THE TURKISH JOURNAL ON ADDICTIONS
www.addicta.com.tr

ORIGINAL ARTICLE

An Investigation of Intrapersonal Predictors of Daily Screen Time: Is Sluggish Cognitive Tempo a Potential Predictor?

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Main Points

- This is the first study to show that sluggish cognitive tempo (SCT) predicts screen time and the transdiagnostic nature of this relationship.
- This study contributed to theory and practice by showing the intrapersonal predictors associated with screen time and that SCT is among these predictors for the first time.
- Sluggish cognitive tempo, as a transdiagnostic construct, can predict screen time based on its relation to rumination, another transdiagnostic construct whose relation to problematic technology use has been previously investigated.
- Transdiagnostic constructs may help explain why only some of people with psychopathology develop problematic technology use.
- From the perspective of clinical practice, not only categorical diagnoses such as depression and anxiety but also approaches to transdiagnostic factors such as SCT should be included in prevention and treatment programs.

Abstract

Screen time defines the time spent in front of television, mobile phone, tablet, computer, and game consoles. Rumination is a transdiagnostic process that has been reported to mediate problematic technology use and is closely related to sluggish cognitive tempo. Sluggish cognitive tempo is frequently associated with psychological disorders known to affect screen time. In this study, it was aimed to examine intrapersonal predictors of screen time and whether sluggish cognitive tempo is among these predictors. 104 female and 60 male adolescents with mean ages of 14.39 ± 1.39 and 13.87 ± 1.96, respectively, participated in the study. Data on screen time and possible predictors were collected from parents and adolescents and analyzed by linear regression analysis. The mean screen time of participants was 8.05 ± 2.18 hours. Correlations between screen time and intrapersonal factors including emotional problems, prosocial behaviors, inattention, hyperactivity, and sluggish cognitive tempo were found to be significant. According to the regression analysis, sluggish cognitive tempo explained 7.2% of screen time. While this study supports the existing literature that inattention, hyperactivity, social, and emotional problems predict screen time, it also revealed for the first time that sluggish cognitive tempo is among the predictors of screen time as a transdiagnostic dimension.
Keywords: Adolescent, predictor, screen time, sluggish cognitive tempo, transdiagnostic

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Received: February 6, 2022
Accepted: April 14, 2022
Available Online Date: June 30, 2022

Introduction

The developments in the digital platform in the last 30 years have made technology more mobile and facilitated access. This change has significantly changed the habits of the society, especially children and adolescents, and has led to an increase in the time spent in front of the screen (Kabali et al., 2015). Screen time defines the time spent in front of television, mobile phone, tablet, computer,

Cite this article as: Gözpınar, N., & Görmez, V. (2022). An investigation of intrapersonal predictors of daily screen time: Is sluggish cognitive tempo a potential predictor? *Addicta: The Turkish Journal on Addictions*, 9(2), 182-188.

DOI: 10.5152/ADDICTA.2022.22003

and game consoles (Hale & Guan, 2015). In this study, the term "screen time" will be used to refer to a one-dimensional construct in which total daily screen time (including television watching, digital gaming, and computer and mobile phone use) is measured on a continuum ranging from low to higher exposure.

According to the displacement theory, screen time can disrupt the functionality of the child/adolescent by replacing the time to be spent on behaviors that positively affect cognitive development such as socializing with family and peers, being physically active, participating in creative games, completing homework, or reading books (Horowitz-Kraus & Hutton, 2018). It has been reported that long-term screen exposure may cause structural and functional changes in brain areas related to executive functions, lead to attention deficit hyperactivity disorder (ADHD) symptoms, negatively affect sleep duration and quality, and increase the risk of obesity and internalized symptoms such as depression and anxiety (Chassiakos et al., 2016; Lissak, 2018; Short et al., 2018). Given the negative effects of screen time on various areas of health, identifying factors with potential impacts on screen use is important for early detection of the population at risk. Since screen use habits begin to form at an early age, predictors of screen time need to be addressed before they become habits (Costigan et al., 2013).

According to the triadic influence theory, risk factors that cause changes in behavior are classified under three headings: intrapersonal, interpersonal, and environmental (Flay & Petraitis, 1994). Although studies investigating predictors of screen time are insufficient to establish a consensus, studies on intrapersonal cognitive and affective risk factors have reported that ADHD, depression, social anxiety, and difficulties in social skills (difficulty making and keeping friends) affect screen time (Chou et al., 2015; Lemmens et al., 2011; Morgan & Cotten, 2003; Prizant-Passal et al., 2016).

Sluggish cognitive tempo (SCT) is a psychiatric phenomenon consisting of symptoms such as excessive daydreaming, slow thinking, getting lost in thoughts, reduced or inconsistent alertness, and underactive behavior (Barkley, 2013). Although SCT symptoms are similar to the ADHD-predominantly inattentive presentation, there is strong evidence that SCT symptoms form a separate symptom cluster from ADHD. At least some of the SCT symptoms (e.g., daydreaming) are defined by internal distractibility, while ADHD symptoms are more often described by external distractibility (Becker et al., 2018). Poor internal attentional control, which is one of the main symptoms of SCT, including the inability to keep away from getting lost in one's thoughts, is closely related to rumination (Whitmer & Gotlib, 2013).

The importance of rumination was emphasized in studies examining moderator and mediator variables in the relationship between psychopathology and problematic technology use (Brand et al., 2016). Rumination is a dysfunctional coping mechanism that takes reference from the individual's own negative thoughts rather than adaptive emotion processing and is closely related to depression and anxiety (McLaughlin & Nolen-Hoeksema, 2011; Michl et al., 2013). Rumination in social relationships, for instance, may cause the person to constantly check their mobile phone for social notifications, leading to excessive reassurance-seeking behavior. Excessive reassurance seeking is a maladaptive coping mechanism that plays a role in the continuation of depression and anxiety (Brozovich & Heimberg, 2008). Maladaptive coping styles are also closely related to almost all types of problematic technology use (gaming addiction, pathological internet use, etc.) (Brand et al., 2014). As a maladaptive coping mechanism, rumination mediates problematic technology use caused by depression and anxiety (Elhai et al., 2018). Similar to mind-wandering, rumination is also a kind of task-unrelated thought that is thought to be at the root of SCT and is reflected in the clinic as daydreaming, which is the most basic symptom of SCT. In addition, it is one of the mechanisms responsible for the frequent association of SCT with internalized disorders such as anxiety and depression (Becker & Willcutt, 2019). Based on the above-mentioned theoretical background and study findings, it was hypothesized that SCT could be among the predictors of screen time. In the literature review, no study was found that evaluated the relationship between SCT and screen time. Therefore, in this study, it was aimed to examine the intrapersonal cognitive and affective predictors of screen time and the relationship between SCT and screen time. Cognitive and affective predictors are conceptualized in a dimensional approach where symptoms can range from minor to major conditions.

Methods

Participants

Adolescents aged 11 – 18 years and their parents who applied to the child and adolescent psychiatry outpatient clinic of a university hospital for any reason were included in the study. As a result of the diagnostic evaluation based on Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5), adolescents with major developmental psychopathologies (autism spectrum disorder, learning disabilities, and specific learning disorder) that would hinder the reading or understanding the questions were identified and excluded from the study. A total of 164 adolescents, 104 girls and 60 boys, participated in the study. The mean ages of female and male participants were 14.39 ± 1.39 and 13.87 ± 1.96, respectively.

This study was approved by the Clinical Research Ethics Committee of İstanbul Medeniyet University Göztepe Training and Research Hospital (approval no: 2021/0464). Parents and their children between the ages of 11 and 18 were informed about the aim, content, and methodology of the study. Informed consent was taken from the adolescents and their parents who volunteered to participate in the study. Participant anonymity and data confidentiality were ensured.

Measures

Screen Time

Screen time was evaluated on the basis of their answers to the following question: "On average, how many hours each day do you spend in front of television, mobile phone, tablet, computer and game console, except for the purpose of accessing distance education activities?" Screen time was included in the analysis as a continuous measurement. It was determined that the screen time showed a normal distribution, satisfying the linear regression analysis assumptions.

Internalizing problems, Peer problems, and Prosocial behaviors

Internalizing problems, peer problems, and prosocial behaviors were assessed using the Strengths and Difficulties Questionnaire

(SDQ) Adolescent Form's emotional problems, peer problems, and prosocial behaviors subscales, respectively. Strengths and Difficulties Questionnaire was developed by Goodman to measure psychological problems in children and adolescents, and it includes three-point Likert-type scoring (Goodman, 1997). It consists of five sub-dimensions as inattention and hyperactivity, conduct problems, emotional problems, peer problems, and prosocial behaviors. Each sub-dimension has five questions. Turkish validity and reliability study was conducted by Güvenir et al. (2008).

Attention Problems and Hyperactivity/Impulsivity

Attention problems and hyperactivity/impulsivity were evaluated using the Turgay DSM-IV Disruptive Behavior Disorders Rating Scale Parent form (T-DSM-IV-S), which was developed by Turgay (1994) and translated by Ercan et al. into Turkish (2001). The T-DSM-IV-S is based on DSM-IV diagnostic criteria and assesses hyperactivity/impulsivity, inattention, opposition defiance, and conduct disorder. They are scored on a four-point Likert scale (0 = not at all; 1 = just a little; 2 = quite a bit, and 3 = very much). The subscale scores on the T-DSM-IV-S were calculated by summing the scores on the items of each subscale. In the present study, hyperactivity/impulsivity (nine items) and inattention (nine items) scores on the scale were used.

Sluggish Cognitive Tempo

Sluggish cognitive tempo was evaluated with the Penny SCT Scale. Penny SCT Scale is a 4-point Likert-type scale consisting of 14 items. Each item is scored as totally disagree (0), somewhat agree (1), agree (2), or totally agree (3). The total score of the scale is obtained by adding up the scores taken from all items. There is a parent and a teacher form. The parent form consists of three sub-dimensions (slow, sleepy, and daydreamer) explaining 70.2% of the total variance. The internal consistency coefficient of the parent form ranges between .93 and .96 and test – retest reliability was found to be sufficient (ranging from .70 to .87) (Penny et al., 2009). Turkish validity and reliability study was conducted by Gozpinar et al. (2022).

Statistical Analysis

Statistical analyses were analyzed using International Business Machines Statistical Package for the Social Sciences software (Windows Release 26.0; SPSS Inc., Chicago, Illinois, USA). The descriptive statistics of the sample were presented as mean scores for continuous variables. Statistical differences between the sexes were analyzed using the independent sample *t*-test. Relationships between dependent and independent variables were analyzed by Pearson's correlation analysis for normally distributed variables. The statistical significance level was determined as $p < .05$. Multivariate linear regression analysis was performed using the "Enter" technique to determine the possible predictors of the dependent variable (screen time). Before the regression analysis, the possible multicollinearity between the variables to be included in the model was examined. Multicollinearity (and tolerance) were evaluated by examining the variance inflation factor (VIF). Variables that showed significant correlation in bivariate analyses ($p < .05$) were included in the regression analyses. In the second step, hierarchical regression analysis (stepwise) was performed.

Results

The mean scores, daily screen time, and standard deviations of each variable by gender are summarized in Table 1. Participants reported that they spent an average of 8.05 ± 2.18 hours per day on different screens. There was no significant difference between boys and girls in terms of daily screen use. Strengths and Difficulties Questionnaire emotional problem and prosocial behavior scores were significantly higher in girls, while inattention and hyperactivity scores were significantly higher in boys. Although the SCT scale scores were higher in girls, the difference between genders was not statistically significant.

The correlation matrix for the independent variables in the study is presented in Table 2. Table 3 shows the zero-order and partial correlations between the independent variables and the dependent variable (screen time). Screen time was positively correlated with emotional problems ($r = .184$, $p = .019$), inattention ($r = .251$, $p = .001$), hyperactivity ($r = .164$, $p = .036$), and SCT scale scores ($r = .278$, $p < .001$). There was a significant negative correlation between screen time and prosocial behaviors ($r = -.181$, $p = .020$). The independent variable most associated with screen time was SCT ($r = .278$). The partial correlations obtained by eliminating the effect of other independent variables on the screen time are as shown in Table 3.

A two-step multivariate linear regression analysis was performed to identify the variables that significantly predicted screen time (Table 4). In the first analysis performed with the Enter method, SCT, inattention, hyperactivity, emotional problems, and prosocial behaviors, which were significantly correlated with

Table 1.
Sample Description

	Female ($N = 104$)	Male ($N = 60$)	Total ($N = 164$)		
	M ± SD	M ± SD	M ± SD	*t*-Test	*p*
SDQ emotional problems	5.135 ± 2.622	3.300 ± 2.287	4.463 ± 2.65	4.517	**<.001**
SDQ peer problems	3.625 ± 1.932	3.517 ± 2.095	3.585 ± 1.987	.335	.738
SDQ prosocial behavior	7.885 ± 1.932	7.217 ± 1.941	7.64 ± 1.956	2.129	**.035**
Turgay inattention	10.077 ± 5.982	12.450 ± 7.871	10.945 ± 6.808	−2.023	**.046**
Turgay hyperactivity	5.865 ± 4.603	9.167 ± 7.594	7.073 ± 6.067	−3.059	**.003**
Penny SCT	14.760 ± 9.808	14.183 ± 9.151	14.549 ± 9.549	.371	.711
Total screen time per day (hours)	8.173 ± 2.196	7.833 ± 2.164	8.049 ± 2.184	.959	.339

SDQ = Strengths and Difficulties Questionnaire; SCT = sluggish cognitive tempo; M = mean; SD = standard deviation.

Table 2.
Correlation Matrix for Independent Variables

Variables	1	2	3	4	5	6
1. Emotional problems	1.000	.210**	−.059	.166*	.018	.363**
2. Peer problems		1.000	−.318**	.078	.061	.106
3. Prosocial behavior			1.000	−.248**	−.245**	-.222**
4. Inattention				1.000	.626**	.625**
5. Hyperactivity					1.000	.312**
6. SCT						1.000

*$p < .05$, **$p < .01$.

Table 3.
Correlations Between Screen Time and Intrapersonal Predictors

	Screen Time			
	r_1	p_1	r_2	p_2
Emotional problems	.184	.019*	.100	.208
Peer problems	.095	.226	.014	.860
Prosocial behavior	−.181	.020*	−.102	.199
Inattention	.251	.001*	.064	.420
Hyperactivity	.164	.036*	.024	.764
SCT	.278	<.001**	.112	.161

r_1 = Pearson's correlation; r_2 = partial correlation; SCT = sluggish cognitive tempo.
*$p < .05$, **$p < .01$.

screen time, were added to the model as independent variables. The regression equation was found to be significant ($F = 3.879$, $p = .02$). The assumptions of error independence were met for analysis (Durbin – Watson = 2.146). The highest VIF values for the model were 2.482. Therefore, we determined that multicollinearity was not present. The analysis showed that the five predictors explained 8.1% of the total variance in daily screen time.

In the second step, variables showing a significant correlation with screen time were added to the model and regression analysis was performed using the stepwise method (Table 4). The regression equation was also significant ($F = 13.616$, $p < .001$). The assumptions of error independence were also met for analysis (Durbin – Watson = 2.127). The highest VIF values for the models were 1.000. It was found that only the SCT ($B = .064$, Beta = .278, $p < .001$) was significantly associated with screen time and explained the 7.2% of the total variance in total daily screen time.

Discussion

In this study, intrapersonal predictors of daily screen time in adolescents aged 11 – 18 were examined. Taken as a whole, SCT alone explained 7.2% of the total variance among intrapersonal predictors as a result of multivariate linear regression analysis.

Participants reported that they spend an average of 8 hours a day in front of any type of screen. The screen time of male and female participants was found to be similar ($p = .339$). In a recent study, it was reported that the average daily screen use time of adolescents in Finland was 4 hours (Männikkö et al., 2020). It has been reported that the daily screen use time of adolescents in Europe was between 3 and 7 hours between 2002 and 2010 (Bucksch et al., 2016). In a study conducted in Turkey in the last days of the long lockdown period, 71.7% of parents reported that the time spent by

Table 4.
Multivariate Linear Regression Predicting Daily Screen Time

	B (95% CI)	Beta	*t*	*p*	Zero Order	Partial
Enter						
(Constant)	7.707 (6.025 to 9.389)		9.052	<.001		
SCT	.033 (−.013 to .08)	.145	1.410	.161	.278	.111
Hyperactivity	.011 (−.059 to .08)	.030	.302	.763	.164	.024
Inattention	.031 (−.044 to .106)	.096	.808	.420	.251	.064
Emotional problems	.089 (−.043 to .221)	.108	1.330	.185	.184	.105
Prosocial behavior	−.124 (−.298 to .049)	−.111	−1.419	.158	−.181	−.112
Stepwise						
Constant	7.122 (6.53 to 7.715)		23.733	<.001		
SCT	.064 (.03 to .098)	.278	3.690	<.001	.278	.278

B = unstandardized coefficient; Beta = standardized beta coefficient; SCT = sluggish cognitive tempo.
$F_{(enter)} = 3.879$ ($p = .02$), Adj. $R^2_{(enter)} = .081$, $SE_{(enter)} = 2.094$; $F_{(stepwise)} = 13.616$ ($p < .001$), Adj. $R^2_{(stepwise)} = .072$, $SE_{(stepwise)} = 2.104$.

their children on the screen increased during the pandemic period and the average daily screen time was 6.42 ± 3.07 hours (Ozturk Eyimaya & Yalçin Irmak, 2021). The fact that this study was carried out in the first days of the lockdown period, when many of the needs of adolescents, including their social needs, were met through the screen, may be related to the reason for excessive screen time. It is known that factors such as feeling safe at school and participating in extracurricular school-based activities (e.g., sports) are negatively associated with screen time (Minges et al., 2015) and adolescents could not access to these activities in this period. Although there are studies reporting that male gender is associated with more screen exposure (Bucksch et al., 2016), it has been reported that screen time tends to increase for female gender as well, since girls use smart mobile phones for a wide variety of purposes (Lopez-Fernandez et al., 2017). The findings of our study reflect the current literature (8.17 ± 2.20 hours and 7.83 ± 2.16 hours, females and males, respectively).

When all intrapersonal cognitive and affective factors including inattention, hyperactivity, SCT, emotional problems, peer problems, and prosocial behaviors (protective factor) were included in the model, 8.1% of screen time was explained. The fact that the search for rewards and excitement is high and screen-mediated activities, especially video games, provide this stimulation and also the difficulties they experience in stopping the activity due to impulsivity cause children and adolescents with ADHD to spend more time in front of the screen (Morgan & Cotten, 2003). Since young people with attention/hyperactivity problems are typically more likely to encounter peer difficulties compared to their typically developing peers, they prefer solitary activities such as spending time in front of a game console and television. In this study, the correlation between screen time and inattention and hyperactivity scale scores was found to be significant ($r_{\text{inattention}} = .251$, $r_{\text{hyperactivity}} = .164$, $p < .05$).

Consistent with the literature reporting that individuals with SCT symptoms have difficulties in social skills, a significant negative correlation was found between SCT and prosocial behaviors ($r = -0.22$, $p < .01$) (Becker et al., 2014). Social skills are necessary to be accepted by peers and to establish lasting relationships. If young people do not have these skills, they may tend to meet their socialization needs through the screen, which does not require them to be socially competent. According to the uses and gratifications theory (Katz & Blumler, 1974), which explains the motivations for technology use, media usage preferences are guided by the satisfaction that arises when the user's needs (socialization, relaxation, etc.) are met. From this perspective, the social difficulties experienced by individuals with SCT symptoms (Becker & Langberg, 2013) may lead them to use screen-mediated activities to meet their socialization needs. The satisfaction provided has a reinforcing effect on screen use, leading to an increase in the time spent in front of the screen. It has been reported that SCT has a reinforcing effect on social anxiety symptoms (Fredrick et al., 2020). The fact that these individuals spend time in front of the screen to alleviate the distress caused by social anxiety may function as a coping mechanism (Prizant-Passal et al., 2016).

In the linear regression model in which intrapersonal predictors were included in the analysis with the stepwise method, SCT, the only significant variable, explained 7.2% of the screen time. There are findings in the literature showing that SCT predicts a number of psychopathologies including depression, anxiety, ADHD, learning difficulties, and sleep problems (Becker & Willcutt, 2019). To the best of our knowledge, this is the first study to show that SCT can predict screen time. Considering the existence of strong evidence supporting the relationship between the factors in the model (excluding SCT) and screen time, it is noteworthy that none of these variables were included in the second model (Lemmens et al., 2011; Morgan & Cotten, 2003; Prizant-Passal et al. , 2016). One possible explanation for this situation is that SCT is a transdiagnostic construct that also predicts other independent variables in the regression equation. Transdiagnostic constructs are becoming increasingly important in understanding the mechanisms involved in the emergence and maintenance of psychopathology (Mansell et al., 2008). Studies on the conceptualization of SCT have suggested that SCT may be a psychopathological "dimension" or a transdiagnostic process that significantly predicts risk and impairment in various psychopathologies (Becker & Willcutt, 2019). The strong evidence that SCT is associated with both externalized and internalized disorders (heterotypic symptom presentation) supports the hypothesis that it may be a transdiagnostic structure. In our study, SCT was significantly correlated with both internalized (emotional problems) and externalized (inattention and hyperactivity) symptoms (Table 2). This finding supports the heterotypic symptom presentation of SCT and the literature knowledge that it may be a psychopathological dimension.

While zero-order correlations between screen time and intrapersonal predictors including SCT were statistically significant, no statistical significance was found in partial correlations (Table 3). This finding suggests that the relationship between intrapersonal predictors and screen time may be complex and some variables may play a mediating role. The use of electronic screen-mediated activities as a tool to cope with stressful life events is an important factor causing an increase in screen use (Brand et al., 2014). Individuals who are more sensitive to stress are more likely to use dysfunctional coping strategies. Increased punishment sensitivity and behavioral inhibition system sensitivity seen in SCT make these individuals sensitive to stress (Becker et al., 2013). So much so that rumination, which is a dysfunctional coping mechanism, is one of the mechanisms underlying SCT. It has been reported that rumination mediates the relationship between depression and anxiety and problematic smart mobile phone use (Elhai et al., 2018). However, the mediating effect of SCT between screen time and psychopathology has not yet been studied. Therefore, this interpretation is only an assumption until the mediating effect of SCT is demonstrated in further studies.

Limitations and Directions/Suggestions for Future Research

On the other hand, there are some limitations of the study. First, screen usage is affected by many factors that interact with each other, as mentioned above. Due to the scope of this study, interpersonal and environmental risk factors that may interact with intrapersonal risk factors were not included in the study. Second, information on screen time was obtained based on adolescent reporting. Considering that adolescents with long-term screen exposure tend to under-report screen time and adolescents with

less screen exposure tend to over-report screen time (Scharkow, 2016), these findings should be supported by future studies in which the evaluation is based on more objective criteria (receiving information from parents and screen time recorder). Third, since this study focused on the total daily screen time, the distribution of this time among certain screen activities and the effect of intrapersonal predictors on the type of application accessed were not examined. Fourth, although it was reported in this study that SCT predicts screen time with a transdiagnostic mechanism, it is not possible to comment on whether anxiety, depression, and other externalized disorders are the antecedents or consequences of this relationship. Longitudinal studies and future studies examining the moderators and mediators of the relationship between SCT and screen time via structural equation models are needed to determine the direction and nature of the relationship.

Ethics Committee Approval: Ethics committee approval was obtained from the Clinical Research Ethics Committee of İstanbul Medeniyet University Göztepe Training and Research Hospital (approval no: 2021/0464).

Informed Consent: All participants and parents provided informed consent and participation was voluntary.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - N.G., V.G.; Design - N.G., V.G.; Supervision - V.G.; Funding - N.G.; Materials - N.G.; Data Collection and/or Processing - N.G.; Analysis and/or Interpretation - N.G., V.G.; Literature Review - N.G., V.G.; Writing - N.G., V.G.; Critical Review - V.G.

Declaration of Interests: The authors have no conflicts of interest to declare.

Funding: The authors declared that this study has received no financial support.

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