




## Examining the Effects of Impulsivity, Intolerance of Uncertainty, and Smartphone Management Styles on Smartphone Addiction with the Mediating Role of Warm Executive Functions

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### ABSTRACT

**Objective:** The increasing use and influence of mobile phones on individuals' daily habits, behaviors, and lifestyles have brought significant changes and may cause serious and important problems in people's lives. This study investigated the impact of variables such as impulsivity and intolerance of uncertainty, along with smartphone management styles on smartphone addiction, mediated by warm executive functions.

**Methods and Materials:** The current study was descriptive and correlational. The sample consisted of 722 high school students selected through convenience sampling. Data were collected using the Bianchi and Phillips (2005) Mobile Phone Addiction Questionnaire, the Barratt Impulsiveness Scale (1997), the Intolerance of Uncertainty Scale by Dugas et al. (1998), the Hsieh, Jen, and Chou (2019) Smartphone Management Styles Questionnaire, and the BRIEF Executive Functions Questionnaire (Parent Form) by Gerard et al. (2000). Data analysis was conducted using Structural Equation Modeling (SEM) through AMOS software version 25.

**Findings:** Results indicated significant inverse relationships between impulsivity and warm executive functions ( $\beta = -0.74, p < 0.001$ ), impulsivity and smartphone addiction ( $\beta = -0.56, p < 0.001$ ), and warm executive functions and smartphone addiction ( $\beta = -0.51, p < 0.001$ ). Direct and significant relationships were found between intolerance of uncertainty and warm executive functions ( $\beta = 0.66, p < 0.001$ ), intolerance of uncertainty and smartphone addiction ( $\beta = 0.73, p < 0.001$ ), and warm executive functions and smartphone addiction ( $\beta = -0.51, p < 0.001$ ). Significant inverse relationships existed between management styles and warm executive functions ( $\beta = -0.83, p < 0.001$ ), and management styles and smartphone addiction ( $\beta = -0.71, p < 0.001$ ).

**Conclusion:** Therefore, it can be concluded that there are relationships between impulsivity, intolerance of uncertainty, and smartphone management styles with smartphone addiction mediated by warm executive functions.

**Keywords:** Impulsivity, Intolerance of Uncertainty, Smartphone Management, Executive Functions.

## 1. Introduction

The use of smartphones has become widespread across the globe in recent years. Unique features of smartphones, such as ease of use, convenience in communication, the ability to easily exchange information, entertainment, and other features have led to the ubiquity of this new technology worldwide. However, these facilities and advantages can lead to excessive use of smartphones, impacting users' daily lives (Cazzulino et al., 2014). Many smartphone users admit that they cannot live without their devices. Despite the conveniences that smartphones provide in people's lives, it is essential to be aware of their negative impacts, the most concerning of which is smartphone addiction. Smartphone addiction refers to excessive and uncontrollable use despite the negative effects on an individual's social, physical, and psychological life (Cha & Seo, 2018). The increased use and influence of mobile phones have brought about significant changes in individuals' habits, behaviors, and lifestyle, potentially causing serious and significant problems in their lives (Samaha & Hawi, 2016). Sadoughi (2017) showed that excessive use of mobile phones negatively affects sleep quality, mental health, and academic performance (Sadoughi, 2017).

Internet addiction falls under the category of impulse control disorders, which involve a persistent desire to perform an act in response to a mental or external stimulus (Elhai et al., 2017; Elhai et al., 2016; Khanbabaei et al., 2022; Kim et al., 2017; Ko et al., 2012; Kuo et al., 2018). Impulsive actions typically have adverse consequences. Impulsivity is considered a central factor in the occurrence of behaviors such as suicide, substance abuse, aggression, personality disorders, attention deficit issues, and criminal behaviors (Kaiser et al., 2016).

One of the constructs related to smartphone addiction is intolerance of uncertainty, widely defined as a cognitive, emotional, and behavioral reaction to uncertainty. It leads to bias in information processing and increased assessment of threat, diminishing coping abilities with challenges (Abdolpour et al., 2018). Intolerance of uncertainty acts as a cognitive schema or filter that shapes individuals' views of their environment (Chen et al., 2018). Generally, intolerance of uncertainty plays a significant role in the emergence of psychological disorders (Kornilova et al., 2015). Evidence suggests that students with emotional and behavioral disorders have significantly less tolerance of uncertainty compared to typical students (Weinstein et al., 2014).

Modern smartphones are not only dealing with physiological changes, academic issues, social pressures, and employment market dynamics, but also experience these issues with their online audiences (Cha & Seo, 2018; Inal et al., 2015; Wolniewicz et al., 2018). High school students, who are teenagers aged fifteen to eighteen, are in the transition phase from childhood to adulthood, a period characterized by a desire to assert themselves and prove their independence. Although adolescence is a period between childhood and adulthood, psychologists do not agree on its duration, which varies depending on culture and environment and generally spans from ages 11 to 20 (Cha & Seo, 2018; Davey & Davey, 2014).

The relationship between impulsivity and addiction to the internet and smartphones has been confirmed in research (Amiri et al., 2015; Pourmohseni & Farshi 2019). Intolerance of uncertainty refers to the difficulty in accepting realities that do not align with an individual's personal desires, and it involves the non-acceptance of uncertain and ambiguous situations and the anticipation of negative outcomes in unclear circumstances (Lu et al., 2019). Smartphone and internet addiction are outcomes of intolerance of uncertainty, as interpersonal relationships in virtual spaces are much easier than in the real world. Additionally, due to the rapid reward nature of the internet, youth become accustomed to environments and situations that provide immediate satisfaction, possibly reducing their tolerance of uncertainty (Lu et al., 2019). Research has shown that adolescents with addiction have higher intolerance of uncertainty compared to healthy groups (Kuo et al., 2018). Research findings have identified a significant relationship between internet and smartphone addiction and intolerance of uncertainty (Lu et al., 2019).

Passive management style shows parental monitoring of children's smartphone use through legislative exercises. Parental control and responsiveness aim to avoid negative impacts on children's everyday functioning. The second management style, proactive or dynamic, equivalent to Baumrind's authoritative style, reflects potential parental efficacy from proactive management and active mediation in children's smartphone use through positive interaction and reasoning. This style addresses avoiding family tension in following regulations, managing use without anger, providing reasons to children for managing smartphone use, parents learning new information and management skills, and avoiding psychological pressure on children during discussions about smartphones (Hsieh et al., 2019).

The third style, authoritative management, reflects parental behavior in controlling what children do with their smartphones, who they talk to, and what apps and websites they use (Hsieh et al., 2019). Some other research has shown that limiting smartphone usage time can disrupt students' academic performance (Park & Oh, 2016). The research by Hsieh et al. (2019) formed the basis for studying the relationship between parental management of smartphone use and smartphone addiction in the current study. In this research, a strong link between parental management and smartphone addiction was reported, and among the three parental management styles, the proactive style was recognized as the best for preventing smartphone addiction (Hsieh et al., 2019). It should be noted, according to research by Harris et al. (2020), that among all 2452 addiction management scales studied, the Parental Smartphone Use Management Scale (PSUMS) is recognized as one of the few with sufficient validity (Harris et al., 2020). Additionally, research by Motahhari Nejad et al. (2018) and Ozgur (2016) reported that the highest level of student internet use occurs when parents adopt a permissive parenting style (Motahhari Nejad & Ghasemi Nejad, 2019; Özgür, 2016).

From a neuropsychological perspective, executive functions are one of the cognitive and metacognitive processes that help individuals focus on important aspects of a task and plan to complete it, appearing to be related to internet addiction (Mohebi et al., 2020). Executive functions are a set of advanced neuropsychological capabilities that include higher cognitive and metacognitive functions and assist in human intellectual functions, learning processes, and daily activities (Poon, 2018). Research has shown the roles of cold and warm executive functions in daily life, such as job capabilities, social interactions, education, and independence in performance (Tye et al., 2017). Results indicate that higher emotional stimulation in warm executive functions is more effective for enhancing students' skills, especially for teenagers, and is more commonly used in developing learning and educational games (Homer et al., 2019). Furthermore, research has shown that reduced academic success and increased risk-taking behaviors correlate with deficits in executive functions (Munro et al., 2017). Research by Brand, Laier, and Young (2014) has confirmed this (Brand et al., 2014). Additionally, Mohebi et al. (2020) showed that there is a direct and negative relationship between executive functions and internet addiction (Mohebi et al., 2020). In this study, the researcher seeks to answer whether smartphone addiction based on impulsivity, intolerance of uncertainty, and smartphone

management styles has a significant effect on teenagers with the mediating role of warm executive functions.

## 2. Methods and Materials

### 2.1. Study Design and Participants

The present study was descriptive-correlational in nature. The population consisted of all regular high school students aged 13 to 16 in Tehran during the academic year 2020-2021 who had access to at least one personal smartphone or their parents' smartphones and had been using the device for at least two months. Convenience sampling was used, targeting male and female students who self-reported excessive smartphone use and were willing to participate. Impulsivity, intolerance of uncertainty, and smartphone addiction questionnaires were given to the students, while the executive functions and smartphone management styles questionnaires were provided to both parents for one or both to complete. Given the unique circumstances of the 2020-2021 academic year, which coincided with COVID-19 restrictions, the use of virtual spaces was deemed necessary. The researcher decided to use a smart bot to distribute the questionnaires virtually and to collect the completed forms online. According to Kline, the sample size in structural equation modeling (SEM) can generally be determined as between 5 to 15 observations per measured variable. Given that the total number of questions was 117, the sample size was determined to be at least 585. In this study, 1175 participants were initially surveyed; however, 453 questionnaires were discarded for various reasons, and 722 were included in the study.

### 2.2. Measures

#### 2.2.1. Mobile Phone Addiction

This is a 17-item self-report tool developed by Bianchi and Phillips (2005) to measure the level of dependency on mobile phones. This scale covers all recorded mobile phone activities, including calls, texts, internet use, gaming, video recording, programming, etc. Phillips and Bianchi (2005) reported an internal reliability of 0.93. In Iran, Naderi and Haghazari (2010) first validated this questionnaire, achieving a correlation coefficient of 0.30 and a Cronbach's alpha of 0.80 (Sadeghi et al., 2021).

### 2.2.2. *Impulsiveness*

The eleventh edition of this questionnaire was developed by Barratt in 1997. It includes 30 items scored on a 4-point Likert scale (never, sometimes, often, always) and evaluates three factors: motor impulsiveness (acting without thinking), cognitive impulsiveness (tolerance of complexities and resistance in immediate decision-making situations), and non-planning (disregard for foresight in behavior and actions). Naderi and Haghazari, in 2009, first validated this scale in Iran, reporting Cronbach's alpha reliability of 0.72 and split-half reliability of 0.60 (Amiri et al., 2015; Tajik et al., 2020).

### 2.2.3. *Intolerance of Uncertainty*

Dugas and colleagues in 1998 demonstrated that the components of intolerance of uncertainty, including positive belief about worry, negative orientation toward uncertainty, and cognitive avoidance, can distinguish patients with generalized anxiety disorder from normal individuals, with intolerance of uncertainty providing greater differentiation between these groups. Sexton and Dugas (2009) believe that intolerance of uncertainty can be measured unifactorially. This scale also considers two factors important in distinguishing anxious individuals from healthy ones: Factor 1: Uncertainty has self-referential implications and leads to negative behavior; Factor 2: It is unfair and ruins everything. The validity of this test was reported as satisfactory by Freeston and colleagues (1994). Bohr and Dugas (2006) prepared and validated the English version. The correlation coefficients of this scale with the Worry Questionnaire ( $r = 0.60$ ), Beck Depression Inventory ( $r = 0.59$ ), and Beck Anxiety Inventory ( $r = 0.55$ ) were significant at the 0.001 level. The initial French version obtained a reasonably good test-retest reliability over four weeks ( $r = 0.78$ ) (Freeston et al., 1994). Bohr and Dugas (2002) reported a test-retest reliability of 0.74 over a five-week period. The initial French version achieved an internal consistency (Cronbach's alpha = 0.91). Bohr and Dugas (2002) reported a Cronbach's alpha of 0.94 for this scale (Abdolpour et al., 2018; Rastgar et al., 2021).

### 2.2.4. *Smartphone Management Styles*

This questionnaire was developed in Taiwan by Hsieh, Jen, and Chou (2019). It assesses parental management styles in monitoring their children's smartphone usage. The styles include: 1. Passive management (permissive), 2.

Proactive management (authoritative), 3. Supervisory management (authoritarian). The tool designed for parents of teenagers consists of 17 questions scored on a seven-point Likert scale. Due to its novelty, this questionnaire had not been used in Iran before and its validity and reliability had not been tested. However, in this study, its psychometric properties were examined. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used to identify and determine the underlying factors of this scale. Based on the analysis of data from 722 sample individuals, the construct validity was confirmed; and in a matrix rotation (Varimax rotation), instead of the three factors proposed in the original questionnaire, four factors were identified. Following expert consultations, the following names were assigned to the four factors: 1. Passive management, 2. Supervisory management, 3. Indifferent management, 4. Proactive management. This test has good factor validity and high reliability, with Cronbach's alpha calculated between 0.93 and 0.95 (Hsieh et al., 2019).

### 2.2.5. *Executive Functions*

This assessment tool was written by Ballester Gerard and colleagues in 2000. It consists of 86 questions scored on a three-point Likert scale. Each question relates to one of the subcategories of the questionnaire, divided into two main parts: behavioral regulation skills and metacognitive skills. The subcategories are as follows: a. Behavioral regulation skills: Inhibition, shifting, and emotional control. b. Metacognitive skills: Planning, organization of materials, monitoring, working memory, and initiation. The validity coefficient for clinical samples, in the parent form, ranges from 0.82 to 0.98, and when used for assessing a normative population, it ranges from 0.80 to 0.97. The validity and reliability of the Persian version of the questionnaire, specifically the behavioral rating scale of executive functions in the parent form, were conducted by Alizadeh and colleagues in the ADHD population (Alizadeh et al., 2014). The original version of the test features good psychometric properties, a straightforward and clear implementation method, and is considered a reliable and practical tool for therapists. The internal consistency reliability of this questionnaire ranges from 0.87 to 0.94, indicating high internal consistency among its subscales (Mohebi et al., 2020).

2.3. Data analysis

In the current study, at the descriptive statistics level, frequency, percentage of demographic variables (gender, etc.), as well as mean and standard deviation of research variables were used. In the inferential statistics section, the Kolmogorov-Smirnov (K-S) test was employed to test for normality. To examine the relationships between variables, correlation tests were used, and data were analyzed using the Structural Equation Modeling (SEM) method with AMOS software version 25.

**Table 1**

*Descriptive Statistics Results*

Variables	Impulsivity	Management Style	Executive Functions	Intolerance of Uncertainty	Smartphone Addiction
Mean	4.26	4.26	4.22	4.23	4.12
SD	0.50	0.74	0.80	0.66	0.81
Skewness	-0.67	-0.99	-1.03	-0.43	-1.23
Kurtosis	0.20	1.01	0.61	-0.33	2.24
K-S Statistic	0.199	0.207	0.170	0.191	0.145
Significance	0.213	0.108	0.132	0.112	0.200

As shown in [Table 1](#), the means of the main variables of the study that served as independent and dependent variables in the model are presented. The means of all the variables studied are relatively high, considering the standard deviation values. Before testing the hypotheses of this study, it is necessary to ensure the normality of the variables. A one-sample Kolmogorov-Smirnov test was used to check the normality of the variables studied. If the significance level is greater than 0.05%, the variable is considered normal; otherwise, the data are non-normal; therefore, according to the following table, all variables are normal ([Table 1](#)). For significance testing of the questions, two indices, critical value and significance level, were used. The critical value is obtained by dividing the estimate of the regression weight by the standard error. According to a significance level of

3. Findings and Results

Demographic findings indicated that 65.0% of the participants were males and 35.0% were females, with 6.0% being 13 years old, 63.0% being 14 years old, 28.9% being 15 years old, and 7.5% being 16 years old. Descriptive statistics for the study variables, including mean, standard deviation, and variance, are reviewed in [Table 1](#).

0.05, the critical path value should be greater than 1.96 or less than -1.96; otherwise, the parameter in the model is not considered significant. Values smaller than 0.05 for the significance level indicate a significant difference calculated for the regression weights from zero at a 99% confidence level.

With the help of the mean variance extracted index, it was determined that all the constructs studied have a mean variance extracted (AVE) higher than 0.5. Reliability was also assessed using Cronbach's alpha reliability index and composite reliability, the results of which are presented in [Table 2](#). Reliability in this context means that there was a consistent interpretation of the questions among the different respondents, with values higher than 0.6 for each construct indicating suitable reliability.

**Table 2**

*Reliability Testing of Scales Using Cronbach's Alpha and Composite Reliability and Validity of Mean Variance Extracted*

Scale (Construct)	Cronbach's Alpha	Composite Reliability (CR)	Acceptable Level	Mean Variance Extracted (AVE)	Acceptable Level
Impulsivity	0.947	0.948	0.6	0.5543	0.5
Management Style	0.942	0.945	0.6	0.5323	0.5
Executive Functions	0.893	0.895	0.6	0.5909	0.5
Intolerance of Uncertainty	0.906	0.907	0.6	0.5750	0.5
Smartphone Addiction	0.839	0.841	0.6	0.5643	0.5
Overall Reliability	0.946	0.948	0.6	0.5820	0.5

The results showed significant inverse relationships between impulsivity and warm executive functions ( $\beta = -0.74, p < 0.001$ ), impulsivity and smartphone addiction ( $\beta = -0.56, p < 0.001$ ), and warm executive functions and smartphone addiction ( $\beta = -0.51, p < 0.001$ ). There were significant direct relationships between intolerance of uncertainty and warm executive functions ( $\beta = 0.66, p < 0.001$ ), intolerance of uncertainty and smartphone addiction ( $\beta = 0.73, p < 0.001$ ), and warm executive functions and

smartphone addiction ( $\beta = -0.51, p < 0.001$ ). Significant inverse relationships existed between management styles and warm executive functions ( $\beta = -0.83, p < 0.001$ ) and between management styles and smartphone addiction ( $\beta = -0.71, p < 0.001$ ) and warm executive functions and smartphone addiction ( $\beta = -0.51, p < 0.001$ ). Therefore, impulsivity, intolerance of uncertainty, and smartphone management styles significantly impacted smartphone addiction, mediated by warm executive functions.

Figure 1

Structural Model with Standard Coefficients

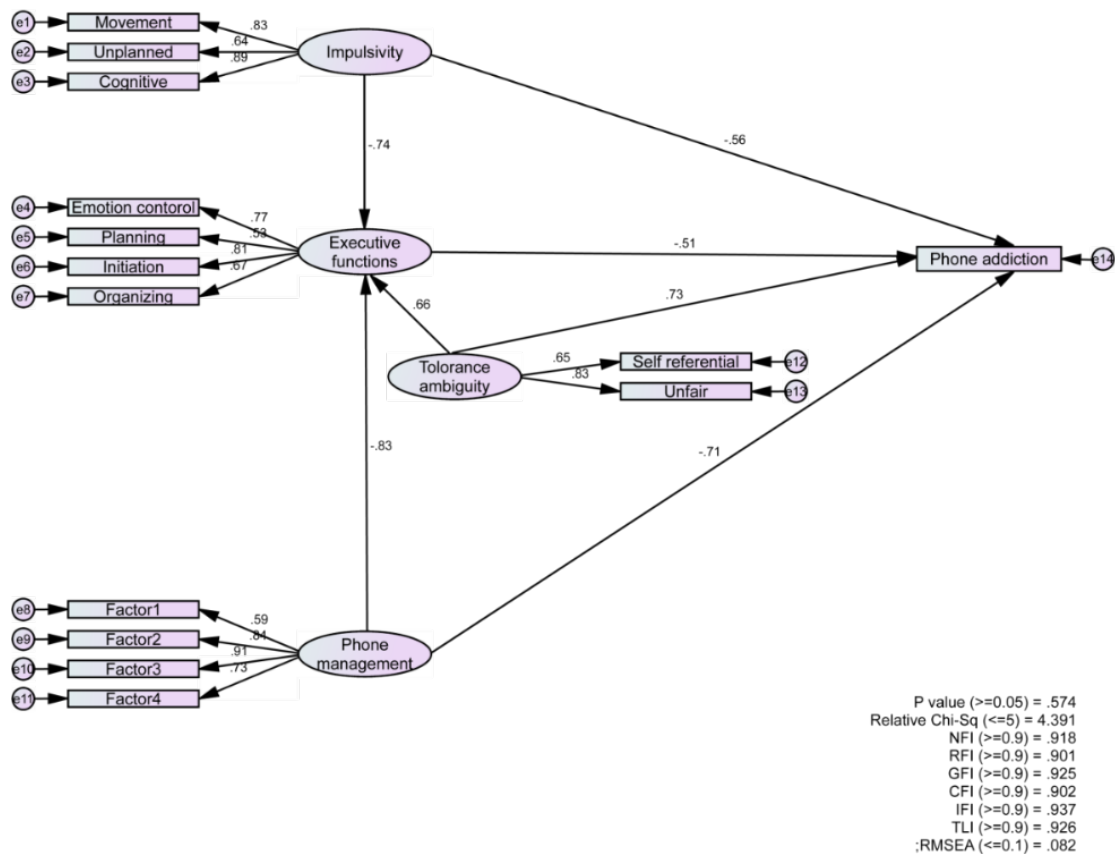


Table 3

Results of Structural Equation Modeling

Relationships of Study Variables	Indirect Effect	Significance Level	CR
Impulsivity → Warm Executive Functions → Smartphone Addiction	0.74 * -0.51 = -0.37	<0.001	5.11
Intolerance of Uncertainty → Warm Executive Functions → Smartphone Addiction	0.66 * -0.51 = -0.33	<0.001	5.20
Management Styles → Warm Executive Functions → Smartphone Addiction	0.83 * -0.51 = -0.42	<0.001	4.38

Model fit indices for structural equation modeling are provided in Table 4.

**Table 4**

*Model Fit Indices*

Index	Acceptable Range	Reported Value
Normalized Chi-Square (CMIN/DF)	Between 3 and 5	4.391
Goodness of Fit Index (GFI)	≥ 0.9	0.925
Adjusted Goodness of Fit Index (AGFI)	≥ 0.9	0.925
Normed Fit Index (NFI)	≥ 0.9	0.918
Incremental Fit Index (IFI)	≥ 0.9	0.937
Tucker-Lewis Index (TLI)	≥ 0.9	0.926
Comparative Fit Index (CFI)	≥ 0.9	0.902
Root Mean Square Error of Approximation (RMSEA)	≤ 0.1	0.082

As observed, the research model exhibits appropriate fit, and the index levels meet the acceptance criteria.

**4. Discussion and Conclusion**

The aim of the present research was to investigate the impact of impulsivity, intolerance of uncertainty, and smartphone management styles with the mediating role of warm executive functions on smartphone addiction. In explaining the significant relationship of impulsivity on smartphone addiction, it can be stated that impulsivity refers to behavior that is performed with little and insufficient caution. This finding is consistent with the previous research results (Hong et al., 2021; Mun & Lee, 2023; Rastgar et al., 2021; Sadeghi et al., 2021; Yang et al., 2020).

In explaining the research findings, intolerance of uncertainty can be described as a cognitive bias that affects how individuals perceive, interpret, and react to uncertain situations at emotional, cognitive, and behavioral levels. Individuals with a high intolerance of uncertainty believe that uncertainty is stressful, confusing, and unfair and should be avoided, ultimately interfering with the individual's ability to function. Parental monitoring and timely protection of children influence adolescent behavior and make them aware of potential dangers in their environment. Indeed, parental supervision serves as a conduit for normal behavior. Insufficient control over children and the diverse applications available on smartphones with various entertainments and online games pave the way for smartphone addiction. Management styles in parenting are decisive and pervasive, playing a significant role in the psychological growth and pathology of children. Discussing the issues of children without considering parental attitudes, behavior, and upbringing methods is nearly impossible.

The structural model of impulsivity, intolerance of uncertainty, and smartphone management styles with the mediating role of warm executive functions fits the data

collected from students. This finding is consistent with the prior research (Brand et al., 2014). Impulsivity means the lack of response inhibition or the prevention of executive function, which is associated with disturbances in the frontal lobe (Khanbabaei et al., 2022; Swann, 2010). Individuals with behavioral addictions have increased risk-taking and cognitive impulsivity and show impairments in the Stroop test, which measures executive function control (Leeman & Potenza, 2012). The study by Chang and Carlson (2014) demonstrated that both impulsivity and prospective memory are related to executive function (Chang & Carlson, 2014). Executive functions enable individuals to inhibit their impulses and restrict pleasure-related behaviors under adverse conditions (Tripathi, 2018). Developmental neuroscientific findings also confirm that executive functions are indirectly related and collaborate for the analysis of information and the execution of activities (Aghaziarati et al., 2023). Adolescents with high impulsivity are unable to perform correctly in tasks related to executive functions, as a disruption in executive functions increases indecision for behaviors such as smartphone addiction. In the study by Muscatello et al. (2014), cognitive dysfunction alongside signs of cognitive inefficacy was shown to be a significant factor in the development and persistence of antisocial behaviors in adolescents (Muscatello et al., 2014). These results indicate that adolescents exposed to impulsive behaviors are primarily affected by emotional states and positive or negative feelings and, to a lesser extent, depend on cognitive performance and structures.

Intolerance of uncertainty is associated with a negative assessment of cognitive processes. Positive beliefs about intolerance of uncertainty are typically triggered in response to intrusive thoughts and doubts with external factors such as news or information and act as a strategy to predict and confront threats. Moreover, intolerance of uncertainty continues as long as individuals recognize that they are

capable of effectively combating the anticipated danger. Therefore, intolerance of uncertainty can increase anxiety, cognitive, and physical symptoms (Kornilova et al., 2015; McEvoy & Erceg-Hurn, 2016; Osmanağaoğlu et al., 2018) and lead to a reduction in warm executive functions. Executive functions are a set of superior organizational and integrative abilities (Luu & Hall, 2017) and include predicting and setting goals, planning, self-regulation, monitoring goals, execution, effective feedback on plans, working memory, etc., which are vital for successful independent, goal-oriented, and adaptive activities (Noone et al., 2016) and can reduce smartphone addiction. A reduction in warm executive functions engages individuals in a vicious cycle of addictive behaviors. Deficits in executive functions make it harder for individuals to break free from this cycle, causing them to spend more hours browsing the web, on social networks, and playing online games and finding it difficult to stop these activities (Homer et al., 2019; Hughes & Ensor, 2011).

Significant development and transformation in executive functions are considered mostly from 12 months to 5 years of age, a period when rapid development occurs in the components and elements of executive functions. Early childhood is a key period for understanding the impact of parents on executive functions, as environmental experiences during this time influence the development of the frontal cortex and are environmentally dependent (Fay-Stammbach et al., 2014). Vygotsky (1986) believed that the basis of human development and transformation is formed in social life. Also, according to ecological theory, individuals are seen within a complex system of relationships in which they grow, and the surrounding environment impacts them. He considers the family as the most basic and institutional microsystem that affects all dimensions of children's existence (Poon, 2018; Raghubar et al., 2010). If children achieve high levels of executive functions early in development, they will have greater social competence and fewer disciplinary reprimands in elementary school and even adulthood, and deficiencies in executive functions cause behavioral-emotional and cognitive impairments (Montoya et al., 2019). In this regard, studies show that individuals with internet addiction have specific deficits in executive functions (Dong et al., 2013). Internet addiction is a mental disorder, and individuals suffering from it have a cognitive bias towards information related to online games and weak executive functioning skills, including low cognitive flexibility and inhibition (Zhou et al., 2012), and there are defects in their working

memory (Zhou et al., 2014). Working memory is an important process for understanding, reasoning, updating, and learning memory, and defects in this function can cause dysfunctions in occupational, social, and educational areas for these individuals (Nie et al., 2016).

## 5. Limitations & Suggestions

Among the limitations of this study was the limited study population confined to Tehran, and perhaps conducting this research in other cities with a larger sample could yield different results. This research, like any other exploratory study, was descriptive and correlational and does not confirm a causal relationship between the research variables, and caution should be exercised in generalizing the results. The lack of control over influencing variables such as intelligence, personality traits, socioeconomic status of families, and cultural differences are other limitations of this research. This research was conducted cross-sectionally, and there is a need for longitudinal research to explore specific dimensions of smartphone addiction and its relationship with motivational, educational, and academic components of students. In the present study, the personality traits of the students were not assessed. It is recommended that the role of personality traits as a mediating variable along with executive functions in explaining smartphone addiction be considered and assessed. It is suggested that future research should carefully examine the emotional behavioral and physiological indices of research variables using more precise tools that minimize measurement error. To better understand the interrelationships between components and sub-scales of the smartphone management scale by parents, higher-order models should also be studied in a larger sample of individuals. It is suggested that necessary training for parents on smartphone management styles and how to interact and deal with children regarding the use of smartphones be provided at the national level through media, universities, parent-teacher associations, schools, etc. Parents should avoid establishing one-sided relationships at home and in their relationships with their children and should focus more on their behavior and communication habits such as encouraging, supporting, trusting, and befriending their children.

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## Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

## Declaration of Interest

The authors of this article declared no conflict of interest.

## Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

## Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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## Authors' Contributions

All authors contributed equally.

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