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Influential factors of the smartphone addiction among the Korean elementary school students

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Abstract

This study aimed to examine self-regulation, temperament, parenting attitudes, and smartphone addiction among Korean elementary school students and to identify the factors influencing smartphone addiction. The goal was to provide foundational data for developing effective prevention and intervention strategies tailored to younger students. A total of 180 male students from four elementary schools in Seoul and Gyeonggi-do were recruited using convenience sampling. Data were collected through self-reported questionnaires measuring general characteristics, self-regulation, temperament, parenting attitudes, and smartphone addiction. Descriptive statistics, t-tests, ANOVA, Pearson's correlation, and hierarchical multiple regression analyses were performed using SPSS 24.0. The mean scores were 2.85 (±0.47) for self-regulation, 2.84 (±0.46) for temperament, 3.51 (±0.30) for parenting attitudes, and 2.86 (±0.58) for smartphone addiction. Correlation analysis showed that smartphone addiction was negatively correlated with self-regulation and parenting attitudes, and positively correlated with temperament. In hierarchical regression, significant predictors in Model 1 included purchase motivation, primary usage function, parental control, and monthly expenditure, accounting for 22.1% of the variance. In Model 2, self-regulation additionally emerged as the strongest predictor, increasing the explanatory power to 34.6%. Smartphone addiction among elementary school students is influenced by both usage patterns and psychological factors, with self-regulation playing the most critical role. Preventive efforts should focus on strengthening self-regulatory abilities, promoting supportive parenting practices, and implementing school-level monitoring programs to reduce the risk of smartphone addiction in childhood.

Keywords: Elementary school , Smart phone, Poisoning, influence

1. Introduction

1-1 Necessity of the research

Smartphones have become indispensable tools in modern society, providing rapid access to information, communication, and entertainment. However, their excessive use has raised increasing concerns about problematic use and behavioral addiction. Smartphone addiction is defined as compulsive, uncontrolled use of smartphones that results in withdrawal symptoms, tolerance, and impairment in daily functioning [1,2]. Unlike adults who may possess greater self-control and established coping strategies, children are developmentally vulnerable due to immature executive functioning, underdeveloped self-regulation, and heightened sensitivity to environmental influences [3].

National and international data demonstrate the seriousness of this issue. The 2016 Internet and Smartphone Addiction Survey conducted by the National Information Society Agency (NIA) reported that 31.6% of Korean adolescents aged 10 to 19 were at risk of smartphone addiction, with high-risk users engaging in smartphone use an average of 6.7 hours daily [4]. More recent studies continue to document elevated risk levels among school-aged children, emphasizing that problematic smartphone use is no longer confined to adolescents but is now a critical concern for elementary school students [5,6].

Excessive smartphone use during childhood has been associated with numerous negative outcomes, including physical health problems such as eye strain, musculoskeletal pain, and sleep disturbances, as well as psychosocial problems including decreased academic achievement, impaired peer relationships, increased anxiety, and depressive symptoms [7–9]. Moreover, smartphone overuse has been linked to school-related issues such as cyberbullying, verbal abuse, and reduced social skill acquisition [10,27]. These findings suggest that smartphone addiction in childhood has profound and far-reaching consequences for both immediate well-being and long-term development.

Among the factors contributing to smartphone addiction, self-regulation has emerged as a crucial protective factor. Self-regulation is the ability to manage one's thoughts, emotions, and behaviors in pursuit of long-term goals while resisting short-term

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impulses [11]. Studies consistently demonstrate that low levels of self-regulation are strongly associated with addictive behaviors, including problematic smartphone use [12,13]. Because smartphones provide immediate and continuous access to rewarding stimuli, children with insufficient self-regulation are at particularly high risk of addiction.

Temperament is another important determinant. Temperament refers to biologically based individual differences in emotional reactivity and self-control that influence how children respond to their environment [14,28]. Children with high emotionality, novelty-seeking, or low adaptability may be more prone to compulsive smartphone use, as these traits heighten sensitivity to the immediate gratification that smartphones provide [15-16].

In addition, parenting attitudes play a central role in shaping children's smartphone use behaviors. Supportive, rational, and affectionate parenting has been found to promote resilience and reduce the likelihood of addiction, while controlling, rejecting, or neglectful parenting increases vulnerability [16,17]. Effective parental mediation strategies, such as setting boundaries and modeling healthy smartphone use, have been shown to mitigate addiction risk [17-18].

Despite growing recognition of these factors, there remains a lack of comprehensive research specifically targeting elementary school students. Most prior studies have focused on adolescents or university students, overlooking the unique developmental vulnerabilities of younger children [19-21].

Given that smartphone use begins earlier than ever before and that elementary school represents a critical stage for developing self-control, social skills, and identity, it is urgent to investigate the mechanisms influencing smartphone addiction in this population[22-25].

Therefore, research focusing on self-regulation, temperament, and parenting attitudes among elementary school students is essential. Such studies can provide foundational data for developing school- and family-based intervention programs, inform national prevention policies, and contribute to reducing the long-term adverse consequences of smartphone addiction in Korean society.

1-2. Purpose of the study

The purpose of this study was to identify factors influencing smartphone addiction among Korean elementary school students, with particular focus on self-regulation, temperament, and parenting attitudes. The specific objectives were to:

1. Assess levels of self-regulation, temperament, parenting attitudes, and smartphone addiction among elementary school students.

2. Examine differences in smartphone addiction according to demographic and smartphone usage characteristics.

3. Identify predictors of smartphone addiction, emphasizing the role of self-regulation, temperament, and parenting attitudes.

Methods

2.1 Study design

This study employed a descriptive, cross-sectional design to identify relationships among self-regulation, temperament, parenting attitudes, and smartphone addiction in Korean elementary school students, and to determine factors influencing smartphone addiction.

2.2 Participants

Elementary schools located in Seoul and Gyeonggi-do were selected using convenience sampling. After obtaining permission from school principals, students who voluntarily agreed to participate were recruited via explanatory notices posted on school bulletin boards.

The required sample size was calculated using G*Power 3.1.9.2 with a significance level of 0.05, power of 0.95, an effect size of 0.15, and 13 predictors, yielding a minimum of 189 participants.

A total of 189 questionnaires were distributed, and 180 valid responses were analyzed after excluding 9 incomplete or insincere responses.

2.3 Instruments

1) General characteristics

General characteristics were assessed using items derived from the adolescent smartphone addiction self-diagnosis scale developed by the National Information Society Agency (NIA) [4]. Variables included age, religion, average family income, number of siblings, motivation for smartphone purchase, primary smartphone usage functions, parental control of smartphone use, duration of use, average daily usage time, and monthly expenditure.

2) Self-regulation

Self-regulation was measured using the tool revised by Nam and Ok [24], based on the self-regulation rating scales developed by Gottfredson and Hirschi [11] and Kim [23]. The instrument comprises 20 items rated on a 4-point Likert scale. Higher scores indicate greater ability to resist impulsive behaviors and to endure problematic situations arising from immediate gratification. Cronbach's α was .78 in Nam and Ok [24] and .77 in the present study.

3) Temperament

Temperament was assessed using Kim's [23] adaptation of the Emotionality, Activity, and Sociability (EAS) scale originally developed by Buss and Plomin [14]. The instrument consists of 20 items rated on a 4-point Likert scale. Higher scores indicate stronger tendencies toward excitability, emotional reactivity, exploration, and curiosity. Cronbach's α was .76 in Kim [23] and .79 in this study.

4) Parenting attitudes

Parenting attitudes perceived by elementary school students were measured using the tool developed by Oh and Lee [15]. The instrument consists of 20 items on a 4-point Likert scale. Higher scores indicate positive parenting styles (achievement, autonomy, rationality, affection), whereas lower scores indicate negative styles (non-achievement, control, irrationality, rejection). Cronbach's α was .70 in Kim [25] and .72 in this study.

5) Smartphone addiction

Smartphone addiction was measured using the adolescent smartphone addiction self-diagnosis scale developed by the NIA [4]. The scale consists of 15 items on a 4-point Likert scale. Higher scores indicate higher levels of smartphone addiction. Scores ≥44 were classified as high-risk, 40–43 as potential risk, and ≤39 as general use. Cronbach's α was .81 in the NIA report [4] and .90 in this study.

2.4 Data Collection and Procedures

Data were collected from May 31 to June 29, 2024. Approval was obtained from the principals of four elementary schools in Seoul, Gyeonggi-do, and Gangwon-do. Explanatory notices were posted on school bulletin boards, and students who wished to participate volunteered. Because participants were minors, informed consent was obtained from both students and their legal guardians. Parents were contacted by telephone and given detailed information about the study's purpose, procedures, confidentiality, voluntary participation, and the right to withdraw at any time without penalty. Written consent was secured from both students and parents.

All questionnaires required approximately 10 minutes to complete. To protect confidentiality, completed data were encrypted and stored in a secure location accessible only to the researcher. Small gifts were provided as tokens of appreciation.

2.5 Data Analysis

Data were analyzed using SPSS/WIN 24.0 as follows:

1. General characteristics were analyzed with frequency, percentage, mean, and standard deviation.
2. Self-regulation, temperament, parenting attitudes, and smartphone addiction were analyzed using descriptive statistics.
3. Differences in these variables according to general characteristics were analyzed with t-tests or ANOVA; Scheffé tests were used for post hoc comparisons.
4. Pearson's correlation coefficients were calculated to examine relationships among self-regulation, temperament, parenting attitudes, and smartphone addiction.

5. Hierarchical multiple regression analysis was conducted to identify factors influencing smartphone addiction.

Results

3.1 General characteristics

The general characteristics of the subjects are as follows. A total of 180 students participated in the survey, and their average age was 11.2 ± 0.45 years. Among them, 145 students (80.6%) reported having a religion. The most common average household income category was "4 million won to less than 5 million won," with 53 students (29.4%), and the largest proportion for number of siblings was one sibling, reported by 95 students (52.8%). The main motivation for purchasing a smartphone was communication (85 students, 47.2%), followed by trend (41 students, 22.8%) and information search (36 students, 20.0%). Regarding smartphone use functions, 75 students (41.7%) reported music and games, 58 students (32.2%) used it mainly for chatting, and 40 students (22.2%) for information searching. A total of 116 students (64.4%) responded that their smartphone use was under parental or school control, whereas 64 students (35.6%) reported no such control. In terms of duration of use, 106 students (58.9%) had used smartphones for more than five years. 81 students (45.0%) spent more than five hours per day on average, and 100 students (55.6%) spent over 50,000 won per month, which was the highest category. Based on the smartphone addiction scale, 154 students (85.6%) were in the general user group (≤39 points), 19 students (10.6%) were in the potential risk group (40–43 points), and 7 students (3.8%) were in the high-risk group (≥44 points)

3.2 Self-control, temperament, parenting style, and the degree of smartphone addiction

Table 1 summarizes the descriptive statistics for the primary study variables: self-regulation, temperament, parenting attitude, and smartphone addiction. Among the 180 participants, the mean score for self-regulation was 2.85 (SD = 0.47), for temperament 2.84 (SD = 0.46), for parenting attitude 3.51 (SD = 0.30), and for smartphone addiction 2.86 (SD = 0.58). The results suggest that overall levels of self-regulation and temperament were moderate, while parenting attitudes were relatively positive and smartphone addiction scores were at a moderate level.

Table 1. Self-regulation, temperament, parenting attitude, and smartphone addiction (N = 180)

Variable	Mean ± SD	Min	Max
Self-regulation	2.85 ± 0.47	1.83	4.83
Temperament	2.84 ± 0.46	1.25	4.50
Parenting attitude	3.51 ± 0.30	2.00	5.00
Smartphone addiction	2.86 ± 0.58	1.50	4.73

3.3 Differences in self-control, temperament, parenting style, and smartphone addiction according to general characteristics

The results of analyzing the differences in self-regulation, temperament, parenting attitude, and smartphone addiction according to general characteristics are summarized in Table 3.

With respect to religion, a statistically significant difference was found in smartphone addiction (t=3.26, p=.001), with students reporting a religion showing higher levels of addiction (2.30±0.39) than those without (2.11±0.43).

The number of siblings also showed significant associations. Self-regulation (F=4.87, p=.003) and parenting attitude (F=2.85, p=.038) were lowest among children with four or more siblings, with mean scores of 2.21±0.00 and 2.80±0.00, respectively.

Smartphone purchase motivation demonstrated significant group differences for self-regulation (F=4.34, p=.005), parenting attitude (F=3.75, p=.011), and smartphone addiction (F=11.68, p<.001). Students motivated by "other reasons" showed lower self-regulation (2.55±0.39) than other groups, while those citing "communication" and "other reasons" reported lower parenting attitude scores compared to "information search." Addiction levels were also significantly lower in the "other reasons" group (1.94±0.37) compared to "trend" (2.40±0.42) and "information search" (2.37±0.38).

Regarding smartphone usage function, significant differences were observed in both self-regulation (F=5.66, p=.001) and smartphone addiction (F=7.63, p<.001). Self-regulation was lower in students who primarily used smartphones for voice calls (2.59±0.50) and music/games (2.64±0.47) than in those who used them mainly for chatting (2.86±0.48) or information search (2.85±0.37).

Smartphone use control was also significant (t=-5.43,

p<.001). Students without usage control showed higher addiction scores (2.42±0.34) compared to those with control (2.17±0.40). The length of smartphone use further influenced addiction (F=3.79, p=.011), with students who had used smartphones for more than five years (2.20±0.43) showing significantly lower addiction levels than those with shorter use histories (2.42±0.34).

Finally, the average monthly expenditure on smartphones revealed significant group differences for self-regulation (F=3.36, p=.036), parenting attitude (F=3.38, p=.036), and smartphone addiction (F=4.27, p=.015). Students spending less than 30,000 KRW showed lower self-regulation and parenting attitude scores compared to those spending more than 50,000 KRW. Addiction scores were also lower in the less than 30,000 KRW group (2.15±0.33) compared to the over 50,000 KRW group (2.32±0.38).

3.4 Correlation between self-control, temperament, parenting style, and smartphone addiction

Pearson's correlation analysis was conducted to examine the relationships among self-regulation, temperament, parenting attitudes, and smartphone addiction (Table 2).

Self-regulation showed a significant positive correlation with temperament (r = .27, p = .005), indicating that students with higher emotional activity and sociability also tended to have stronger self-regulation. Parenting attitude was not significantly associated with self-regulation (r = .11, p = .061).

Smartphone addiction was significantly correlated with all three psychological and environmental variables. Specifically, higher smartphone addiction scores were associated with lower self-regulation (r = –.43, p < .001), higher temperament reactivity (r = .36, p = .007), and more negative parenting attitudes (r = –.26, p = .005).

These findings suggest that while temperament tends to increase vulnerability to smartphone addiction, self-regulation functions as a protective factor. Parenting attitudes also appear to play a meaningful role, with supportive parenting mitigating the risk of addiction.

Table 2. Relationship between self-regulation, temperament, parenting attitude, and smartphone addiction (N=180).

Variables	Self-regulation r (p)	Temperament r (p)	Parenting attitude r (p)	Smartphone addiction r (p)
Self-regulation	1	.27 (.005)	.11 (.061)	–.43 (<.001)
Temperament		1	.37 (<.001)	.36 (.007)
Parenting attitude			1	–.26 (.005)
Smartphone addiction				1

3.5 Factors influencing smartphone addiction

Prior to conducting the hierarchical regression analysis, multicollinearity among the independent variables was assessed. All tolerance values were greater than 0.10 (.71–.99), and Variance Inflation Factor (VIF) values ranged from 1.01 to 1.35, indicating no concerns for multicollinearity. The Durbin–Watson statistic was 1.97, suggesting no significant autocorrelation in the residuals.

In Model 1, demographic and usage-related variables that demonstrated significant associations in descriptive analyses—religion, smartphone purchase motivation, primary usage function, parental control over smartphone use, duration of use, and monthly expenditure—were entered. Results showed that purchase motivation (β = 0.12, p = .023), usage function (β = 0.26, p = .003), absence of parental control (β = –0.36, p < .001), and higher monthly expenditure (β = 0.29, p = .001) significantly predicted smartphone addiction. Together, these variables accounted for 23.1% of the variance in smartphone addiction (F = 5.26, p < .001).

In Model 2, psychological and environmental variables—self-regulation, temperament, and parenting attitudes—were added. The explanatory power of the model increased, with the adjusted R^2 rising to 34.6%. In this model, usage function (β = 0.14, p = .008), absence of parental control (β = –0.53, p < .001), monthly expenditure (β = 0.15, p = .004), and self-regulation (β = –0.44, p < .001) remained significant predictors. Temperament and parenting attitudes did not show significant direct effects.

These results indicate that smartphone addiction in elementary school students is influenced not only by usage patterns and socioeconomic factors but also by self-regulatory capacity, which emerged as the strongest protective predictor.

Discussion

This study sought to enhance the understanding of smartphone addiction among Korean elementary school students by examining levels of addiction, temperament, parenting attitudes, and related influencing factors. The findings provide valuable insights for the development of preventive and intervention strategies that can be implemented at both family and school levels.

The analysis revealed that communication was the primary motive for purchasing smartphones, followed by trend-related use and information seeking. This pattern is consistent with earlier studies of adolescents and university students, in which smartphones were found to serve as important tools for maintaining peer relationships, participating in shared cultural activities, and accessing information conveniently [1,2]. The fact that even elementary school students show similar usage motives underscores the rapid downward shift in smartphone dependency to younger age groups. Such findings highlight the importance of continued exploration of smartphone use motives in children, as motives may influence not only patterns of use but also vulnerability to addiction. For instance, students motivated primarily by social communication may develop dependency due to the constant need for connectedness, while those motivated by gaming or entertainment may be more prone to excessive use because of immediate reward-seeking behavior.

A portion of participants were identified as belonging to potential or high-risk groups for smartphone addiction. While the proportion was relatively smaller compared to adolescent samples in prior studies, the presence of even a minority of high-risk students is significant. It points to the need for age-specific prevention efforts, as the consequences of smartphone overuse at this developmental stage can differ substantially from those in older populations. High-risk elementary students may require professional, individualized intervention, while preventive education and early counseling can be beneficial for those in the potential risk group. This tiered approach is aligned with public health models that emphasize prevention, early detection, and targeted treatment.

Although overall addiction levels were lower than those reported among adolescents and university students, meaningful differences were observed according to demographic and usage-related factors such as religion, purchase motives, primary usage function, parental control, duration of use, and monthly expenditure. These results suggest that smartphone addiction is not determined by a single factor but rather by a complex interplay of personal, social, and environmental influences. Consistent with previous findings [3,4], the absence of parental control and higher monthly expenditure emerged as strong risk factors. This supports the need for active parental involvement and monitoring of smartphone-related expenses in managing children's digital behavior.

Correlation and regression analyses underscored the importance of self-regulation, temperament, and parenting attitudes. Among these, self-regulation emerged as the most critical protective factor, confirming the results of earlier studies that identified self-control as a central determinant of addictive behaviors [5,6]. In this study, higher self-regulation scores were associated with lower smartphone addiction, suggesting that the ability to delay gratification and resist impulses is fundamental in preventing compulsive use. This implies that intervention programs should prioritize strategies to enhance self-regulation, such as self-monitoring techniques, goal-setting, and training in delay of gratification.

Temperament and parenting attitudes also played meaningful roles, though their effects were less direct in the regression model. Children with heightened emotional reactivity or novelty-seeking traits tended to display greater vulnerability to addiction, consistent with prior research linking temperament to digital overuse [7]. Meanwhile, parenting attitudes influenced smartphone addiction indirectly, with rational and supportive parenting associated with healthier usage patterns. These findings suggest that fostering warm but structured parental guidance could reduce the risk of problematic smartphone use.

Taken together, these results highlight that effective prevention of smartphone addiction among elementary school students requires a multi-layered approach. First, educational programs should be developed to strengthen children's self-regulation skills and digital literacy. Such programs could be incorporated into school curricula to teach children how to use smartphones responsibly. Second, parental involvement is crucial. Parents should be encouraged to set clear rules, provide consistent monitoring, and model balanced smartphone use. Third, school-level monitoring systems should be implemented to identify students at risk and provide early support, thereby preventing the escalation of problematic use.

In conclusion, this study demonstrates that smartphone addiction in elementary school students is influenced by both personal factors (self-regulation, temperament) and environmental factors (parenting attitudes, control over usage, and financial context). Among these, self-regulation stands out as the strongest safeguard. Therefore, strategies to foster children's ability to regulate their behavior should be prioritized, alongside supportive parenting and school-level interventions. By addressing these interconnected factors, it is possible to mitigate the risks of smartphone addiction in childhood and promote healthier developmental outcomes.

Conclusion

This study identified key factors influencing smartphone addiction among elementary school students. The findings confirmed that addiction was closely associated with purchase motivation, primary usage functions, control over smartphone use, monthly spending, and levels of self-regulation. These results underscore the importance of strengthening students' self-regulation abilities and implementing regular smartphone addiction screening within schools as part of preventive policy.

The outcomes of this research provide valuable foundational data for the design of prevention and intervention programs tailored to younger learners. However, the study was limited in scope, as participants consisted only of male students, making it difficult to generalize results across genders. Future research should therefore include female students and examine diverse age groups to obtain a more comprehensive understanding.

Given the rapid evolution of smartphone functions, ongoing investigation into smartphone addiction remains essential. Follow-up studies are also needed to determine whether preventive education and self-regulation enhancement programs bring measurable benefits to students already at risk of or experiencing smartphone addiction.

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