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The Role of Parental Phubbing and Ego-Resilience in Adolescents' Tendency Toward Digital Game Addiction: A Neural Network Approach

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Abstract

Aim: The growing prevalence of digital games and their potential impact on mental health highlight the need to identify protective mechanisms against possible negative effects. The present study aimed to investigate the role of parental phubbing and ego-resilience in adolescents' tendency toward digital game addiction: a neural network approach.

Method: This research employed a descriptive-correlational design. The statistical population included all male high school students (second cycle) in public schools of Karaj during the 2024 academic year. A total of 300 students were selected using a cluster random sampling method and completed the Digital Game Addiction Scale by Başol et al. (2018), the Parental Phubbing Scale by Ding et al. (2020), and the Ego-Resilience Scale by Block and Kremen (1996). The collected data were analyzed through an artificial neural network using the multilayer perceptron (MLP) approach in SPSS version 26.

Results: The findings indicated that parental phubbing and ego-resilience significantly contributed to predicting digital game addiction among adolescents ($p< 0.01$). Neural network analysis revealed that parental phubbing positively predicted digital game addiction, whereas ego-resilience negatively predicted it. Parental phubbing emerged as the strongest predictor (100%), while ego-resilience served as a protective factor (57.8%). Moreover, the artificial neural network model accurately captured the trends and variations of digital game addiction based on these variables.

Conclusion: The results demonstrated that parental phubbing and ego-resilience are critical factors in explaining adolescents' digital game addiction. Moreover, the artificial neural network model showed high accuracy in predicting the intensity and course of this addiction. Accordingly, strengthening ego-resilience and addressing parental communication patterns can serve as preventive strategies to reduce digital addiction among adolescents.

Keywords: Digital Game Addiction, Parental Phubbing, Ego-Resilience, Adolescents

Introduction

The increasing use of digital games, particularly among adolescents, has drawn growing attention from researchers to their psychological and social consequences. One of the most critical outcomes is digital game addiction, defined as excessive and compulsive involvement in games that can disrupt individuals' daily functioning. This phenomenon has been linked to a variety of psychological and social factors (Kuss & Griffiths, 2012). Recent studies indicate that approximately 22.4% of adolescent's exhibit symptoms of game addiction, with boys being at higher risk compared to their female peers (Aksoy & Erol, 2021).

In contemporary society, addiction has expanded at an accelerating pace and has become one of the major challenges in mental health, attracting the attention of governments and mental health professionals alike (Makas & Koç, 2025). Digital game addiction has thus emerged as an important topic in mental health and behavioral sciences. Given the growing popularity of video games, research in this field is steadily expanding and has drawn the interest of many scholars (Akçakese & Demirel, 2025). In recent years, technology has become an integral part of children's and adolescents' lives, with digital games especially through the widespread use of smartphones emerging as one of their most popular forms of entertainment, providing unprecedented accessibility (Kapetanovic et al., 2025). Digital game addiction refers to the uncontrolled and excessive use of games, often involving more than three to four hours of daily play (Zulkarnaen et al., 2025). Problematic gaming and internet use have become major challenges in recent years, attracting increasing attention from educators, psychologists, and policymakers (Çelikkaleli et al., 2025). With technological advancement, the internet and digital games have become inseparable from everyday life, particularly for high school students, occupying a considerable portion of their time (Nogueira-López et al., 2023).

Recently, parental phubbing has emerged as a significant factor influencing adolescents' social and emotional adjustment (Tong et al., 2024). The widespread use of mobile phones during social interactions has been referred to as phubbing (Wang & Lei, 2022). Parents often use their smartphones to communicate with their children a phenomenon that, while facilitating communication, can reduce the quality of direct parent–child interactions and increase adolescents' feelings of being ignored or "phubbed" (Wang et al., 2023).

Parental phubbing is defined as a negative form of parent–child interaction, reflecting the degree to which children are ignored when parents' attention is directed toward their

smartphones (Ding et al., 2020). In essence, it refers to situations where parents shift their focus to their smartphones while interacting with their children. This phenomenon has become increasingly common and has been directly associated with internet addiction among adolescents (Zhao et al., 2025). Social learning theory emphasizes that observational learning is one of the most important mechanisms through which children

and adolescents acquire behaviors (Bandura & Walters, 1977). According to this theory, children's behaviors are shaped by observing and modeling the actions of their parents (Xie et al., 2019). Within this framework, adolescents may perceive parental phubbing as a negative behavioral model and are likely to imitate it (Wang et al., 2023). Furthermore, researchers have identified parental phubbing as a potential risk factor for adolescents' positive development (Xiao & Zheng, 2022; Xie et al., 2019). Some studies have shown that parental phubbing can significantly predict adolescents' problematic or excessive internet use (Shen et al., 2023).

On the other hand, ego-resilience has been theoretically linked to digital game addiction, as individuals with greater ego-resilience are more capable of adapting to stress and maintaining emotional balance, reducing the likelihood of developing maladaptive coping behaviors such as excessive gaming (Kim, 2016). Ego-resilience is defined as a personality trait that enables the flexible regulation of impulses and emotions in accordance with situational demands and personal needs. This trait facilitates an individual's adaptation to changing environmental conditions (Block, 2002). Block (2002) conceptualized ego-resilience as an emotional processing system that enables individuals to respond effectively to environmental changes and stressors. According to this perspective, individuals with higher levels of ego-resilience are able to maintain stability while remaining flexible when facing adversities, thereby managing stress more effectively and recovering from it. In contrast, individuals with lower ego-resilience tend to exhibit rigid and stereotyped behaviors when confronted with unfamiliar situations or stressors. Substantial empirical evidence indicates that ego-resilience plays a critical role in mental health (Block, 2002). Sanecka et al. (2023) demonstrated that adolescents with higher levels of ego-resilience are better able to identify and mobilize resources when facing stressors. High ego-resilience fosters a more positive perspective toward adversities, increasing the likelihood of successful coping and enhancing overall well-being. Kwon (2020) demonstrated that ego-resilience plays a mediating role in the relationship between social stigma and depressive symptoms, such that adolescents with higher levels of ego-resilience exhibit fewer depressive symptoms. Kim (2016) reported that in the experimental group, digital game addiction significantly decreased, while participants' ego-resilience and adaptation to school life significantly increased. Um et al. (2019) demonstrated that ego-resilience can mitigate the impact of smartphone dependence on aggressive behaviors and improve adolescents' emotion regulation and social behaviors.

Despite the growing body of research on digital game addiction, little is known about how parental phubbing and ego-resilience jointly contribute to adolescents' vulnerability to this behavior. Previous studies have mainly relied on linear statistical methods, which

may not fully capture the complex, nonlinear interactions among these variables. To address this research gap, the present study employs an artificial neural network approach

to model these multidimensional relationships more accurately. This study is innovative in integrating parental behavioral patterns and individual psychological resilience within a predictive computational framework. Given the increasing prevalence of digital gaming among adolescents and the potential psychosocial risks it poses, investigating these mechanisms is both timely and necessary. Therefore, the present study aims to examine the role of parental phubbing and ego-resilience in adolescents' tendency toward digital game addiction using a neural network approach.

Methods

This study is classified as applied research in terms of its objective and as a descriptive-correlational study in terms of its nature and method. The statistical population consisted of all male students in the second grade of public high schools in Karaj during the 2024 academic year. Given the large size of the population, it can be considered as an infinite population (Saraei, 2014). In such cases, specifying the exact population size is unnecessary. To obtain generalizable results and reduce sampling error, the sample size was determined based on the Krejcie and Morgan table (1970). Considering the cluster nature of the sampling method, which increases the likelihood of sampling error, and accounting for potential non-responses or incomplete questionnaires, 300 students were selected from the target population using a multistage cluster random sampling method. To participate in the study, students were required to meet the following inclusion criteria: (a) being aged between 15 and 18 years, (b) being enrolled in public schools in Karaj during the 2024–2025 academic year, (c) providing informed consent from both the student and their parents or legal guardian, (d) having no severe psychiatric disorders (as indicated by school records or confirmed by the school counselor), and (e) being able to read and respond to the questionnaires independently. The exclusion criteria included: (a) failure to complete the questionnaires or providing invalid responses, (b) absence during the testing session or voluntary withdrawal, (c) the emergence of serious psychological or behavioral symptoms that made continued participation inappropriate, and (d) receiving concurrent formal therapeutic or counseling services outside of school that could affect the study outcomes.

After obtaining official approval from the Karaj Department of Education and completing the necessary administrative procedures, the researcher coordinated with school principals, counselors, and teachers to schedule the data collection sessions. One of the four educational districts of Karaj was randomly selected, and from the list of public secondary schools in that district, two schools were chosen using a cluster random sampling method. The purpose of the study and the confidentiality of responses were explained to the students, and informed consent was obtained from both the students and their parents. The questionnaires were administered in groups during regular school hours in a quiet classroom setting under the direct supervision of the researcher. Each session lasted approximately 30–40 minutes. The completed questionnaires were collected immediately after completion to ensure data quality and consistency.

Ego Resilience Questionnaire: This questionnaire was developed by Block and Kremen (1996) and consists of 14 items rated on a 4-point Likert scale ranging from 1 (not at all true) to 4 (very true). The total score is calculated by summing the item scores, resulting in a possible range from 14 to 56. Higher scores indicate greater ego resilience, reflecting greater flexibility, adaptability, and effective coping with stress, whereas lower scores reflect lower ego resilience, indicating rigidity and difficulty adapting to environmental demands. The internal consistency reported by Block and Kremen (1996) was 0.82. Chen et al. (2020) also reported favorable psychometric properties for the scale. In the present study, reliability was assessed using the internal consistency method, and Cronbach's alpha coefficient for the total scale was 0.88.

Digital Game Addiction Questionnaire: The Digital Game Addiction Questionnaire is a 21-item instrument developed by Başol and Kaya (2018) to assess the level of digital (online) game addiction. Each item is rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total score is obtained by summing the item scores, yielding a possible range from 21 to 105. Higher scores indicate a greater level of digital game addiction or risk thereof, reflecting stronger preoccupation with gaming, loss of control, and interference with daily functioning. Conversely, lower scores reflect minimal or no signs of game addiction, indicating balanced gaming behavior. in Kaya et al.'s (2023) study, the questionnaire demonstrated a Cronbach's alpha of 0.88. Content validity was confirmed through expert review and minor revisions based on the feedback of five university instructors (psychologists). Basharpoor and Ahmadi (2024) evaluated construct validity using convergent and discriminant validity methods, which were supported. In the present study, internal consistency reliability was assessed via Cronbach's alpha, and the coefficient for the total scale was 0.86

Parental Phubbing Questionnaire: The revised Parental Phubbing Scale developed by Ding et al. (2020) was used in this study. This unidimensional scale consists of 9 items adapted from Roberts and David (2016). A sample item is: "During a typical meal that I spend with my parents, my parents take out their mobile phones and check them." Each item is rated on a five-point Likert scale ranging from 1 (never) to 5 (always). The total score is obtained by summing all item responses, resulting in a possible range from 9 to 45. Higher scores indicate greater levels of parental phubbing, reflecting more frequent parental engagement with mobile phones during interactions with their child, whereas lower scores indicate less frequent or minimal parental phubbing. Previous studies have demonstrated good validity and reliability for this scale among Chinese adolescents (Zhang et al., 2021; He et al., 2022; Xiao & Zheng, 2022). In Ding's (2023) study, confirmatory factor analysis indicated that the original structure of the Parental Phubbing Scale had a good model fit ($\chi^2/df = 4.63$, CFI = 0.95, GFI = 0.96, TLI = 0.94, RMSEA = 0.07), and the internal consistency reliability (Cronbach's alpha) was 0.82. In the present

study, internal consistency reliability was also assessed, and the Cronbach's alpha coefficient for the total scale was 0.90.

For data analysis, descriptive statistical indices such as mean and standard deviation were used. Furthermore, after data preparation, Pearson's correlation test was employed to examine the relationships among the research variables. In addition, to evaluate the model, the data were analyzed using an artificial neural network with the multilayer perceptron method (MPL) in SPSS version 26. The significance level was set at 0.05.

Results

A total of 300 male students with a mean age of 16.16 years (SD = 1.258) participated in this study. A total of 300 male students with a mean age of 16.16 years (SD = 1.26) participated in this study. Regarding their parents' occupations, 118 (39.3%) were employees, 142 (47.3%) were self-employed, and 40 (13.4%) were retired. In terms of academic major, 132 (44.0%) studied in the humanities, 103 (34.3%) in experimental sciences, and 65 (21.7%) in mathematics. To analyze the research question regarding the relationships between parental phubbing, ego-resilience, and adolescents' tendency toward digital game addiction using an artificial neural network, parental phubbing and ego-resilience were considered as input layer variables (predictors), while digital game addiction was treated as the output layer variable (criterion). As shown in Table 1, the correlation results indicated that parental phubbing scores were positively and significantly associated with digital game addiction, whereas ego-resilience was negatively and significantly correlated with digital game addiction ($p < 0.001$).

Table 1. Descriptive Statistics and Correlation Matrix of Digital Game Addiction, Parental Phubbing, and Ego-Resilience

Variables	(1)	(2)	(3)
Ego-Resilience (1)	1		
Parental Phubbing (2)	**-0.32	1	
Digital Game Addiction (3)	**-0.54	**0.38	1
mean	20.04	49.71	36.76
Standard deviation	7.97	6.60	12.57

****Pearson correlation test, p > 0.001**

Table 2. Artificial Neural Network Data for Digital Game Addiction, Parental Phubbing, and Ego-Resilience Variables

Parental Phubbing	1	Covariates	Input layer
Ego-Resilience	2		
2		Number of nodes	
Standardized		Covariate application method	
1		Number of hidden layers	Hidden layer
2		Number of nodes in Hidden layer 1	
Hyperbolic tangent		Performance function	
Digital Game Addiction	1	Dependent variable	Output layer
1		Number of units	
Standardized		Method of using the dependent variable	
Identification		Performance function	
Sum of squares error		Performance error	

Table 2 shows that a feed-forward network was used to train the neural network, which has an input layer with two nodes or units. The number of input units includes the number of covariates plus the bias. This network also has a hidden layer with two nodes. The output layer represents the level of digital game addiction. As illustrated in Figure 1, the hidden layer used a hyperbolic tangent activation function, while the output layer used an identity activation function. Blue lines indicate positive synaptic weights, and gray lines indicate negative weights.

Figure 1. Synaptic weights and neural network layers of the variables Digital Game Addiction, Parental Phubbing, and Ego-Resilience

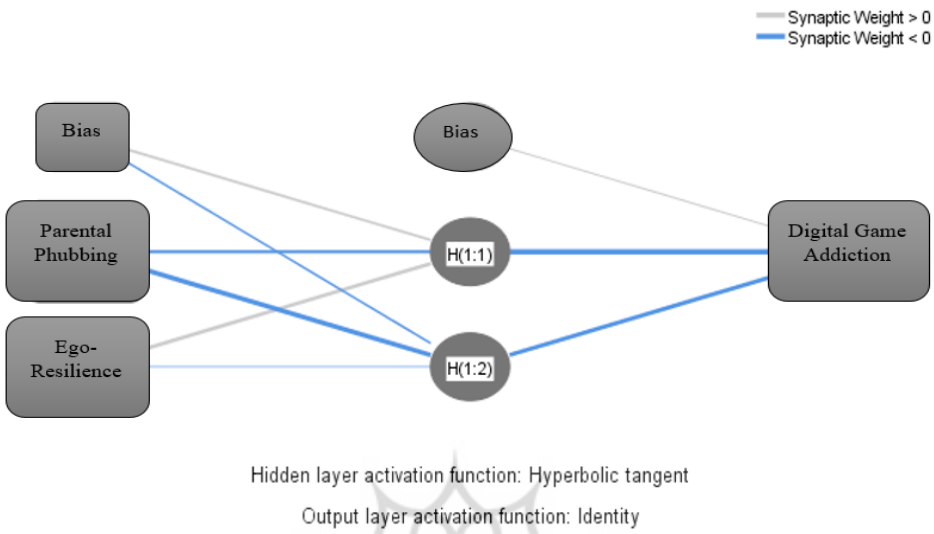

Figure 1 shows the layers of the neural network in the relationship between Ego-Resilience, Parental Phubbing, and Digital Game Addiction and its synaptic weights. The Multilayer Perceptron (MLP) network has a Hidden layer with two nodes. The activation function of the Hidden layer is the hyperbolic tangent, and the activation function of the Output layer is the Identity function. As can be seen in the figure, the synaptic weights are drawn with different colors and thicknesses; blue lines indicate negative weights and gray lines indicate positive weights. Also, the thickness of the lines indicates the intensity of the effect of the weights. The model used is a feed-forward network with one Hidden layer and two nodes that uses the nonlinear hyperbolic tangent function to process the data. The training process is performed in batch mode and automatically until error convergence is achieved by the software.

Table 3. Normalized Importance of Input Variables (Parental Phubbing and Ego-Resilience) in Predicting Digital Game Addiction

Variables	Normalized importance	Importance in percentage
Parental Phubbing	0.634	100
Ego-Resilience	0.366	57.8

During neural network analysis, the data were divided into two sets: training (Train) and testing (Test), with the test set comprising 20% of the data. Using the test data and the

learning process, the accuracy of the constructed model can be assessed. The estimation of the artificial neural network model, based on two indices—mean squared error (MSE) and relative error—showed an error of 0.768 in the training sample and 0.313 in the test sample. The closer these values are to zero, the closer the network output is to the desired output. Table 3 presents the importance of input layer variables in modeling the neural network and predicting digital game addiction. It shows that, in descending order of importance, parental phubbing (100%) and ego-resilience (57.8%) play the most significant roles in predicting digital game addiction using the artificial neural network method.

Table 4. Estimated Parameters of the Artificial Neural Network and the Contribution of Parental Phubbing and Ego-Resilience Variables

Predictors		Predicted value		
		Hidden middle layer		Output layer
		First node H(1)	Second node H(2)	Digital Game Addiction
Input layer	Bias parameter	0.375	0.631	
	Parental Phubbing	0.468	0.656	
	Ego-Resilience	-0.491	-0.018	
Hidden layer	Bias parameter			0.053
	First node H(1)			-0.716
	Second node H(2)			-0.608

Table 4 shows the estimated connection weights of the artificial neural network. In the input layer, parental phubbing had positive weights (0.468 and 0.656), indicating that higher parental phubbing increased the predicted level of digital game addiction. In contrast, ego-resilience had negative weights (–0.491 and –0.018), showing that higher ego-resilience reduced the predicted level of addiction. In the hidden layer, the negative weights (–0.716 and –0.608) suggest that both hidden nodes had a moderating effect on the final output. Overall, parental phubbing acted as a risk factor, whereas ego-resilience functioned as a protective factor in predicting digital game addiction.

Discussion

The present study aimed to examine the role of parental phubbing and ego-resilience in adolescents' tendency toward digital game addiction using a neural network approach. The findings indicated that parental phubbing and ego-resilience play significant roles in predicting adolescents' digital game addiction. The artificial neural network model employed consisted of an input layer with two nodes and a hidden layer with two nodes.

The results indicated that the artificial neural network model was able to accurately predict digital game addiction based on parental phubbing. Consistent with this finding, researchers have identified parental phubbing as a potential risk factor for adolescents' positive development, significantly predicting problematic or excessive internet use among adolescents (Xiao & Zheng, 2022; Xie et al., 2019; Shen et al., 2023). This finding can be explained by the fact that parental neglect or phubbing, through reduced supervision, emotional support, and effective guidance, creates conditions conducive to adolescents' problematic engagement with digital games. According to Bandura's social learning theory (Bandura, 1977), adolescents acquire behaviors through observing and modeling significant individuals and their environments. When parents are less involved in direct interaction, guidance, and monitoring of their children's activities (Bandura & Walters, 1977), adolescents may adopt alternative behavioral patterns, such as digital gaming, to gain immediate gratification, cope with stress, or fill social voids. These conditions reduce opportunities for adolescents to practice self-regulation and coping skills, gradually leading to addictive behaviors in digital game use. Therefore, parental phubbing not only acts as a direct risk factor but also, by weakening social learning processes and reducing opportunities for constructive parent–child interactions, can significantly increase the tendency toward digital game addiction. This highlights the importance of preventive interventions and active parenting education.

Furthermore, the results indicated that the artificial neural network model was able to accurately predict the fluctuations and trajectory of digital game addiction based on ego-resilience. Consistent with these findings, Sanecka et al. demonstrated that adolescents with higher levels of ego-resilience are better able to identify and mobilize resources when facing stressors; high ego-resilience fosters a more positive outlook toward adversities, increasing the likelihood of successful coping and enhancing well-being. Additionally, Kwon (2020) showed that ego-resilience plays a mediating role in the relationship between social stigma and depressive symptoms, such that adolescents with higher levels of ego-resilience exhibit fewer depressive symptoms. Kim (2016) also reported that in the experimental group, digital game addiction significantly decreased, while participants' ego-resilience and school life adjustment significantly increased. Moreover, Um et al. (2019) demonstrated that ego-resilience can mitigate the impact of smartphone dependence on aggressive behaviors and improve adolescents' emotion regulation and social functioning. In explaining this finding, based on the Protective–Risk Model framework, digital game addiction in adolescents typically emerges from a combination of risk factors such as academic stress, peer pressure, and widespread

internet access (Fergus & Zimmerman, 2005). However, the presence of a protective factor like ego-resilience can mitigate the impact of these risks. Ego-resilience refers to an individual's capacity for cognitive and emotional flexibility when facing challenging situations (Block, 2002). Adolescents with higher resilience are less likely to resort to avoidant or immediate relief strategies, such as immersing themselves in digital games, when confronted with failure or stress; instead, they can employ more adaptive coping strategies, such as problem-solving or cognitive reappraisal (Sanecka et al., 2023).

From the perspective of emotion regulation theory, digital game addiction often results from difficulties in managing negative emotions (Gross, 2015). Ego-resilience helps adolescents manage their emotions more adaptively and prevents them from turning to digital games as a way to alleviate anxiety or depression (Gross, 2015). Consequently, ego-resilience can directly and indirectly reduce the propensity for digital game addiction by enhancing emotion regulation, diminishing the impact of stress, and replacing avoidant strategies with adaptive coping mechanisms. This study has several important limitations that should be considered. First, given its cross-sectional design, causal inferences cannot be fully established. Future research could employ experimental or longitudinal designs to clarify the directionality of relationships between variables. Second, the data in this study were homogeneous, and self-report bias may have inflated shared variance and exaggerated the results. Therefore, future studies would benefit from larger and more representative samples, including data collection from parents and peers. Third, the study included adolescents from only one specific geographic region; thus, generalizing the findings to other cultural populations should be done with caution. Future research could replicate these findings among adolescents from different regions and cultural backgrounds.

Conclusion

The present study showed that parental phubbing and ego-resilience significantly influence adolescents' tendency toward digital game addiction. Unhealthy parent–child interactions and low resilience increase the risk of excessive gaming, while strengthening resilience and improving family communication can serve as protective factors. These findings highlight the need for family- and school-based interventions that promote healthy digital habits and enhance adolescents' coping skills.

Disclosure Statements

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