Overall, an integrated approach involving educators, parents, and mental health professionals could create an environment conducive to nurturing empathy in children while responsibly managing their engagement with digital games.

4.2. Strengths and limitations

One of the strengths of this study is contributing to the understanding of the relationship between digital game addiction and empathy levels among children. In addition, hierarchical regression and mediation analyses were employed, allowing the exploration of more nuanced interactions between digital game addiction, empathy, and sociodemographic variables. These analyses reinforce the robustness of the data by identifying both direct and indirect effects within the model. Moreover, the inclusion of validated scales for measuring both digital game addiction and empathy ensures that the results are grounded in reliable assessments, enhancing the overall credibility of the study.

However, the study also has several limitations. One of the limitations is the cross-sectional nature of the study, which restricts the ability to draw causal inferences about the relationships between variables. Although the mediation model was structured in a causally coherent direction, the directionality of the proposed pathways cannot be confirmed without longitudinal data. Longitudinal studies would therefore be beneficial to observe changes over time and provide insights into the long-term effects of digital game addiction on empathy.

The cross-sectional design of the study represents an important limitation, as it precludes conclusions regarding the directionality or causality of the observed relationships. Although the mediation model was specified based on theoretical considerations, alternative explanations, including reverse or bidirectional relationships, are plausible. For example, children with lower levels of empathy may be more likely to engage in excessive digital gaming, rather than digital game addiction leading to reduced empathy. Longitudinal and experimental studies are therefore needed to clarify the temporal and causal dynamics of these associations.

Additionally, reliance on self-report measures may introduce biases, as children might underreport or overreport their gaming behaviours or empathetic tendencies due to social desirability effects. The empathy scale used in this study consists of 21 dichotomous items summed into a total score, which does not yield a truly continuous outcome variable. The discrete and bounded nature of the scores may constrain the precision of the regression estimates. Furthermore, the internal consistency of the scale as measured by the KR-20 coefficient (0.71) reflects a modest level of reliability, which may limit the scale's sensitivity and attenuate observed effect sizes due to measurement error. Although bootstrapping was employed to address violations of homoscedasticity and residual non-normality, these violations indicate that the data do not fully conform to classical regression assumptions, and findings should therefore be interpreted with appropriate caution. Finally, the sample was drawn from a specific geographic region and age group, which limits the generalizability of the findings to broader adolescent populations. Unmeasured confounders such as parenting style, peer relationships, and socioeconomic background may also have influenced the observed associations and should be considered in future research.

Several potentially important variables were not measured in the present study and may have influenced the observed relationships. First, the type and content of digital games (e.g., prosocial, cooperative, or violent games) were not assessed, although previous research indicates that gaming effects on socio-emotional outcomes such as empathy are highly content-dependent. Second, while digital game addiction was measured as a behavioural pattern, actual screen time or duration of gameplay was not evaluated, and these constructs may differ conceptually and empirically. Third, socioeconomic status was assessed only indirectly through parental occupation, and more comprehensive indicators such as family income and parental education were not included.

In addition, the study did not assess children's psychological characteristics, such as anxiety, depressive symptoms, or attention-related difficulties, which may act as confounding variables influencing both gaming behaviour and empathy. Finally, although parental monitoring and supervision were discussed in relation to practical implications, these variables were not empirically measured. Future studies should incorporate these factors to provide a more comprehensive understanding of the mechanisms underlying the relationship between digital game use and empathy.

5. Conclusion

This study demonstrates that higher levels of digital game addiction were significantly associated with lower empathy levels among primary school children. The results indicate that males exhibit higher levels of digital game addiction, whereas female demonstrate higher empathy scores. Overall, children's digital game addiction levels were close to moderate, while empathy levels were relatively low, and a clear negative relationship was identified between these two variables. Higher levels of digital game addiction were associated with lower empathy scores among the participating children.

Hierarchical regression analysis revealed that digital game addiction was the strongest predictor of empathy, explaining a substantial proportion of variance beyond sociodemographic factors. Gender also

emerged as a significant predictor, and mediation analysis further showed that digital gaming addiction partially mediated the relationship between gender and empathy, accounting for 27.6% of the total effect. The direct association between gender and empathy remained significant after accounting for the mediating role of digital gaming addiction, indicating that gaming addiction does not fully account for gender differences in empathy but represents one relevant pathway through which these differences operate.

These results highlight the importance of early identification and monitoring of digital game addiction in children. Psychiatric nurses and other mental health professionals play a crucial role in screening children at risk, raising awareness, and implementing preventive strategies to protect children's emotional development. Developing effective interventions to prevent or reduce digital game addiction may contribute to improving empathy and supporting healthier psychosocial development during childhood. Based on the results, strategies to control adolescents' technology use are recommended.s

Abbreviations

GAM: General Aggression Model

I-PACE: Interaction of Person-Affect-Cognition-Execution

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Non-Interventional Clinical Research Ethics Committee of Mardin Artuklu University (Date: 13/02/2024, Reference number: 2024/02-18). Institutional approval was also obtained from the Provincial Directorate of National Education (Date: 29/03/2024 Reference number: E-63050228-605.01-99851931). Written informed consents were obtained from all individual participants and the parents or legal guardians of any participant under the age of 16. The present study was conducted according to the principles of the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no conflicts of interest.

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CRediT authorship contribution statement

Behiye Dilmen Bayar: Conceptualization, Methodology, Validation, Formal analysis, Resources, Data curation, Visualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing.

Mine Ayanoğlu: Conceptualization, Methodology, Validation, Formal analysis, Resources, Data curation, Visualization, Methodology, Project administration, Supervision, Formal analysis, Writing – original draft, Writing – review & editing.

Ahmet Butun: Conceptualization, Methodology, Validation, Formal analysis, Resources, Data curation, Visualization, Methodology, Project administration, Supervision, Formal analysis, Writing – original draft, Writing – review & editing.

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Clinical trial number

Not applicable

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Table

Table 1 is available in the Supplementary Files section.

Figures

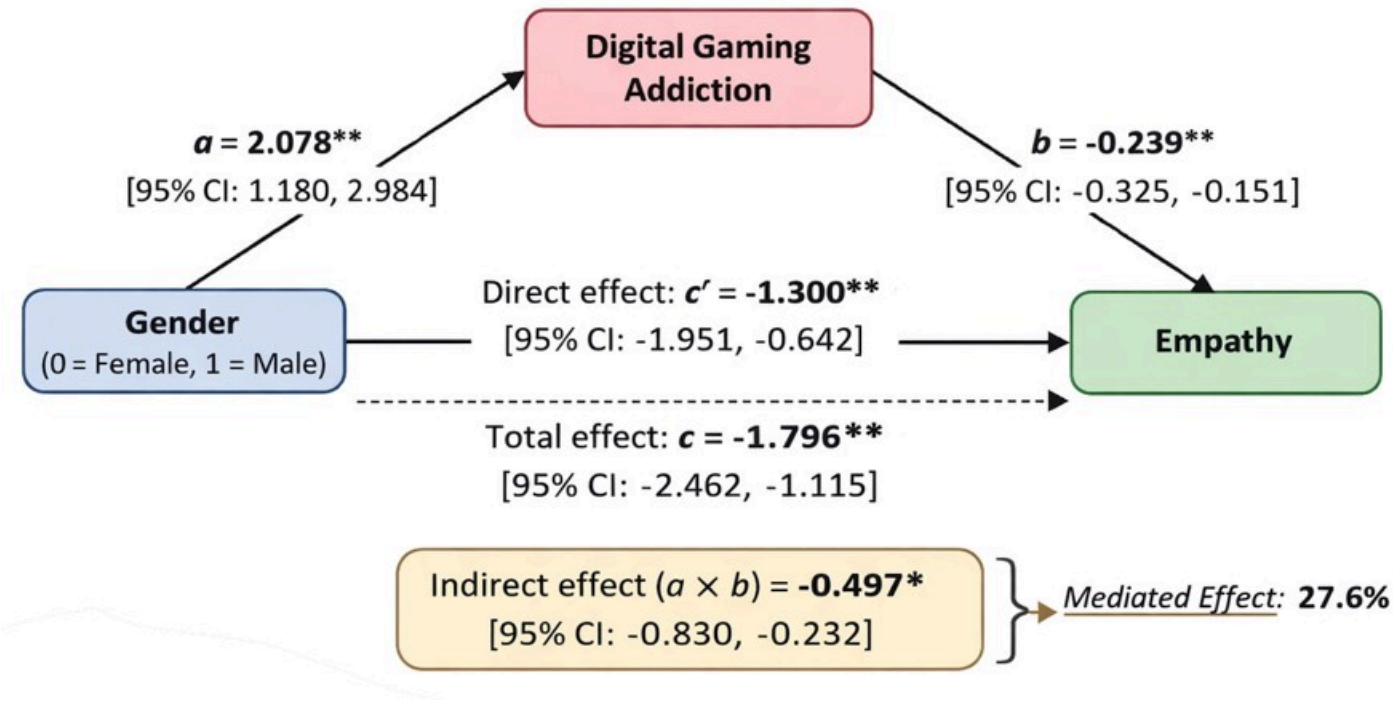


Figure 1

Mediation model: *p=0.01, **p<0.001.

Results shown as unstandardized coefficients.

Supplementary Files

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- table1.docx