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THE EFFECTS OF DIGITAL ADDICTION ON EMOTIONAL AND BEHAVIORAL PROBLEMS AND LONELINESS AMONG MIDDLE SCHOOL STUDENTS: A MIXED-METHODS STUDY

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Abstract

This study aimed to examine the effects of middle school students' levels of digital addiction on emotional and behavioral problems, and loneliness. A sequential explanatory design was employed with 1313 students who completed the Digital Addiction Scale for Children, the Strengths and Difficulties Questionnaire, and the Children's Loneliness Scale. Seventeen students also participated in semi-structured interviews. Pearson correlation and linear regression analyses were used for quantitative data, while content analysis was applied to qualitative data. The introverted and interpersonal dimensions of digital addiction were significant predictors of emotional distress, conduct problems, hyperactivity, interpersonal problems, prosocial behavior, and loneliness. Emotional and behavioral problems also significantly predicted loneliness. The qualitative findings revealed themes such as time spent with digital devices, coping strategies, positive and negative effects of digital device use, and the impact of digital deprivation. Overall, interpersonal and intrapersonal relations were found to increase emotional and behavioral difficulties. Interpersonal relations positively predicted peer problems and loneliness but negatively predicted prosocial behavior, while intrapersonal relations did not predict peer problems, conduct issues, or loneliness. Emotional symptoms, conduct problems, and peer problems increased loneliness, while prosocial behavior decreased it.

Keywords: Addiction, Adolescent, Behavioral symptoms, Loneliness, Mixed methods.

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INTRODUCTION

Digital addiction occurs when individuals begin to experience negative effects from their constant interactions with technological tools (Sechi, Loi, & Cabras, 2021). Digital addiction is defined as dependence on digital devices and applications; it is an umbrella term that primarily encompasses the negative effects of these technologies on daily life, including addiction to the internet, television, social media, digital games, and/or smartphones (Arslan, Kırık, Karaman & Çetinkaya, 2015). It is a form of behavioral addiction with many addicts in nearly all age groups, and it is considered the most prevalent form of addiction in the modern age (Horzum, 2011). The phenomenon of digital addiction is becoming increasingly central to the lives of many people, directly affecting the dynamics of daily life and leading to numerous physical, emotional, and social problems (Çelik et al., 2023; Peper & Harvey, 2018; Reichert et al., 2021).

Researchers frequently demonstrate that digital addiction affects individuals' emotions and personality traits. Individuals who interact intensively with technology begin to place less importance on interacting and bonding with others and become disengaged from social life (Kay & Sağlam, 2025; Volungis, Kalpidou, Popores & Joyce, 2020). Individuals with compulsive computer-use behaviors have been observed to exhibit aggression and introversion, as well as antisocial and narcissistic personality traits (Black, Belsare & Schlosser, 1999). One study found that individuals with internet addiction tended to lie more frequently, exhibit higher levels of psychoticism and neuroticism, display inconsistent emotional responses, and demonstrate weaker social behavior compared to those without internet addiction (Cao & Su, 2007). In another study, a positive correlation was found among internet addiction, openness to experience, and extraversion (McElroy, Hendrickson, Townsend & DeMarie, 2007). Moreover, problematic internet users were found to be more distant in their interpersonal relationships, more likely to dislike others, and less responsive to events (Xiuqin et al., 2010). Other researchers concluded that greater use of, and preference for, digital communication tools were linked to higher levels of internalizing symptoms, identity distress, existential anxiety, peer aggression, and attachment-related anxiety, despite their negative association with relationship avoidance (Cyr, Berman & Smith, 2015). Furthermore, elevated emotional problems and social media addiction were found to be associated with lower levels of self-esteem (Acar, Avcılar, Yazıcı & Bostancı, 2022).

Studies have revealed that loneliness is positively correlated with digital addiction (Huang, Zhang, Duan & He, 2023). Moreover, lonely people who lack strong social relationships and social skills have been found to engage in more online interactions and to use the internet as a tool to alleviate their loneliness and other life problems (Kim, LaRose & Peng, 2009). Lonely people use the Internet to communicate, to seek emotional support, and to cope with their moods. They may express their feelings on the internet similarly to other people, but their internet use in this way increases their digital dependency, creating a vicious cycle and further negatively affecting their social and emotional well-being (Morahan-Martin & Schumacher, 2003).

Since middle school education is a major transition points in the lives of children entering adolescence, a thorough understanding of the factors affecting this transition and of how to manage them is essential. To date, mixed-methods studies have focused on the prevalence of internet addiction and related psychological comorbidities (Tenzin et al., 2019), the relationship between lifestyle and smartphone addiction (Freitas, Gaíva, Diogo & Bortolini, 2022), effective intervention strategies for smartphone addiction (Chun, 2018), and smartphone usage patterns, addiction, and related factors (Ladani, Yogesh, Trivedi, Gandhi & Lakkad, 2025). In contrast, the aim of the present study is to explain the relationships among middle school students' digital addiction, emotional and behavioral problems, and loneliness using an explanatory sequential design.

MATERIAL AND METHOD

Research Model

This study employed a mixed-methods approach, incorporating both quantitative and qualitative methods. Mixed-methods research is a research methodology in which researchers collect, analyze and integrate both quantitative and qualitative data in a single or multistage study (Creswell & Clark, 2017). Mixed-methods research designs can be further divided into four categories: explanatory, explanatory-embedded, explanatory-sequential, and variational. The present study employed an explanatory sequential design. The explanatory sequential design consists of two stages. In the first stage, quantitative data are collected. After the quantitative data were analyzed using statistical methods,

qualitative data were collected using qualitative methods to examine the data in depth. Data collection processes are carried out separately (Yıldırım & Simsek, 2021). In this context, quantitative data was first collected in our study, and then qualitative data were collected from students with low, medium, and high dependency scores to ensure maximum diversity and were analyzed. The research design is shown in Figure 1.

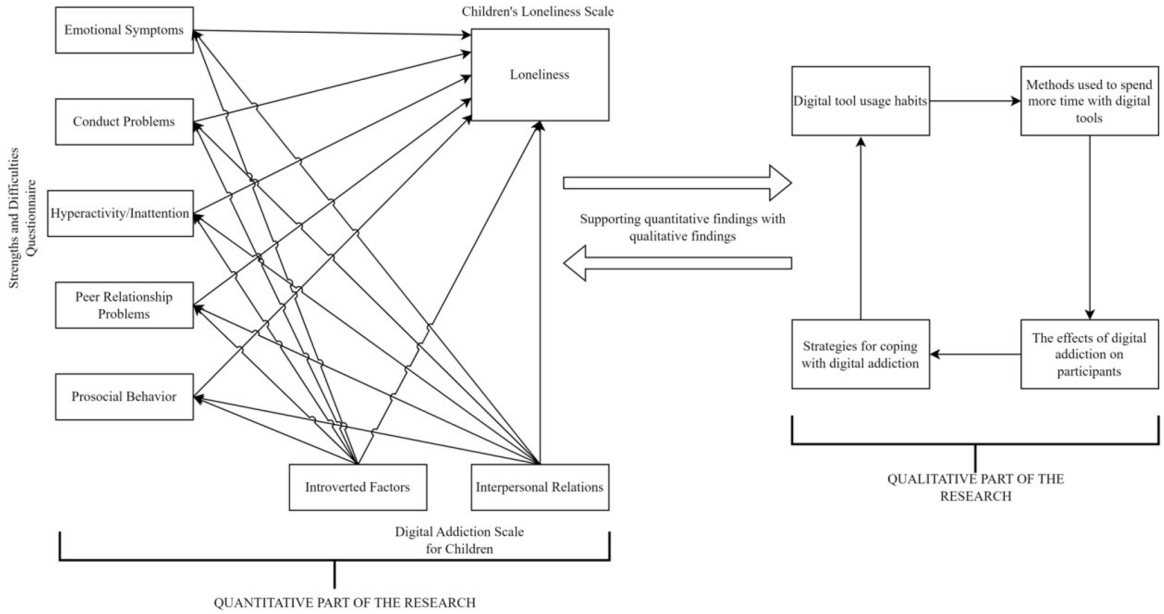


Figure 1. Research Model

Participants

The study population consisted of students in grades 6–8 (N = 10,750). Random (simple random) sampling was used to select participants (Büyüköztürk, Akgün, Demirel, Karadeniz & Çakmak, 2016; Kılıç, 2013). The minimum sample size for the quantitative portion of the study was calculated to be 984, with a confidence level of 0.999 and an error level of 5%. Subsequently, 1,313 students were enrolled in the study to ensure the validity and reliability of the collected data.

Using maximum variation sampling, 35 students with high, average, and low digital addiction scores were selected to form the study group for the qualitative portion of the research. Parental consent forms were sent to the families of those students. Seventeen children (6 low scorers, 5 average scorers, 6 high scorers) whose parents consented to the child's participation in the study were included.

Data Collection Tools

In the quantitative phase of the study, a personal information form, the Digital Addiction Scale for Children (DASC), the Strengths and Difficulties Questionnaire (SDQ) for adolescents, and the Children's Loneliness Scale (CLS) were administered. The personal information form collected information on the students' personal and sociodemographic characteristics and their digital device use habits.

Digital Addiction Scale for Children: The DASC is a measurement tool designed to assess digital device use in children aged 9–12 years. This scale measures the extent to which children's use of smartphones, tablets, and/or laptops/computers negatively affects their educational, psychological, social, and physical well-being. The scale comprises two dimensions: intrapersonal and interpersonal relations. As criteria for addiction, interpersonal relations include mood modification, preoccupation, withdrawal, and tolerance. The interpersonal factors include conflict, deception, displacement, relapse, and problems, all of which are also criteria for addiction. The Cronbach's alpha for the scale is 0.936. Higher scores indicate a greater risk of digital addiction (Hawi, Samaha, & Griffiths, 2019). For this study, Cronbach's alpha coefficients were 0.84 for intrapersonal relations, 0.85 for interpersonal relations, and 0.90 for the scale as a whole.

Strengths and Difficulties Questionnaire: The SDQ consists of 25 items across five dimensions: emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behavior. The reliability coefficients of these dimensions and of the total score are 0.22–0.70 and 0.73, respectively. An increase in the total score indicates greater inattention/hyperactivity, conduct problems, emotional symptoms, and peer relationship problems, and decreased prosocial behavior (Güvenir et al., 2008). In this study, Cronbach's alpha values for the emotional symptoms and conduct problems subscales were 0.67 and 0.50, respectively. Cronbach's alpha was 0.50 for the hyperactivity/inattention subscale, 0.28 for the peer relationship problems subscale, and 0.66 for the prosocial behavior subscale. It was decided that the value obtained was sufficient, and the scale was included in the study.

Children's Loneliness Scale: The internal validity coefficient of the CLS, which was designed to measure the degree of loneliness in children, was found to be 0.87. Higher CLS scores indicate higher degrees of loneliness (Kaya, 2005). In our study, the Cronbach Alpha reliability coefficient for CLS was calculated as 0.91.

Semi-Structured Interview Form: This form was developed based on a review of the relevant literature and on input from experts, including developmental and child psychologists. It aimed to explore children's digital habits and the internal and interpersonal dimensions of digital addiction. The form included open-ended questions designed to gain deeper insight into students' experiences with digital device use. For example, students were asked whether digital devices were replacing their daily responsibilities or activities ("Are digital devices replacing your daily responsibilities or activities?") and how they felt when they were unable to use or were asked to limit their use of digital devices ("How do you feel when you are unable to use your digital devices when you try to limit your use, or when you are asked to stop or reduce your use?").

Data Collection Process

The data for the study were collected between March 4, 2022, and March 15, 2022, in four separate sessions conducted face-to-face with each student at the school where they were studying. Prior to the administration of the scales, the purpose and scope of the study were explained to the students, and they confirmed their voluntary participation. Qualitative data were collected face-to-face in an empty room where students could feel comfortable. During the interviews, the purpose of the study and the scientific and ethical principles involved in the survey process were explained to the students. The process began with a simple conversation between the researcher and the students, and the students were given the opportunity to review the semi-structured interview form before the formal interview began. The semi-structured interview form includes six questions about children's digital habits and the intrapersonal and interpersonal dimensions of digital addiction, along with follow-up questions probing these dimensions. Sample follow-up questions are as follows: "What do the people around you say about your use of digital tools? Do your family, friends, teachers, or others complain about your use of digital tools?" With the students' consent, the interviews were recorded using a voice recorder. These interviews lasted between 20 and 25 minutes.

Data Analysis

Quantitative data were coded using IBM SPSS Statistics 25, and the assumption of normality, as well as skewness and kurtosis were examined. Pearson correlation analysis was used to test the relationships between scale values; simple linear regression analysis was used to estimate the effects of independent variables on dependent variables.

In this study, content analysis was used to examine qualitative data. In content analysis, the collected data are examined and interpreted systematically and in depth using certain filters to reveal the themes, facts, and conclusions of the research (Baltacı, 2019).

In this study, as suggested by Sarı and Nayır (2020), the responses to each question were first carefully analyzed, and similar statements were grouped for coding. The data were manually coded by the researcher. During the coding process, both the conceptual framework the literature was considered, and new codes were developed based on the participants' responses. These codes were combined, commonalities were identified, and themes were derived. In the final stage, the codes and themes identified were explained and the results were interpreted. In this context, five themes were identified: methods used to increase time spent on digital devices, strategies for coping with digital addiction, effects of digital addiction on daily life and interpersonal relationships, positive and negative effects of digital devices on participants, and effects of digital deprivation.

In qualitative research, study validity and reliability are ensured by the following criteria: internal validity (reliability), external validity (transferability), internal reliability (consistency), and external reliability (verifiability) (Shenton, 2004; Yıldırım & Şimşek, 2021). In qualitative research, data diversification, detailed description, and expert opinions can be used to ensure internal validity (Tutar, 2022). In this study, the processes of data collection, analysis, and interpretation are described in detail to ensure internal validity, and the research themes are similarly outlined. Additionally, the data analysis process was reviewed by an independent researcher. In qualitative research, external validity concerns the extent to which research findings can be applied and generalized to other situations (Lincoln & Guba, 1986). For external validity, the methods for selecting and identifying participants and for structuring the interviews are reported in detail. Additionally, the results are compared with those of previous studies to identify similarities and differences. To ensure internal reliability, participants' direct statements were included in the interpretation of the results. To assess external reliability, participants were asked questions in an unbiased manner, and responses were collected in writing without interference. Confidentiality was maintained when presenting participant information, and participants were coded as P1, P2, P3, etc., instead of using their names.

Ethical Considerations

Ethical approval for the study was obtained from the İnönü University Scientific Research and Publication Ethics Committee (2021/2067), and permission to conduct research in schools was obtained from the Ministry of National Education. Prior to their inclusion in the study, participants were thoroughly informed about the study's general aim, duration, confidentiality protocols, and conditions of participation. Informed consent was also obtained from the parents or legal guardians of the participants.

RESULTS

Results Obtained from the Quantitative Research

The demographic data of the students participating in the study are presented in Table 1. Of the students participating in the study, 50.7% were boys and 49.3% were girls. When the students' grade levels are examined, 35.5% are in sixth grade, 32.9% are in seventh grade, and 31.6% are in eighth grade.

Table 1. Information on the Sociodemographic Characteristics of Participants

Characteristic		N	%
Gender	Male	647	49.3
	Female	666	50.7
Grade	6th grade	466	35.5
	7th grade	432	32.9
	8th grade	415	31.6
Family income	Low	165	12.6
	Average	998	76.0
	High	150	11.4
Mother's education level	Illiterate	143	10.9
	Elementary school	426	32.4
	Middle school	304	23.2
	High school	261	19.9
	University	145	11.0
	Master's degree or PhD	27	2.1
	No information	7	0.5
Father's education level	Illiterate	53	4.0
	Elementary school	189	14.4
	Middle school	266	20.3
	High school	369	28.1
	University	334	25.4
	Master's degree or PhD	81	6.2
	No information	21	1.6
Success in the classroom	Highly successful	354	27.0
	Moderately successful	890	67.8
	Low level of success	69	5.3
Duration of digital device usage on weekdays	None	152	11.6
	0-1 hour	613	46.7
	1-3 hours	397	30.2
	3-5 hours	101	7.7
	5-9 hours	35	2.7
	9 hours or more	15	1.1
Duration of digital device usage on weekends	None	94	7.2
	0-1 hour	347	26.4
	1-3 hours	507	38.6
	3-5 hours	250	19.0
	5-9 hours	73	5.6
	9 hours or more	42	3.2

The results of the descriptive and correlation analyses for DASC, SDQ subscales, and CLS are presented in Table 2. According to the correlation analysis, interpersonal relations showed a strong positive association with intrapersonal relations (r = 0.789), a moderate relationship with conduct problems (r = 0.492), and weaker but significant relationships with emotional symptoms (r = 0.354), hyperactivity/inattention (r = 0.357), peer problems (r = 0.271), and loneliness (r = 0.261). A negative correlation with prosocial behavior was found (r = -0.276). Intrapersonal relations also had a moderate association with conduct problems (.440) and weaker associations with emotional symptoms (.341), hyperactivity/inattention (.348), peer problems (.235), loneliness (.225), and prosocial behavior (-.228). Emotional symptoms were positively related to conduct problems (0.340), hyperactivity/inattention (0.438), peer problems (0.374), and loneliness (0.427), but they were not significantly related to prosocial behavior. Other notable findings included moderate-to-low correlations between conduct problems and hyperactivity, peer problems, and loneliness, while prosocial behavior was consistently negatively correlated with these variables.

Table 2. Results of Descriptive Statistics

	X	SD	1	2	3	4	5	6	7	8
1. DASCif	221.211	908.563	-							
2. DASCir	251.455	1026.483	.789**	-						
3. SDQes	34.478	252.286	.354**	.341**	-					
4. SDQcp	27.997	197.282	.492**	.440**	.340**	-				
5. SDQhi	40.297	218.012	.357**	.348**	.438**	.371**	-			
6. SDQprp	33.663	195.545	.271**	.235**	.374**	.314**	.224**	-		
7. SDQpb	78.233	209.183	-.276**	-.238**	-.027	-.327**	-.150**	-.202**	-	
8. CLS	299.063	1268.706	.261**	.225**	.427**	.313**	.266**	.455**	-.222**	-

**: p<0.01, DASC: Digital Addiction Scale for Children, SDQ: Strengths and Difficulties Questionnaire, DASCif: DASC "intrapersonal relations" dimension, DASCir: DASC "interpersonal relations" dimension, SDQes: SDQ "emotional symptoms" dimension, SDQcp: SDQ "conduct problems" dimension, SDQhi: SDQ "hyperactivity/inattention" dimension, SDQprp: SDQ "peer relationship problems" dimension, SDQpb: SDQ "prosocial behavior" dimension, CLS: Children Loneliness Scale

Results of the regression analysis predicting loneliness from social and emotional problems are presented in detail in Table 3. Our analysis shows that intrapersonal relations significantly and positively predict emotional symptoms (β=.224), conduct problems (β=.384), hyperactivity/inattention (β=.219), peer relationship problems (β=.227), and loneliness (β=.222), whereas they significantly and negatively predict prosocial behavior (β=-.234). In addition, our results indicate that interpersonal relationships significantly and positively predict emotional symptoms (β = 0.165), conduct problems (β = 0.137), hyperactivity/inattention (β = 0.176), and peer relationship problems (β = 0.056). However, interpersonal relations are not significant predictors of loneliness (β = 0.050) and prosocial behavior (β = -0.053).

Table 3. Regression Analysis

	Emotional symptoms		Conduct problems		Hyperactivity/inattention		Peer relationship problems		Prosocial behavior		Loneliness	
	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Intrapersonal relations	.224***	.012	.384***	.008	.219***	.010	.227***	.009	-.234***	.010	.222***	.061
Interpersonal relations	.165***	.010	.137***	.007	.176***	.009	.056***	.008	-.053	.009	.050	.054
Model R^2	0.134		0.249		0.138		0.073		0.076		0.068	
Model F	102.725		216.994		106.034		53.011		54.846		48.669	

*: $p<0.05$, ***: $p<0.001$

Results Obtained from the Qualitative Research

After the qualitative data were analyzed using content analysis, the study's themes, categories, and codes were identified. In this context, five themes were identified: methods used to spend more time with digital devices, strategies for coping with digital addiction, effects of digital addiction on daily life and human relations, positive and negative effects of digital devices on participants, and effects of digital deprivation.

Theme 1: Methods Used to Spend More Time with Digital Devices

In the context of Theme 1, the participating children used resistance, exchange, lying, and anger projection to spend more time on their digital devices. Reported resistance behaviors included participants exceeding time limits set by their families on digital device use and arguing with their families to continue using them. For example:

P17: "*Sometimes I yell at them not to bother me. Sometimes, when they take [the device] and hide it I find it anyway.*"

Among the reported exchange methods, participants whose use of digital devices was restricted in some way bargained with their parents in order to use the devices more. For example:

P12: *"I'm trying to improve my academic achievement in order to play more."*

P9: *"They keep the phone at all times; they say they'll never give it to me again, but they do return it. If they do not give it to me, I do not study; consequently, they give it to me."*

P17: *"...my parents hide it, but I find it and continue to use it [I say], 'I just got it, don't bother me, I don't want to go outside.'"*

P9: *"My mom tries to limit me because I want to spend more time on my phone; for this reason, we usually fight. I become angry and hit objects when my mother attempts to take the phone."*

P6: *"...I feel bad; I get angry and hit myself against the wall."*

Theme 2: Strategies for Coping with Digital Addiction

In the context of Theme 2, participants used various strategies to cope with digital addiction, such as setting time limits, practicing self-restraint, distracting themselves with other thoughts, avoiding technological devices, and following a daily schedule. For example:

P7: *"It used to happen. Once I began taking it, I could not quit using it. There had to be a warning. To handle it, I would set a time limit for myself, using it from this time to this time. I would also set my alarm, and when it rang, I would start my homework."*

P13: *"I try to handle it by shutting myself in a room without any technological devices and spending time there."*

P11: "...I was too dependent for a while. I tried not to think about it much, I was thinking about other things."

P17: "I try to cope by preparing a daily plan and following it, but I can't handle it that well."

Some participants did not attempt to address this problem. For example:

P12: *"I don't try to cope with it, I just play until my family takes [the device] away from me."*

Reasons participants might avoid addressing their digital addiction include failing to see it as a problem or lacking information about methods to combat it. Methods that help children cope effectively with digital addiction at the individual level should be offered.

Theme 3: Effects of Digital Addiction on Daily Life and Human Relations

In the context of Theme 3, digital devices were found to affect the participants' eating habits, family interactions, peer relationships, and school life. Participants reported behaviors such as delaying meals, not eating at all, or thinking about their ongoing games while eating, often due to their reluctance to pause digital activities or their lack of awareness of how much time had passed. These behaviors led to disruptions in their regular nutrition routines. For example:

P16: *"...when I was playing games, I was late for dinner or my mind was always on the game while eating."*

P13: *"Sometimes I stop eating and watch TV."*

P5: *"I put off eating."*

The participants' habits of using digital devices were also found to have a negative effect on their family relationships. Participants spent time on their digital devices instead of spending time with their family members or participating in joint family activities, and they often distanced themselves from or argued with them. For example:

P8: *"I was missing out on hours of reading books and couldn't spend enough time with my family."*

P17: *"Sometimes I do not even know what is going on at home. Sometimes they call me for dinner and I do not go; sometimes I stay hungry until the middle of the night."*

It was stated that parents became angry, threatened their children, complained, gave advice, and suggested that their children's health would deteriorate, in order to limit their use of digital devices. According to the children, these techniques used by parents are not very effective, and the intended lessons are not internalized. It is necessary to inform parents about how to address digital addiction in a healthy, scientifically sound manner.

Analysis of the effects of the participants' digital activities on their school lives showed that some participants did not complete, postponed, or forgot their homework or studying, missed the school bus, experienced difficulty focusing in class, and were sometimes unwilling to attend school. For example:

P2: *"I put off studying."*

P13: *"... it affects me negatively because I don't do my homework, don't study, and don't spend enough time with my family."*

According to the information given by the participants in their interviews, the uncontrolled use of digital devices negatively affected their academic performance, they were they were warned by their teachers at school and were ordered to meet with the school's guidance counselors. Participants also mentioned the positive effects of digital devices on interpersonal relationships in their daily lives, and negative effects, such as reduced socialization. For example:

P17: *"...it prevents me from socializing. I don't talk to anyone too much."*

P12: *"It allows me to socialize with my friends."*

Theme 4: Positive and Negative Effects of Digital Devices on Participants

In the context of Theme 4, it was seen that the use of digital devices had both positive and negative effects on the participants. Participants stated that digital devices provide support for research and homework, they learn new things thanks to these tools, they enjoy temporary relaxation, they are informed about current developments, they acquire new hobbies, they find relief from negative emotions, and they are able to calm down, socialize, and relieve stress or loneliness. For example:

P11: *"It has a positive effect because I can do research and learn new things."*

P12: "*... sometimes it makes me forget bad things… I watch videos to improve myself. For example, I have a skill in origami and I improve it."*

P7: "*...listening to music helps me get away from negative emotions."*

P9: *"It relieves my sadness and loneliness. I don't really tell anyone about my things."*

However, the use of digital devices was observed to have negative physical effects on the participants, including headaches and dizziness, low back pain, hand numbness and tingling, eye pain and burning, disrupted sleep patterns, fatigue, and limitations in daily physical activities. In addition, participants stated that they did not spend time with their families due to their use of digital devices; they were disconnected from their environments; they had difficulty focusing on their classes; they experienced fears; they lost their sense of time or their willpower; and they spent more time than necessary on their digital devices. For example:

P7: *"When I use it too much, I get a headache and it makes my eyes blurry."*

P17: "Sometimes I can sleep for only three hours. It makes me feel tired, and sometimes my eyes hurt. My fingers are numb. I also experience brief lapses of attention. I can't hear when someone calls me."

P13: "It negatively affects me because it occupies a large portion of my time. It makes me feel tired, and my eyes hurt, but I still feel compelled to continue using it."

Theme 5: Effects of Digital Deprivation

Within Theme 5, participants reported that digital deprivation led to feelings of loneliness, sadness, and shame. Sometimes they engaged in reckless behavior, became obsessive, lost control and had outbursts of anger, felt upset or resentful, experienced a sense of spiritual emptiness or disappointment, wanted to cry, or felt incomplete. For example:

P2: "*I feel very bad when I can't find my phone or when they take it away. I feel incomplete."*

P6: *"I feel bad, I get angry, I hit myself against the wall, I become embarrassed around my friends; it happens in the most enjoyable part of the game." I feel very embarrassed in front of my friends; I feel like crying."*

P8: *"I feel bad, I shout and fight, I get angry."*

P11: *"I feel frustrated and unfinished. My mind stays there [in the game]."*

P9: *"I want to smash everything; it happens instantly, and I feel demoralized."*

P17: *"Sometimes I can sleep for only three hours. It makes me feel tired, and sometimes my eyes hurt. My fingers are numb. I also experience brief lapses of attention. I can't hear when someone calls me."*

P13: *"It negatively affects me because it occupies a large portion of my time. It makes me feel tired, and my eyes hurt, but I still feel compelled to continue using it."*

In addition, parents' interventions in their children's use of digital devices disappointed the children, who perceived these interventions as violations of their freedom. Furthermore, one of the factors leading children to digital addiction seemed to be the deterioration of their relationships with friends and the ensuing desire to address loneliness using digital devices.

DISCUSSION

The purpose of this study was to examine the effects of digital addiction among middle school students on emotional symptoms, behavioral problems, prosocial behaviors, peer relationships, and loneliness, using quantitative and qualitative data in an explanatory sequential design. The relationships between introversion and interpersonal relationships, as dimensions of digital addiction, and psychosocial variables were analyzed and the obtained quantitative findings were supported by qualitative data obtained from semi-structured interviews with students.

The results showed that intrapersonal and interpersonal relations, as dimensions of digital addiction, significantly predicted emotional symptoms among the participating middle-school students. In other words, higher levels of digital addiction are associated with higher levels of emotional symptoms in middle school students. Difficulties in children's interpersonal and intrapersonal relationships can cause emotional problems that affect their social lives (Almourad, McAlaney, Skinner, Pleya & Ali, 2020; Çelik & Çelik, 2023; Peper & Harvey, 2018). Cho, Sung, Shin, Lim & Shin (2013) stated that students with digital addiction may experience behavioral or emotional problems in their daily lives, such as being more withdrawn or experiencing anxious or depressive moods more often than their peers. The study's quantitative results are supported by qualitative findings. For example, students with higher addiction scores may exhibit emotional reactions, such as loneliness, emptiness, sadness, or helplessness, when separated from their digital devices; they may also cry or experience depressive symptoms during periods of digital deprivation. Therefore, higher levels of digital addiction lead to more frequent and intense emotional symptoms in middle school students, which may negatively affect their mental health and contribute to problems such as loneliness, helplessness, unhappiness, and mood fluctuations. Cross-cultural evidence also supports our findings. For example, a study conducted in South Korea shows that excessive smartphone use among adolescents is associated with poorer mental health, including higher stress and depressive symptoms (Yun & Choi, 2024). A study of Italian adolescents linked problematic internet use to poorer emotional adjustment and interpersonal functioning (Milani, Osualdella, & Di Blasio, 2009). These results show similar negative effects of digital addiction across different cultural contexts.

According to our results, the intrapersonal and interpersonal dimensions of digital addiction also significantly predict conduct problems in middle school students. This implies that middle school students with higher levels of digital addiction may exhibit more conduct problems. Research shows a relationship between excessive use of digital devices and behavioral symptoms in children and adolescents, ranging from hostility and aggression to social withdrawal and depressive symptoms (Benedetto et al., 2024; Kahraman, Yilmaz Irmak & Basokcu, 2017; Machado et al., 2018). Among the qualitative findings of this study were observations that students with high addiction scores experienced behavioral problems such as outbursts of anger, defiance of rules, resistance, and lying these findings suggest that digital addiction significantly affects not only individuals but also social functioning. International evidence is consistent with these findings. For example, a large-scale study conducted in China found that adolescents with internet addiction exhibited higher levels of aggression, impulsivity, and rule-breaking behavior (Xiuqin et al., 2010).

Our findings further revealed that symptoms of attention deficit and hyperactivity were more common among middle school students with higher levels of digital addiction. In particular, symptoms such as restlessness, impatience, difficulty concentrating, and hyperactivity may be exacerbated by digital addiction. The literature supports this finding: studies have shown a reciprocal, reinforcing relationship linking digital addiction, distraction, and impulsivity (Li et al., 2025; Morita et al., 2022). Analysis of the qualitative data indicated that students with high digital addiction scores had difficulty managing their time, often postponed their homework and other responsibilities, and struggled to focus on their classes; these problems negatively affected their academic achievement. These findings suggest that digital addiction can have serious effects not only on behavior but also on cognitive functions and academic performance. A recent study conducted in Iran found that excessive online gaming impairs cognitive abilities and reduces motivation to learn and to attend school among adolescent students (Soltani Nazarlou, Delavarpour & Tabatabaee, 2025).

According to our results, intrapersonal relations, as a dimension of digital addiction in middle school students, significantly predicted peer-relationship problems (positive association) and prosocial behavior (negative association). This indicates that higher levels of digital addiction are associated with increased peer problems among middle-school students. At the same time, digital addiction is associated with decreased prosocial behavior. On the other hand, the dimension of interpersonal relations was positively related to peer relationship problems not to prosocial behaviors. Leung (2004) reported that the excessive use of digital devices causes individuals to reduce their interactions with family members, distance themselves from their social environments, and experience increased levels of depression and loneliness. Especially during adolescence, when peer relationships and approval are particularly meaningful, digital addiction and perceptions of virtual reality can create interpersonal and emotional problems (Milani, Osualdella & Di Blasio, 2009). In addition, adolescents who cannot make friends among their peers, are not included in a community, or are not accepted may experience a loss of self-esteem and self-confidence, and, as a result, they may show characteristics such as aggression, selfishness, anger, jealousy, insecurity, or timidity (Yücel, 2009). Among the qualitative findings of our study, participants with high digital addiction scores spent little time with their families and peers, withdrew from social activities, and turned to virtual environments rather than real-life social relationships, leading to social isolation and introversion. In addition, a decrease in prosocial behaviors was observed among these participants; they exhibited fewer such behaviors, including helping, sharing, and spending time with others. Therefore, digital addiction may weaken adolescents' social relations and adaptation, constituting a risk factor not only for individuals but also for social development. Cross-cultural studies support this trend. For example, a recent multinational study (conducted in Italy, Spain, Ecuador, and Peru) found that problematic internet use is associated with peer difficulties across different cultural settings and poorer social adjustment (Varchetta et al., 2024). Kliesener et al. (2022) reported significant associations between problematic smartphone use in children and adolescents and both increased behavioral difficulties and lower quality of life; this pattern is consistent with social isolation and decreased prosocial behavior observed in our study, which occurred alongside high digital addiction scores.

Finally, according to our results, the intrapersonal aspects of digital addiction significantly predicted loneliness among middle school students. In other words, intrapersonal factors such as mood modification, preoccupation, withdrawal, and tolerance are associated with greater loneliness in middle school students. Previous research has also shown a significant relationship between digital addiction and loneliness in adolescents (Ime, Akyıl & Caglar, 2024; Peper & Harvey, 2018). The excessive use of digital devices may lead adolescents to prefer solitude by disrupting socialization processes and peer relationships, and may also weaken communication skills, thereby negatively affecting courage, assertiveness, and social interactions (Yücel, 2009). Among our qualitative findings, participants with high digital addiction scores reported experiencing loneliness both as a reason for turning to digital devices and as a result of emotions experienced during periods of digital deprivation. These findings suggest that digital addiction may have a bidirectional and reinforcing relationship with loneliness. A large-scale study conducted in China has shown that problematic internet use is strongly correlated with perceived loneliness among adolescents (Xiuqin et al., 2010). Another study involving adolescents from four countries shows that greater interaction with the digital environment increases the sense of social isolation (Varchetta et al., 2024).

CONCLUSION

The findings of this study have revealed that digital addiction is not a phenomenon limited to technology use; it is associated with multidimensional problems including emotional symptoms, behavioral issues, loneliness, and poor social relationships. In particular, introversion and poor interpersonal relationships increase loneliness and problematic behaviors, and decrease prosocial behaviors among middle school students. Limiting the use of digital devices is not enough to combat digital addiction. Holistic intervention programs should be developed for areas such as social skills, problem-solving, emotional awareness, and self-control. This study has also revealed that the current methods used by families to control children's use of digital devices are often insufficient and ineffective. This heightens the importance of counseling and parent education programs that aim to strengthen parent-child relationships. Since digital addiction is difficult to overcome through individual efforts, schools should conduct regular screening and provide support through multidisciplinary teams comprising psychological counselors, child development specialists, and mental health professionals. While this study has provided a new framework for examining the phenomenon of digital addiction on a theoretical level, its findings can also be used to develop effective prevention and intervention programs for this.

This study is derived from the doctoral dissertation titled 'Profiling secondary school students with digital addiction tendencies' approved by the Institute of Health Sciences, İnönü University.

Ethics Committee Approval: Ethical approval for the study was obtained from the İnönü University Scientific Research and Publication Ethics Committee (2021/2067), and permission to conduct research in schools was obtained from the Ministry of National Education.

Informed Consent: Informed consent was obtained from the parents or legal guardians of the participants.

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