

Research Article

Digital game addiction in elementary students: The impact of digital literacy, parental styles, and background variables

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This study explores the influence of digital literacy, parental styles, and background variables on digital game addiction among elementary school students. Given the formative nature of early childhood and the significant role of parental influence, understanding these relationships is essential to promoting healthy digital habits. The sample comprised 530 fourth-grade students from four primary schools in Turkey. Data were collected using the "Scale of Digital Game Addiction for Children", "Digital Literacy Scale for Primary School Students", and "Parental Style Scale". A cross-sectional survey design was employed, and a hierarchical regression analysis was conducted. The analysis revealed that gender, screen time, and screen activity were significant predictors of digital game addiction, whereas the technology-use rule did not have a significant effect. The inclusion of digital literacy sub-factors further enhanced the amount of variance explained in digital game addiction, with "privacy and security knowledge" emerging as a significant predictor. Additionally, dimensions of parental style, particularly "acceptance/involvement" and "psychological autonomy," were found to have a significant impact on digital game addiction. These findings highlight the complex interplay between digital literacy, parental influence, and background factors in shaping digital game addiction, providing critical insights for parents, educators, and policymakers aimed at promoting healthy digital behaviors among young learners.

Keywords: Digital game addiction; Digital literacy; Elementary school children; Parental style

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1. Introduction

The digital transformation of our era requires individuals to adapt to keep pace within a technology-driven world. Children are increasingly exposed to technology from an early age, which affects how they study, communicate, and occupy themselves. So, children must develop new skills, behaviors, and mindsets, such as digital literacy, to navigate this digital landscape effectively. Digital literacy, which is defined as an individual's ability to find, evaluate, use, create, and share information using digital technologies (Reddy et al., 2020; Van Laar et al., 2017), has emerged as a critical skill set for handling the complexities of the digital world (Ng, 2012). Digital literacy could be a way for students to harness technology in a way that allows them to engage with the world meaningfully, but the extensive use of digital devices like smartphones, tablets, and laptops without adequate direction or balance may show up as addictive behavior. This is

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particularly evident in digital gaming, where a strong absence of quality control and systematic supervision results inevitably in the increase of problematic gaming/binge gaming/gaming addiction (Kuss & Griffiths, 2012).

This addiction has emerged as a significant concern for parents, educators, and researchers due to its potential negative impacts on mental health, social behavior, and academic performance (Ersoy & Şahbaz, 2023). The immersive nature of digital games—enhanced by sound and light effects, rewards, engaging visuals, and challenging tasks—can fulfill children's needs for achievement, entertainment, and leisure. However, the addictive potential of these games often outweighs their benefits. Numerous studies have demonstrated the adverse outcomes of digital game addiction on children, such as decreased academic performance, disrupted sleep patterns, impaired social interactions, and delayed responsibilities (Anderson & Dill, 2000; Gentile, 2009; Horzum, 2011; Sun et al., 2023). Furthermore, digital game addiction is linked to an increased risk of psychological issues, including depression, anxiety, loneliness, and low self-esteem (Lemmens et al. 2011; Mentzoni et al., 2011; Van Rooij et al., 2011). Charoenwanit and Sumneangsator (2014) also mentioned that if children get addicted to playing games, they may lose their interest in going to school and education too; rather they focus on just gaming which eventually leads to having low grades or even be at the stage of refusing in going to school. This suggests that heavy use of digital games in this way is likely to deprive children of other, more beneficial activities. As a result, we must find an intermediate solution instead of eliminating digital games from children's lives, as it would limit their development at the technological level and acquiring significant skills for the world. Hence if we can teach children to play these games consciously and responsibly, most of the risks associated with digital game addiction can be minimized (Aydemir, 2022).

In line with this perspective, Ng (2012) argues that educating children to be digitally literate is the most effective way to protect them from potential dangers, particularly given the challenges in parental and institutional control over children's access to digital tools. In this regard, parental style plays a pivotal role in mediating children's digital experiences. For example, a lack of boundaries and attention from parents can contribute to children's digital game addiction, prompting them to use gaming as a coping strategy for stress and potentially hindering their development of healthy coping mechanisms (Ersoy & Şahbaz, 2023).

Furthermore, different parenting approaches, such as authoritative or permissive styles, significantly influence how children interact with digital media and manage their screen time (Livingstone & Helsper, 2008). For instance, an authoritative parenting style, characterized by warmth and reasonable control, has been associated with positive digital literacy outcomes and a reduced risk of digital game addiction (Lwin et al., 2008). Conversely, permissive or uninvolved parenting may lead to less regulated screen time and a greater susceptibility to addictive behaviors.

Despite the number of studies dealing with digital game addiction and literacy growing, the relations that exist between these factors and parental style in elementary students have received relatively little attention. The insights gained could be more critical since early childhood is a formative period in which most of the behavioral habits are set and, in particular, parental influence is strong. The present study, therefore, investigates how digital literacy, parental styles, and some background variables predict levels of digital game addiction in elementary students as part of the wide examination of how the dynamics within families shape children's digital lives. The present research will try to provide insights that may be useful for parents, educators, and policymakers in encouraging good digital habits and literacy among young learners through the investigation of such relationships.

In light of the research framework, the following hypotheses were tested.

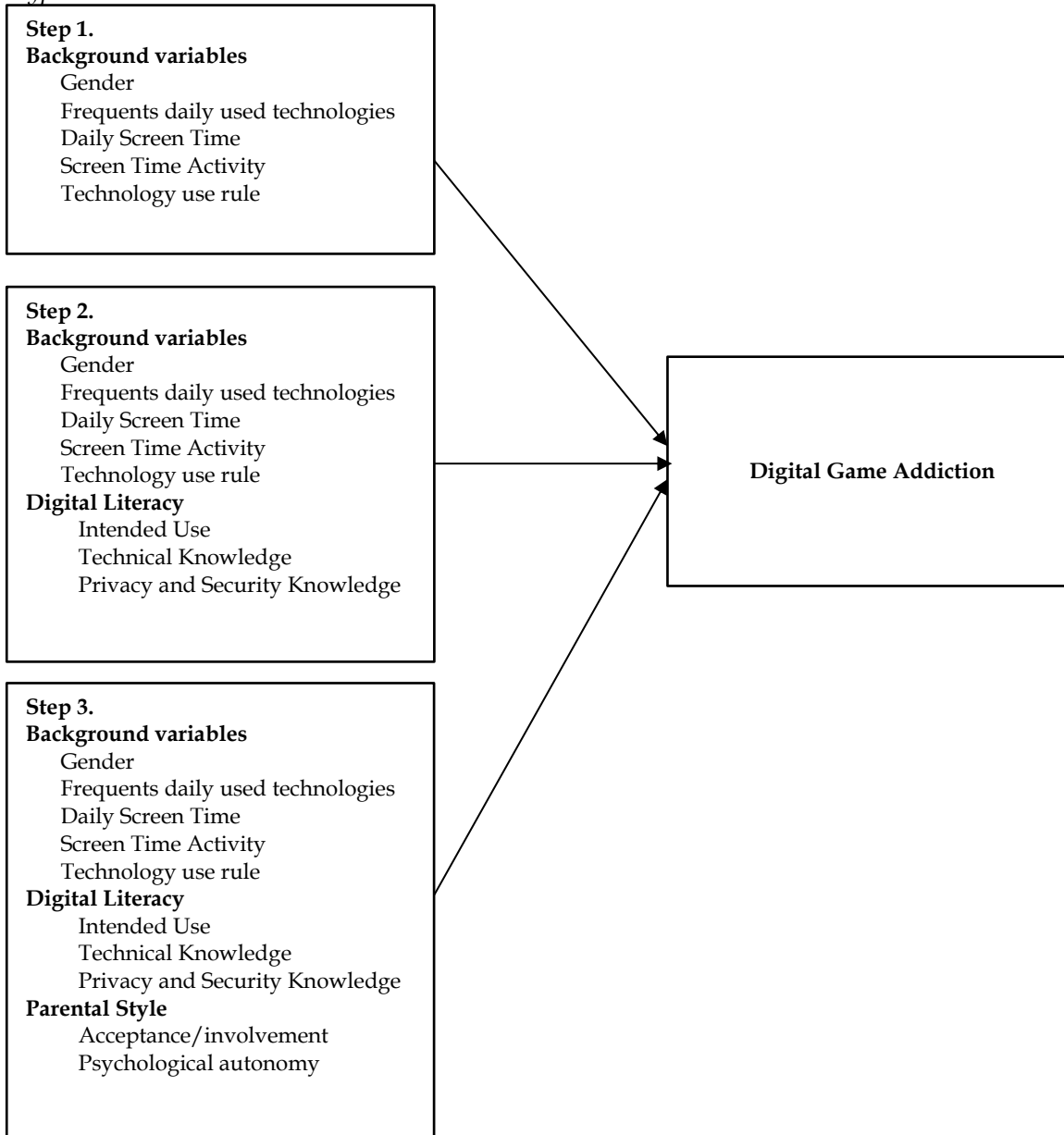
H1: Gender, frequents daily used technologies, daily screen time, screen time activity and technology use rule singly or in combination influence digital game addiction of elementary students.

H2: Gender, frequents daily used technologies, daily screen time, screen time activity, technology use rule, and digital literacy singly or in combination influence digital game addiction of elementary students.

H3: Gender, frequents daily used technologies, daily screen time, screen time activity, technology use rule, digital literacy, and parental style singly or in combination influence digital game addiction of elementary students.

Figure 1

Hypothesized Model



2. Method

2.1. Participants

Participants consisted of 580 fourth-grade primary school students. The data was collected from four different primary schools in a province in the western part of Turkey. Before the data collection, ethical committee approval for the measurement tools was obtained and sent to the schools where data would be collected. Participation in the study was voluntary, and consent forms were filled out by the parents of the students. The researcher personally collected data in all

of the classrooms, with the approval of the teachers. Of the collected survey responses, 530 were considered valid and subjected to further analysis.

2.2. Measurements

The research data was collected using a personal information form, a scale of digital game addiction for children, a digital literacy scale, and a parental style scale.

2.2.1. Personal information form

Personal information form included: a) gender, b) frequents daily used technology, c) daily screen time, d) screen time activity, and e) technology use rule. The gender variable was coded as 0 for males and 1 for females. The frequently used technology was assessed with the question, 'Which of the following digital devices do you spend most of your time with during the day?' The responses were coded as follows: 1 for Smartphone, 2 for Tablet, 3 for PC/Laptop, and 4 for Television. Regarding daily screen time, children were asked "How much time do you spend on screens daily?". The following answers were provided "less than one hour", "1-3 hours", and "more than 3 hours". Screen time activity was assessed by the following question "Which of the following activities do you engage in the most while on screen?". The responses were coded as follows: 0 for "game playing, watching a video" and 1 for "homework or learning". The presence of rules regarding technology use was assessed by the question "Do you have any rules regarding screen time at home with your family?". The responses were coded as 0 for "No" and 1 for "Yes".

2.2.2. Scale of Digital Game Addiction for Children

The Scale for Digital Game Addiction for Children was developed by Şahin et al. (2019). The scale comprised of 5-point Likert type six items and a single factor. The responses ranged from "Absolutely not applicable to me" and "Exactly applicable to me." The Cronbach alpha value of the scale was found to be 0.78.

2.2.3. Digital Literacy Scale for primary school students

Digital literacy scale was developed by Şahin et al. (2022) to determine the digital literacy of primary school students. The scale consisted of 16 items with a three-point Likert type. The digital literacy scale is composed of three sub-dimensions: "intended use", "technical Knowledge" and "privacy and security knowledge". Cronbach alpha value for the scale was found to be .842.

2.2.4. Parenting Style Scale

The Parenting Style Scale was developed by Lamborn et al. (1991) and adapted into Turkish by Yılmaz (2000). The scale consisted of 26 items with three sub-dimensions: acceptance/involvement, psychological autonomy, and strictness/supervision. The scale was developed with three different age groups, namely primary school, high school, and university students, through separate analyses. The total score is not used in the scale and each sub-dimension is evaluated within itself. Cronbach's alpha internal consistency coefficients were .65 for the acceptance/involvement subscale, .75 for the strictness/supervision subscale, and .67 for the psychological autonomy subscale. In this study, only acceptance/involvement and psychological autonomy subscales of the scale were used. As the 'strictness/supervision' sub-dimension includes questions such as 'What time are you allowed to stay out at night during the week' or 'How much do your parents try to know where you go at night', this dimension was not included in the study as it is not culturally appropriate for the age of 4th grade primary school students. The total score is not used in the scale and each sub-dimension is evaluated within itself.

2.3. Statistical Analyses

Statistical analysis of data was performed using Statistical Package for the Social Sciences 22.0. Data were checked for outliers and normality assumptions. Standardized z-scores were examined to detect outliers. A total of 21 cases with z-scores outside the ± 3 range were excluded from the

study. Normality was tested using skewness and kurtosis values. Several statistical tests were performed to examine hypotheses, including, descriptive statistics, independent sample t-test, and one-way ANOVA to assess between-group differences, Pearson's r correlation, and hierarchical regression analysis to examine the relation between variables. The acceptable level of validity was set at a p -value of .05 (5%).

3. Results

3.1. Descriptive Statistics

Table 1 shows that 53.8% of the participants were female. While the majority of participants use smartphones (42.3%) most frequently, televisions (29.4%) emerge as the second most used technology, with PC/laptop (6.7%) being the least used. The majority of primary school students are reported to spend 1-3 hours (56.4%) per day in front of screens. They reported that they spend most of their screen time playing games and watching videos (81.1%). Lastly, the majority of participants stated that they have rules in their homes about using digital technologies (72.3%).

Table 1
Description of Participants

<i>Characteristics</i>	<i>f</i>	<i>%</i>
Gender		
Female	274	53.8
Male	235	46.2
Frequently used technology		
Smartphone	210	41.3
Tablet	115	22.6
PC/Laptop	34	6.7
Television	150	29.4
Daily Screen Time		
Less than 1 hour	163	32
1-3 hours	287	56.4
More than 3 hours	59	11.6
Screen Time Activity		
Homework or learning	96	18.9
Game playing and Watching video	413	81.1
Technology use rule		
Yes	368	72.3
No	141	27.7

The descriptive statistics and skewness and kurtosis values of scales are shown in Table 2. The skewness and kurtosis coefficients were found to be within the range of ± 3 , indicating that the normal distribution assumption was met (Kline, 2016).

Table 2
Descriptive Statistics of Scales

	<i>N</i>	<i>Min.</i>	<i>Max.</i>	<i>M</i>	<i>SD</i>	<i>Skewness</i>	<i>Kurtosis</i>
Digital Game Addiction	509	6	27	12.73	4.62	.491	-.387
Digital Literacy	509	22	47	33.13	4.26	.267	.044
Intended use	509	8	21	14.06	2.29	.158	-.324
Technical knowledge	509	5	15	10.04	2.32	.124	-.556
Privacy and security knowledge	509	4	12	9.02	1.88	-.251	-.712
Parental Style	509						
Acceptance/involvement	509	19	36	29.58	3.42	-.619	.115
Psychological autonomy	509	11	33	22.90	4.19	-.079	-.258

Note. M: Mean; SD: Standard deviation.

The multicollinearity issue was checked through the variance inflation factor [VIF] and tolerance value of independent variables. The VIF scores range from 1.01 to 1.07 and the tolerance value ranged between .930 to .969 indicating that multicollinearity was not a significant problem of study (Hair et al., 2019).

3.2. Group Differences in Digital Game Addiction

To examine the digital game addiction in terms of gender, technology-use rules, and screen activity independent sample *t*-test was performed (see Table 3).

Table 3

Independent sample t-test results

Variable	N	M	SD	t	p
Gender					
Male	235	13.63	4.60	4.14	<.01
Female	274	11.95	4.50		
Technology use rule					
No	141	13.64	4.69	2.78	.006
Yes	368	12.38	4.54		
Screen activity					
Game playing, watching video	413	13.29	4.57	5.90	<.01
Homework or learning	96	10.30	3.99		

Independent sample test results showed that the digital game addiction of male students was significantly higher than that of female students ($t = 4.14, p < .01$). When digital game addiction scores were examined based on whether or not there are rules regarding technology usage at home, it was found that digital game addiction is significantly lower in the group with technology use rules ($t = 2.78, p < .01$). Additionally, a significant difference in digital game addiction was observed based on the screen activity that consumed the most time ($t = 5.9, p < .01$). Specifically, digital game addiction was notably higher for activities such as "video watching or game playing" compared to "homework or learning."

To examine digital game addiction in terms of frequent daily use of technologies and daily screen time a one-way ANOVA test was performed (see Table 4).

Table 4

ANOVA Results for Digital Game Addiction

	N	M	SD	F	p
Frequently used technology					
Smartphone	210	13.29	4.34	1.95	.120
Tablet	115	12.57	4.65		
PC	34	12.18	5.42		
Television	150	12.19	4.72		
Daily Screen Time					
Less than one hour	163	11.36	4.18	27.31	<.01
1-3 hours	287	12.77	4.52		
More than 3 hours	59	16.30	4.34		

Table 4 shows that there were no significant differences in digital game addiction in terms of the most frequently used technology ($F_{(3,505)} = 1.95, p > .01$). However, there were significant differences in digital game addiction based on daily screen time ($F_{(2, 506)} = 27.31, p < .01$). Post hoc comparisons were conducted using the Scheffe test, which is more suitable when sample sizes are unequal. Pairwise comparisons indicated that students with daily screen times exceeding 3 hours ($M = 16.30, SD = 4.34$) exhibit significantly higher levels of digital game addiction compared to their counterparts. Furthermore, students with daily screen times of 1-3 hours ($M = 12.77,$

SD = 4.52) show significantly higher levels of digital game addiction than those with daily screen times of less than one hour ($M = 11.36$ SD = 4.18).

3.3. Relationship between Digital Game Addiction, Digital Literacy, and Parental Style

To examine the relationship between digital game addiction, digital literacy, and parental style Pearson correlation analysis was executed. Table 5 presents Pearson's r correlation coefficients between digital game addiction and sub-factors of digital literacy and parental style.

Table 5

Correlation table of variables

	1	2	3	4	5	6
1. Digital Game Addiction	1					
2. Intended Use	-.116**	1				
3. Technical Knowledge	-.038	.135**	1			
4. Privacy and Security Knowledge	-.185**	.085	.203**	1		
5. Acceptance/involvement	-.188**	.124**	.020	.028	1	
6. Psychological autonomy	-.158**	-.103*	-.035	-.024	-.104*	1

Note. ** $p < .01$; * $p < .05$

As seen in Table 5 digital game addiction is significantly negatively correlated with "intended use" ($r = -.116$) and "privacy and security knowledge" ($r = -.185$) sub-factors of digital literacy. The correlation coefficient between digital game addiction and "technical knowledge" ($r = -.038$) was not statistically significant. The subfactors of parenting style, "acceptance/involvement" ($r = -.188$) and "psychological autonomy" ($r = -.158$), were also found to have a significant negative correlation with digital game addiction.

3.4. Hierarchical Regression Analysis for Predicting Digital Game Addiction

Hierarchical regression analysis was used to predict digital game addiction in elementary students through demographic variables, digital literacy, and parental style. Three sets of regression analyses were executed. In the first step gender, technology use rule, daily screen time, and screen activity were entered into the equation as background variables because of significant differences in digital game addiction.

In the second step, digital literacy -sub-factors were included in the model: intended use, technical knowledge, and privacy and security knowledge. The third step of regression model two sub-scales of parental style: acceptance/involvement and psychological autonomy. Table 6 contains the standardized regression coefficients (β), R^2 , and change $R^2(\Delta R^2)$.

In the first step, it was found that the variables of gender, screen time, and screen activity significantly predicted digital game addiction of elementary students, while the unique contribution of the technology-use rule was not significant in the model ($F_{(4, 504)} = 21.79$ $p < .001$). The variables in the first step explained approximately 15 % of the digital game addiction ($R = .384$, $R^2 = .147$) (H1 accepted). In the second step, three sub-factors of digital literacy were entered into the model. Although the "privacy and security knowledge" dimension of digital literacy was a significant predictor, neither "intended use" nor "technical knowledge" were significant predictors of digital game addiction. The second model explained 18% of digital game addiction with a significant increase in the variance from ($\Delta R^2 = .33$) the first model ($R = .425$, $R^2 = .181$, $F_{(7, 501)} = 15.79$, $p < .001$) (H2 accepted). The third stage of the regression model included two scales of parental style, namely "acceptance/involvement" and "psychological autonomy". Both of the sub-factors of parental styles were found to be significant predictors of digital game addiction and the third model of regression explained 22,5% of the digital game addiction variance ($R = .474$, $R^2 = .225$, $F_{(9, 499)} = 16.07$, $p < .001$) (H3 accepted).

Table 6
Hierarchical regression analysis results

	B	β	t	p	R	R ²	ΔR^2
Step 1					.384	.147**	.147**
Constant	-0.38		-2.36	.019			
Gender	-0.23	-0.11	-2.73	.007			
Screen time	0.38	0.24	5.68	<.001			
Screen activity	-0.49	-0.19	-4.62	<.001			
Technology use rule	-0.13	-0.06	-1.38	.168			
Step 2					.425	.181**	.033**
Constant	-0.37		-2.33	.020			
Gender	-0.24	-0.12	-2.91	.004			
Screen time	0.36	0.23	5.52	<.001			
Screen activity	-0.49	-0.19	-4.61	<.001			
Technology use rule	-0.10	-0.04	-1.06	.289			
Intended Use	-0.07	-0.07	-1.77	.078			
Technical Knowledge	-0.01	-0.01	-0.19	.852			
Privacy and Security Knowledge	-0.16	-0.16	-3.85	<.001			
Step 3					.474	.225**	.044**
Constant	-0.38		-2.49	.013			
Gender	-0.22	-0.11	-2.68	.008			
Screen time	0.34	0.22	5.31	<.001			
Screen activity	-0.45	-0.18	-4.32	<.001			
Technology-use rule	-0.05	-0.02	-0.58	.561			
Intended Use	-0.08	-0.08	-1.90	.058			
Technical Knowledge	-0.01	-0.01	-0.23	.814			
Privacy and Security Knowledge	-0.16	-0.16	-3.96	<.001			
Acceptance/involvement	-0.13	-0.13	-3.30	.001			
Psychological autonomy	-0.18	-0.18	-4.48	<.001			

4. Discussion and Conclusion

The findings of the present study will go a long way in informing practitioners of those factors that influence digital game addiction among students in elementary school. Precisely, analysis reveals that gender, screen time, and screen activity are significant predictors of digital game addiction, whereas technology-use rules are not. The findings also point out that "privacy and security knowledge," as part of digital literacy, and different parental styles, such as "acceptance/involvement" and "psychological autonomy," are involved in shaping children's digital game addiction. The findings fit with and extend prior literature related to digital game addiction and child development.

In the first step, gender, screen time, and activity on the screen appeared as strong predictors of digital game addiction from the regression model. This finding was consistent with earlier findings that generally speaking, boys tend to be more prone to digital game addiction than girls (Choo et al., 2010; Rehbein et al., 2015). First, boys may be more attracted to the reward systems in gaming, such as leveling up or reaching high scores, where there is a stimulus for repeated behavior, which can lead to addictive behavior. In addition, most digital games designed and marketed these days tend to be more towards male interests; these themes involve actions, combats, or sports that probably appeal more naturally to boys. Whereas girls might use digital devices less or more for social networking/communication, the same is not necessarily true for gaming.

Additionally, the positive correlation between increased screen time with digital game addiction echoes findings from earlier research that emphasize the relationship between extensive screen use and addictive behaviors in children (Gentile et al., 2011; Kuss & Griffiths, 2012). Based on similar findings in their study, Geniş and Alkaya (2023) emphasized that reducing digital game addiction requires limiting digital device use and encouraging children to participate in sports and artistic activities that contribute to their socialization and communication skills. Screen activity was also an important predictor of digital game addiction. Children who use digital devices for game playing and watching videos are more susceptible to developing addictive behaviors compared to those who use the internet mainly for homework or learning. This finding supports that activities like gaming and watching videos, which provide immediate rewards and stimulate the brain's reward centers, are more likely to lead to addictive behaviors than more goal-oriented activities, such as doing homework or learning (Peterson, 2021). However, the lack of a significant contribution from technology-use rules suggests that merely having rules about technology use may not be sufficient to reduce digital game addiction risk. This aligns with the arguments of Blum-Ross and Livingstone (2016), who stated that rules alone are often ineffective without consistent enforcement and engagement from parents.

In the second step of the analysis, the inclusion of three sub-factors of digital literacy—namely, "privacy and security knowledge," "intended use," and "technical knowledge," which provided deeper insights into the relationship between digital literacy and digital game addiction. Notably, only the "privacy and security knowledge" dimension emerged as a significant predictor of digital game addiction. This suggests that children who are aware of online risks, such as privacy breaches and cybersecurity threats, may develop better self-regulation skills, which in turn could reduce their susceptibility to digital game addiction. Children who are unaware of privacy and security risks might engage more freely with digital games and online platforms, leading to increased exposure and potentially addictive behaviors. This finding aligns with previous research that emphasizes the role of awareness and understanding of online privacy and security in enhancing self-regulation within digital environments (Andrews et al., 2020; Livingstone et al., 2018). Conversely, the lack of significance for "intended use" and "technical knowledge" suggests that while these aspects of digital literacy are essential, they do not directly correlate with lower levels of digital game addiction. This outcome can be contextualized within broader discussions on digital literacy. For instance, Livingstone et al. (2023) argue that an exclusive focus on technical skills in digital literacy education may be inadequate, as it risks neglecting critical thinking and evaluative skills necessary for responsible digital behavior. Similarly, Ng (2012) notes that while

digital literacy is crucial for navigating the complexities of the digital world, it does not inherently promote mindful or balanced digital practices.

The third stage of the regression model introduced parental styles, specifically "acceptance/involvement" and "psychological autonomy," both of which were significant predictors of digital game addiction. These findings are consistent with the existing literature, which has long emphasized the importance of parenting style in influencing children's digital behaviors. For instance, Bjelland et al. (2015) found that when children view their parents as fostering autonomy, they are more likely to comply with rules regarding digital device use, which helps reduce their tendency toward addictive behaviors. Furthermore, authoritative parenting, characterized by warmth, involvement, and reasonable control, has been associated with a reduced risk of digital game addiction and positive digital literacy outcomes (Lwin et al., 2008; Moazedian et al., 2014). Huang et al. (2020) also noted that children without game addiction were more likely to have experienced compassionate and understanding parenting, while those with game addiction were more often exposed to parenting styles involving abandonment, rejection, or over-involvement. In contrast, permissive or uninvolved parenting has been linked to higher levels of digital game addiction due to a lack of regulation and oversight (Ayas & Horzum, 2013; Lo et al., 2020). The significance of "psychological autonomy" suggests that when parents encourage independence while maintaining a supportive relationship, children may develop better self-regulation skills and be less prone to addictive behaviors. This finding supports research that advocates for balanced parenting approaches, which foster both autonomy and guidance (Chou & Lee, 2017). It can be suggested that effective digital parenting includes limiting very young children's screen time, co-using devices, discussing online safety, and providing guidance rather than just restrictions.

Overall, the results of this study suggest that while individual variables such as gender and time spent on screen are implicated in digital game addiction, contextual variables such as digital literacy and parental style are also required. This amplifies the necessity for addressing digital game addiction through a holistic approach that encompasses not just limiting screen time but also enhancing certain digital literacy competencies and encouraging healthy parenting practices. These findings therefore point to the need for intervention programs to foster education for both children and parents in a balanced approach toward the use of digital media; to encourage digital literacy, including privacy and security awareness; and to develop authoritative parenting practices that combine warmth with reasonable control and autonomy support.

Future research should further investigate the interplay between these factors, considering additional variables such as cultural context, socio-economic status, and peer influences that might affect digital game addiction. Moreover, longitudinal studies could provide deeper insights into how these relationships evolve and the long-term impact of various interventions on reducing digital addiction risks among young learners.

In conclusion, this study underscores the multifaceted nature of digital game addiction among elementary students. It highlights the importance of a balanced approach that incorporates digital literacy education and supportive parenting styles to mitigate addiction risks and promote healthy digital habits among children.

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