

# Self-Control and Digital Media Addiction: The Mediating Role of Media Multitasking and Time Style

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**Introduction:** As being an initiating actions and resisting short-term temptations, self-control is negatively related to digital media addiction. However, many studies indicate that there are variables that may mediate this relationship. The present study investigated the mediating role of media multitasking and time style in the relationship between self-control and digital media addiction.

**Methods:** The study included N= 2193 participants with a mean age of  $M = 23.26$  ( $SD = 6.98$ ) from seven countries: Brazil, Hong Kong, Israel, Italy, Poland, Turkey, and the United States. The authors used the Brief Self-Control Scale, the Media Multitasking Scale, the Time Styles Scale, the Problematic Smartphone Use Scale, the Problematic Internet Use Scale, and the Problematic Facebook Use Scale.

**Results:** Results revealed that self-control was negatively related to all assessed types of problematic digital media use, namely problematic Internet use, problematic smartphone use, and problematic Facebook use. Media multitasking was found to be a significant mediator of the relationship between self-control and problematic digital media use.

**Discussion:** High self-control can be preventative against uncontrolled and automatic social media checking, whereas low self-control fosters the habit of continuously remaining current.

**Keywords:** self-control, digital media addiction, media multitasking, time style

## Introduction

The present study investigated the mediating role of media multitasking and time style in the relationship between self-control and digital media addiction. Previous studies suggest links between problematic phone use and self-control.<sup>1,2</sup> Self-control was also negatively related to social media addictions.<sup>3,4</sup> Studies indicate that some variables can mediate the relationship between self-control and new media addiction.<sup>5</sup> Servidio found partial mediation of fear of missing out in the relationship between self-control and problematic smartphone use.

## Self-Control and Digital Media Addiction

Digital media addiction—which takes different forms, such as addiction to mobile phones, social media, the Internet, television, or video games—is a common problem with negative effects for all age groups worldwide. Nowadays, the use of new technologies connected to the Internet is widespread and can lead to addiction.<sup>6</sup> However, the term Internet addiction seems narrow, and the studies suggested that this phenomenon should be considered multidimensionally.<sup>7,8</sup> Therefore, using the umbrella term digital media addiction (DMA) seems justified, combining Internet addiction,<sup>9</sup> smartphone addiction<sup>10</sup> and Facebook addiction.<sup>11,12</sup> These phenomena represent other aspects of digital media

addiction. Based on previous research, we can define digital media addiction as compulsive use of digital media, eg, tablets, smartphones, laptops, computers, and social media.<sup>10,12,13</sup> Digital media addiction manifests symptoms typical for behavioural addictions, difficulty controlling and tolerance, mood modification or withdrawal symptoms.<sup>13–15</sup>

Self-control, defined as the ability to initiate actions, resist short-term temptations to achieve long-term goals<sup>16</sup> and effortful inhibition of destructive behaviors,<sup>17</sup> is an important predictor of success and health. In the context of digital media use, low self-control manifests itself in impulsive behavior and frequent risk-taking, which is linked to the risk of addictions such as Internet addiction.<sup>3</sup> Lower levels of self-control have been associated with higher levels of problematic mobile phone use<sup>1,2</sup> and smartphone addiction.<sup>18</sup> It turned out that people with low self-control responded to mobile notifications very quickly after getting a signal.<sup>19</sup> Self-control seems to be one of the most essential predictors of problematic phone use.<sup>20</sup> Rho and colleagues<sup>20</sup> identified five types of problematic smartphone use based on psychiatric symptoms, distinguishing the non-comorbid type and other types with mixed psychiatric symptoms where self-control plays a crucial role. Csibi and collaborators<sup>21</sup> analyzed the intensity of addiction components (conflict, salience, mood modification, tolerance, withdrawal syndrome, and relapse) across different age groups. They found that young users spent more time than older ones with their mobile phones and scored higher on the tolerance component, which is closely related to self-control ability and is still in its development stage in adolescence and young adulthood.<sup>21</sup>

## Media Multitasking

The development of media facilitates the simultaneous performance of multiple media tasks. Several studies have demonstrated an increase in this kind of behavior.<sup>22,23</sup> At least 90% of TV viewers multitask while watching TV. According to Deloitte Development LLC (2016), millennials (those in the 14–32 age group at the time of the survey) had the highest level of multitasking behavior during TV watching and were involved in up to four additional activities while watching TV, Generation Xers (the 33–49 age group), were involved in up to three additional activities. Those aged 50 and above were involved in up to one additional activity while watching TV. According to this study, it can be said that the number of multitasking varies according to age. Looking at the definition of what the concept of media multitasking is media multitasking refers to engagement in at least two tasks or switching between tasks involving digital media.<sup>24,25</sup> Increased media multitasking has been found to be a predictor of depression and social anxiety beyond overall media use and personality traits.<sup>26</sup>

Some studies indicate cultural differences in media multitasking.<sup>27</sup> One of the salient results revealed that American participants spent more time using screen devices and were more engaged in media multitasking than Taiwanese participants, while Taiwanese participants reported higher screen addiction than Americans.<sup>27</sup> What is more, one study found cross-cultural differences between American, Kuwaiti, and Russian students in terms of media multitasking behaviors.<sup>28</sup> Media multitasking was more prevalent among American and Kuwaiti students than Russian students.<sup>28</sup> On the individual level, media use was predicted by media ownership and sensation seeking. In the Kuwaiti and Russian samples, females reported multitasking more often than males, whereas, in the American sample, men multitasked more than women. Differences in the factors predicting multitasking behavior were found on a macro level. For instance, computer ownership, Internet penetration, and press freedom were likely to predict more frequent simultaneous media use.<sup>28</sup>

Another cross-cultural study by Kononova and Chiang<sup>28</sup> examined the differences between the United States and Taiwan in terms of how media and audience factors, such as country of residence, media ownership, and polychronicity, predicted media multitasking behaviors and looked into whether different motivations to multitask mediated the effects of those factors. Its results revealed that ownership, polychronicity, and four motivations (control, entertainment, connection, and addiction) positively predicted media multitasking. Polychronicity interpreted as an individual's penchant for multitasking, significantly impacts media multitasking. Those who scored high on polychronicity had a stronger tendency to media multitask. Americans reported higher polychronicity and a higher degree of media multitasking than Taiwanese.<sup>28</sup> The study by Voorveld and colleagues<sup>29</sup> aimed to determine the prevalence of media multitasking across six countries: Germany, the United States, the United Kingdom, and the Netherlands as monochronic countries, and France and Spain as polychronic ones. Differences in media multitasking were found; Americans were the strongest media multitaskers, and the Dutch were the weakest. The cultural factor in predicting the frequency of media

multitasking behavior in three contexts based on the nature of media combination was also included in the study by Srivastava, Nakazawa, and Chen.<sup>30</sup> Polychronicity at the individual level showed a significant positive association with the frequency of online, offline, and mixed media multitasking behaviors.

## Time Style

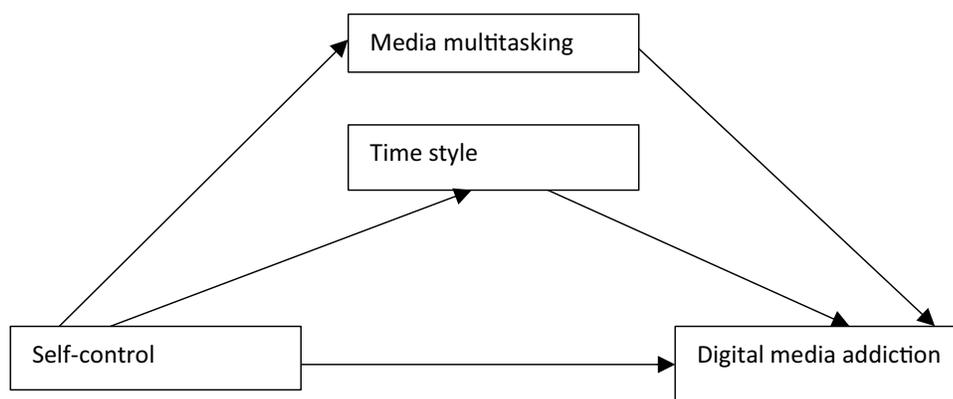
People differ in their attitude towards time, structure time, and manage their time, mainly related to their personality and culture.<sup>31</sup> The literature discusses the approach to time as an element of the silent language<sup>32</sup>—a concept emphasizing the importance of the nonverbal dimension in intercultural communication. To understand a culture or country, you must better understand how time is organized. The way people structure their time is called time style and can be either economic (marked by a preference for organization) or non-organized.<sup>31</sup> Research shows that, as far as time structuring is concerned, some cultures are predominantly oriented towards a clock-based organization of time while others are marked by event-based time structuring.

As defined by Usunier and Valette-Florence,<sup>31</sup> a clock-based organization means organizing life according to the clock, setting deadlines, dividing time into segments, formulating plans and designing structures, and acting according to them. Cultures with this approach to time are referred to as clock time cultures. There are also cultures in which time is approached in terms of events rather than plans or deadlines.<sup>33,34</sup> The countries where the study was conducted represent cultures with different approaches to time, with a strong (the USA, Hong Kong), moderate (Poland, Israel, Turkey), and weak (Brazil, Italy) tendency to rely on a clock-based structuring of time. Based on previous evidence suggesting a negative association between time management and multitasking,<sup>35</sup> we tested whether media multitasking was related to time style.

## The Present Study

Ekşi et al<sup>5</sup> study revealed that general procrastination was a mediator between self-control and digital media addiction. In a different study, increased media multitasking during cognitive activities was associated with decreased self-control, while media multitasking during recreational activities was associated with high social achievement, normality, and high self-control.<sup>36</sup> Therefore, we expected that media multitasking and time style would mediate the relationship between self-control and digital media addiction (Figure 1). We predicted that low self-control would be associated with higher media multitasking (H1) and a more non-organized time style (H2), both of which would subsequently be associated with higher levels of digital media addiction (H3).

The body of research indicates that it is worth considering the use of new technologies in a cultural context.<sup>14,37</sup> W cross-cultural analyses showed that the prevalence of social media addiction depends on the dimension of collectivism – individualism.<sup>14</sup> The study in the US and Italy found that the models explaining the Internet and social media are not universal, which is an argument to conduct research with samples from different countries.<sup>38</sup> Apart from the varying levels of polychronic, or media multitasking, other decisive factors considered in the selection process were the



**Figure 1** Theoretical model.

characteristics critical for explaining digital media addiction: technological development, political freedoms that allow unrestricted circulation of information, and cultural attributes.<sup>28,39</sup> The selected countries differ regarding industrial, economic, societal, and technological development (<http://hdr.undp.org/en/countries>; <http://data.worldbank.org/>).

What is more, Internet and Facebook penetration play crucial. The prevalence of Internet addiction varies across different countries.<sup>40</sup> Furthermore, Internet and Facebook penetration rates in those countries differ (<http://www.internetworldstats.com/>; <http://www.netlivestats.com/>). Moreover, the countries differ in terms of political constraints on information distribution, press freedom (<https://rsf.org/en/ranking>) and level of democratization is different in selected countries (<http://democracyranking.org/wordpress>). These discrepancies in access to the Internet and Facebook create different backgrounds for their users. More differences between the countries included in the study are shown in the Inglehart–Welzel cultural map of the world ([www.worldvaluessurvey.org](http://www.worldvaluessurvey.org)), which arranges countries in two dimensions: traditional vs secular-rational values and survival vs self-expression values.

The study aimed to test the relationship between self-control and digital media addiction. We indicated the role of media multitasking and time style in this relationship. We tested the model with data from seven countries. According to our knowledge, previous research did not include media multitasking and time style in explaining digital media addiction. The advantage of the presented study is to show the results considering the samples in a cultural context.<sup>38</sup>

### Participants and Procedure

The study included 2193 participants from seven countries, including the United States, Brazil, Hong Kong, Israel, Italy, Poland, and Turkey, with a mean age of  $M = 23.26$  ( $SD = 6.98$ ) years. Due to missing data, 5.2% of participants ( $N = 114$ ) were eliminated from the research, resulting in a final sample size of 2079 (1274 females, 61.28%, and 805 males, 38.72%) for further analysis: The following is the distribution of participants by country: 161 from Brazil, 285 from Hong Kong, 298 from Israel, 255 from Italy, 486 from Poland, 331 from Turkey, and 263 from the United States. The characteristics of participants from each country are presented in Table 1. The minimum sample size will be  $N = 160$  in each country. Considering the sample size analysis carried out for the two-level model using the sjstats R package,<sup>41–44</sup>

**Table 1** Characteristics of Participants from Each Country

Variable	Category	Country													
		Brazil		Hong Kong		Israel		Italy		Poland		Turkey		United States	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
Gender															
	Female	94	58.4	233	81.8	82	27.5	203	79.6	246	50.6	242	73.1	174	66.2
	Male	67	41.6	52	18.2	216	72.5	52	20.4	240	49.4	89	26.9	89	33.8
Marital status															
	Single	153	95.1	275	96.5	123	41.3	127	49.8	426	87.6	271	81.9	255	97.7
	Married	5	3.1	10	3.5	175	58.7	3	1.2	14	2.9	57	17.2	6	2.3
	Separated/divorced	2	1.2	0	0.0	0	0.0	0	0.0	1	0.2	2	0.6	0	0.0
	Widowed	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.3	0	0.0
	Other	1	0.6	0	0.0	0	0.0	125	49.0	45	9.3	0	0.0	0	0.0
Social status															
	Student	122	75.8	224	79.2	–	–	224	87.9	347	71.4	214	64.7	146	55.9
	Employed	7	4.3	13	4.6	–	–	9	3.5	36	7.4	58	17.5	106	40.6

(Continued)

Table 1 (Continued).

Variable	Category	Country													
		Brazil		Hong Kong		Israel		Italy		Poland		Turkey		United States	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
	Student and employed	23	14.3	45	15.9	–	–	22	8.6	81	16.7	23	6.9	9	3.5
	Unemployed	8	5.0	1	0.3	–	–	0	0.0	22	4.5	8	2.4	0	0.0
	Retired	1	0.6	0	0.0	–	–	0	0.0	0	0.0	28	8.5	0	0.0
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Age		19.37	2.81	22.67	4.83	29.19	11.13	21.97	4.36	22.74	2.74	25.13	8.85	19.44	3.69

**Notes:** For the United States, there were two cases of missing data concerning the marital status and two such cases concerning social status; for Hong Kong, there were two cases of missing data concerning social status; for Israel, the response option concerning marital status was “married/relationship”, and there was no question about social status.

the results showed that minimum sample size should be 112 subjects per cluster and 787 total sample size ( $\alpha = 0.05$ ; power = 0.08; effect size = 0.2; cluster number = 7).

The study was conducted in local languages. After the electronic version of the questionnaire was prepared, the link to the research site was sent out via the Internet. A convenience sampling approach was used to obtain a large group of respondents that differ in terms of socio-demographic characteristics. The participants volunteered to take part in the study and received no monetary reward. They were assured about the anonymity of the data they provided. The study was approved by the Institute of Psychology ethic committee board.

## Method

To measure dispositional self-control, we used the Brief Self-Control Scale,<sup>45</sup> which consists of 13 items (eg, “I am good at resisting temptation”). Participants responded on a 5-point Likert-type scale, indicating to what extent they agreed or disagreed with each of the statements (1 = strongly disagree to 5 = strongly agree).

Media multitasking was measured with the 9-item Short Media Multitasking Scale,<sup>46</sup> which focused on three media activities: watching TV, using social network sites, and sending messages through phone or computer. Participants rated each item on a 4-point Likert-type scale, indicating how often they engaged in each of the nine activities (1 = never to 4 = very often).

The structuring of time was assessed with the Time Styles Scale (TSS),<sup>31</sup> which consists of the Economic Time subscale (eg, “I like to have a definite schedule and stick to it”) and the Non-Organized Time subscale (eg, “I hate following a schedule”). Participants indicated on a 5-point Likert-type scale how strongly they agreed or disagreed with each of the seven statements (1 = strongly disagree to 5 = strongly agree).

To measure digital media addiction, we used three methods: (1) smartphone addiction, we used the Smartphone Addiction Scale—Short Version (SAS-SV),<sup>47</sup> which consists of 10 items (eg, “Missing planned work due to smartphone use”) with 6-point rating scales (1 = strongly disagree to 6 = strongly agree). (2) Problematic Internet use was assessed with the Problematic Internet Use Questionnaire—Short Form (PIUQ-SF-6),<sup>48</sup> consisting of six questions for participants to respond to on a 5-point Likert-type scale (1 = never to 5 = always / almost always; eg, “How often do you try to conceal the amount of time spent online?”). (3) To measure problematic Facebook use, we administered the 8-item Facebook Intrusion Questionnaire,<sup>11</sup> which quantifies participants’ Facebook involvement on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree; eg, “I have been unable to reduce my Facebook use”).

The reliability of scores on the measures used for each country is reported in [Appendix A](#). The values of Tucker’s phi,<sup>49</sup> assessing the cross-cultural equivalence of the analyzed variables,<sup>50</sup> are also presented in [Appendix A](#).

**Table 2** The Intraclass Correlation Coefficient (ICC) Values for Outcome Variables and Mediators

Variable	ICC	SE	95% CI	
			LL	UL
Problematic smartphone use	0.127	0.065	0.044	0.316
Problematic Internet use	0.023	0.014	0.007	0.072
Problematic Facebook use	0.108	0.053	0.040	0.262
Media multitasking	0.176	0.085	0.063	0.403
Economic time style	0.039	0.024	0.012	0.124
Non-organized time style	0.054	0.032	0.017	0.161

**Abbreviations:** ICC, intraclass correlation coefficient; SE, standard error; CI, confidence interval; LL, lower limit; UL, upper limit.

## Statistical Analyses

Descriptive statistics are presented as means and standard deviations. Additionally, taking into account the possible differences between countries, we used a multilevel Pearson correlation coefficient to calculate the relationships between the analyzed variables. Additionally, in order to determine the differences between countries, we performed one-way ANOVA with post hoc Tamhane's T2 test. The effect size was calculated using partial eta squared.

In order to analyze the mediating effects of media multitasking, economic time style, and non-organized time style on the associations between self-control and problematic behaviors (problematic smartphone use, problematic Facebook use, problematic Internet use), we performed multilevel mediation analyses with restricted maximum likelihood (REML) estimator.<sup>51</sup> A multilevel mediation analysis was performed separately for each problematic behavior. We applied this technique because of the multilevel nature of the data, which had been collected in different countries, and due to the intraclass correlation coefficient (ICC) results. More precisely, the values of ICC—a measure of the clustering effect—ranged from 0.023 to 0.176 (see Table 2).

We conducted the mediation analysis using the 1-(1-1)-1 design with random intercepts and slopes<sup>52</sup> separately for each problematic behavior. We specified the diagonal covariance matrix for each mediation model and the diagonal residual covariance matrix. Indirect effects were tested using the Monte Carlo method (10,000 samples) with 95% confidence intervals (95% CI). Additionally, age was included as a within-level covariate because of its correlations with the study variables. Due to the small number of clusters relating to multilevel analysis,<sup>53</sup> only within fixed-effects with random effects were presented. We computed the following model fit statistics:  $-2$  times the Log Likelihood ( $-2LL$ ), Akaike's Information Criterion (AIC), Hurvich and Tsai's Criterion (AICC), Bozdogan's Criterion (CAIC), and Schwarz's Bayesian Criterion (BIC).<sup>54</sup> The descriptive statistics were calculated using SPSS 27 and the multilevel correlation analysis was carried out using R software with the correlation package.<sup>55</sup> The mediation analyses were carried out using SPSS 27 software with MLmed macros.<sup>54</sup>

## Results

The descriptive statistics and correlations between the examined variables are shown in Table 3. Problematic smartphone use was positively associated with media multitasking and non-organized time style. It was also negatively associated with self-control and age. Problematic Internet use was positively related to media multitasking and non-organized time style, whereas self-control was negatively associated with economic time style, age, and problematic Internet use. Problematic Facebook use was positively related to media multitasking and negatively related to self-control. The three problematic behaviors were positively intercorrelated. Detailed results are shown in Table 3.

There were statistically significant differences between countries on the measures of self-control, media multitasking, economic time style, non-organized time style, problematic smartphone use, problematic Facebook use, and problematic Internet use (see Table 4). It should be noted, however, that the effect sizes of these differences were small.

**Table 3** Descriptive Statistics and Correlations Between the Analyzed Variables ( $N = 2079$ )

Variable	Descriptive Statistics		Multilevel Correlations						
	M	SD	[1]	[2]	[3]	[4]	[5]	[6]	[7]
[1] Self-control	3.15	0.67							
[2] Media multitasking	2.59	0.61	-0.17***						
[3] Time style: Economic time	3.59	0.96	0.30***	0.03					
[4] Time style: Non-organized time	2.49	0.94	-0.26***	0.01	-0.59***				
[5] Problematic smartphone use	2.79	1.03	-0.40***	0.29***	-0.04	0.09***			
[6] Problematic Facebook use	2.36	1.14	-0.23***	0.24***	0.01	0.05	0.42***		
[7] Problematic Internet use	2.36	0.78	-0.42***	0.25***	-0.12***	0.12***	0.67***	0.41***	
[8] Age	23.26	6.98	0.12***	-0.22***	0.05	-0.03	-0.16***	-0.02	-0.18***

Note: \*\*\* $p < 0.001$ .

## Problematic Smartphone Use

In the multilevel mediation analysis, indirect effects were not calculated due to errors in some of the estimated random effects, namely the random slope between self-control and media multitasking and the random slope between non-organized time style and problematic smartphone use. Consequently, these random effects were excluded and the modified model was recalculated ( $-2LL = 19,583.70$ ,  $AIC = 19,617.70$ ,  $AICC = 19,617.78$ ,  $CAIC = 19,754.11$ ,  $BIC = 19,737.11$ ). The multilevel mediation analysis revealed a significant indirect effect between self-control and problematic smartphone use via a non-organized time style. Similarly, there was a significant indirect effect between self-control and problematic smartphone use via economic time style. The indirect effect between self-control and problematic smartphone use via media multitasking was also significant (see Table 5 and Table 6). There was a significant unstandardized direct effect between self-control and problematic smartphone use (direct effect =  $-0.572$ ,  $SE = 0.057$ ,  $p < 0.001$ , 95% CI  $[-0.713, -0.431]$ ). These results indicate partial mediation between self-control and problematic smartphone use via media multitasking, economic time style, and non-organized time style.

## Problematic Internet Use

Due to errors in some of the estimated random effects, namely the random slope between self-control and media multitasking, the random slope between age and problematic Internet use, the random slope between economic time style and problematic Internet use, and the random slope between non-organized time style and problematic Internet use, we did not calculate the indirect effects. Consequently, these random effects were excluded and the modified model was reanalyzed ( $-2LL = 18,690.72$ ,  $AIC = 18,720.72$ ,  $AICC = 18,720.78$ ,  $CAIC = 18,841.08$ ,  $BIC = 18,826.08$ ). The results of multilevel mediation analysis showed that there was a significant indirect effect only between self-control and problematic Internet use via media multitasking (see Table 6 and Table 7). Given the significant unstandardized direct effect between self-control and problematic Internet use (direct effect =  $-0.462$ ,  $SE = 0.048$ ,  $p < 0.001$ , 95% CI  $[-0.583, -0.341]$ ), these results indicate partial mediation between self-control and problematic Internet use via media multitasking.

## Problematic Facebook Use

As in the previous multilevel mediation analyses, the indirect effects were not calculated due to errors in estimated random effects, namely the random slope between self-control and media multitasking. Consequently, this random slope was removed from the model and the modified mediation model was reanalyzed ( $-2LL = 20,328.46$ ,  $AIC = 20,364.46$ ,  $AICC = 20,364.54$ ,  $CAIC = 20,508.89$ ,  $BIC = 20,490.89$ ). The multilevel mediation analysis revealed an indirect effect between self-control and problematic Facebook use via media multitasking (see Table 6 and Table 7). Additionally, the findings showed that there was a statistically significant indirect effect between self-control and problematic Facebook

**Table 4** Differences Between Countries in the Analyzed Variables

Variable	Country														F	p	$\eta_p^2$ with 95% CI	Significant Differences Between Countries
	Brazil[1]		Hong Kong[2]		Israel[3]		Italy[4]		Poland[5]		Turkey[6]		United States[7]					
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD				
Self-control	3.31	0.68	2.92	0.58	3.31	0.65	3.30	0.64	2.97	0.64	3.29	0.71	3.16	0.67	21.91	0.001	0.06 [0.04, 0.08]	1-2 1-5 2-3 2-4 2-6 2-7 3-5 4-5 5-6 5-7
Media multitasking	2.43	0.54	2.52	0.59	2.25	0.65	2.50	0.54	2.72	0.58	2.54	0.49	3.08	0.51	60.13	0.001	0.15 [0.12, 0.17]	1-3 1-5 1-7 2-3 2-5 2-7 3-4 3-5 3-6 3-7 4-5 4-7 5-6 5-7 6-7
Time style: Economic time	3.37	1.19	3.63	0.71	3.60	0.86	3.69	1.07	3.49	0.95	3.43	1.08	3.98	0.75	11.74	0.001	0.03 [0.02, 0.05]	1-7 2-7 3-7 4-7 5-7 6-7
Time style: Non-organized time	2.40	1.14	2.74	0.71	2.23	0.91	2.19	0.99	2.47	0.95	2.77	0.96	2.56	0.82	17.61	0.001	0.05 [0.03, 0.07]	1-2 1-6 2-3 2-4 2-5 3-5 3-6 3-7 4-5 4-6 4-7 5-6
Problematic smartphone use	2.79	1.17	3.15	0.92	2.79	0.91	2.55	0.87	2.25	0.85	3.37	1.11	2.86	0.95	55.53	0.001	0.14 [0.11, 0.16]	1-2 1-5 1-6 2-3 2-4 2-5 2-7 3-4 3-5 3-6 4-5 4-6 4-7 5-6 5-7 6-7
Problematic Facebook use	2.10	1.13	2.76	1.17	2.57	1.18	2.13	0.86	2.80	1.19	1.75	0.85	2.01	0.98	48.51	0.001	0.12 [0.10, 0.015]	1-2 1-3 1-5 1-6 2-4 2-6 2-7 3-4 3-6 3-7 4-5 4-6 5-6 5-7 6-7
Problematic Internet use	2.52	0.97	2.51	0.82	2.45	0.78	2.25	0.71	2.17	0.73	2.34	0.77	2.46	0.68	10.20	0.001	0.03 [0.01, 0.04]	1-5 2-4 2-5 3-4 3-5 4-7 5-6 5-7

**Table 5** Multilevel Mediation Model of the Relationship Between Self-Control and Problematic Smartphone Use via Media Multitasking, Non-Organized Time, and Economic Time

Parameters		On-Time Style: Non-Organized Time		On-Time Style: Economic Time		On Media Multitasking		On Problematic Smartphone Use	
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
<i>Within fixed-effects</i>									
	Age	-0.001	0.004	0.005	0.005	-0.018**	0.003	-0.011	0.004
	Self-control	-0.359***	0.041	0.414**	0.072	-0.125***	0.018	-0.572***	0.057
	Time style: Non-organized time							0.057*	0.025
	Time style: Economic time							0.105**	0.027
	Media multitasking							0.358**	0.052
	Constant	2.483	0.087	3.599	0.075	2.578	0.099	2.824	0.139
<i>Within random-effects</i>									
	Residual variance outcome	0.793***	0.025	0.800***	0.025	0.295***	0.009	0.701***	0.022
	Intercept	0.049	0.030	0.037	0.023	0.068	0.040	0.133	0.078
	Slope								
	Age	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Self-control	0.005	0.007	0.029	0.021	-	-	0.016	0.013
	Time style: Economic time							0.001	0.002
	Media multitasking							0.010	0.012

Notes: \*\*\*p < 0.001. \*\*p < 0.01. \*p < 0.05.

**Table 6** Unstandardized Indirect Effects with 95% Confidence Intervals

Model Pathway	Point Estimate	Standard Error	z	p	95% CI	
					LL	UL
The model including problematic smartphone use						
Self-control → Time style: Non-organized time → Problematic smartphone use	-0.020	0.009	-2.175	0.030	-0.039	-0.003
Self-control → Time style: Economic time → Problematic smartphone use	0.044	0.014	3.195	0.001	0.020	0.073
Self-control → Media multitasking → Problematic smartphone use	-0.045	0.009	-4.814	0.001	-0.065	-0.028
The model including problematic Internet use						
Self-control → Time style: Non-organized time → Problematic Internet use	-0.007	0.007	-0.966	0.334	-0.022	0.007
Self-control → Time style: Economic time → Problematic Internet use	0.002	0.009	0.276	0.782	-0.014	0.019
Self-control → Media multitasking → Problematic Internet use	-0.028	0.007	-4.119	0.001	-0.043	-0.016
The model including problematic Facebook use						
Self-control → Time style: Non-organized time → Problematic Facebook use	-0.020	0.013	-1.486	0.137	-0.046	0.005
Self-control → Time style: Economic time → Problematic Facebook use	0.039	0.018	2.120	0.034	0.005	0.077
Self-control → Media multitasking → Problematic Facebook use	-0.047	0.014	-3.295	0.001	-0.077	-0.021

Abbreviations: CI, confidence interval; LL, lower limit; UL, upper limit.

**Table 7** Multilevel Mediation Model of the Relationship Between Self-Control and Problematic Internet Use via Media Multitasking, Non-Organized Time, and Economic Time

Parameters		On-Time Style: Non-Organized Time		On-Time Style: Economic Time		On Media Multitasking		On Problematic Internet Use	
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
<i>Within fixed-effects</i>									
	Age	-0.001	0.004	0.005	0.005	-0.018**	0.003	-0.013***	0.003
	Self-control	-0.359***	0.041	0.414**	0.072	-0.125***	0.018	-0.462***	0.048
	Time style: Non-organized time							0.020	0.020
	Time style: Economic time							0.006	0.020
	Media multitasking							0.225**	0.043
	Constant	2.483	0.087	3.599	0.075	2.578	0.099	2.385	0.052
<i>Within random-effects</i>									
	Residual variance outcome	0.793***	0.025	0.800***	0.025	0.295***	0.009	0.458***	0.014
	Intercept	0.049	0.030	0.037	0.023	0.068	0.040	0.017	0.011
	Slope								
	Age	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Self-control	0.005	0.007	0.029	0.021	-	-	0.012	0.010
	Media multitasking							0.007	0.008

Notes: \*\*\*p < 0.001, \*\*p < 0.01.

use via economic time style (see Table 6). However, no statistically significant association was found between economic time style and problematic Facebook use (see Table 8). Consequently, the relationship between self-control and problematic Facebook use via economic time style cannot be considered a mediation effect. Moreover, given the significant unstandardized direct effect between self-control and problematic Facebook use (direct effect = -0.343, SE

**Table 8** Multilevel Mediation Model of the Relationship Between Self-Control and Problematic Facebook Use via Media Multitasking, Non-Organized Time, and Economic Time

Parameters		On-Time Style: Non-Organized Time		On-Time Style: Economic Time		On Media Multitasking		On Problematic Facebook Use	
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
<i>Within fixed-effects</i>									
	Age	-0.001	0.004	0.005	0.005	-0.018**	0.003	0.010	0.006
	Self-control	-0.359***	0.041	0.414**	0.072	-0.125***	0.018	-0.343***	0.051
	Time style: Non-organized time							0.054	0.036
	Time style: Economic time							0.093	0.040
	Media multitasking							0.373**	0.098
	Constant	2.483	0.087	3.599	0.075	2.578	0.099	2.303	0.154

(Continued)

Table 8 (Continued).

Parameters		On-Time Style: Non-Organized Time		On-Time Style: Economic Time		On Media Multitasking		On Problematic Facebook Use	
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
<i>Within random-effects</i>									
	Residual variance outcome	0.793***	0.025	0.800***	0.025	0.295***	0.009	0.999***	0.031
	Intercept	0.049	0.030	0.037	0.023	0.068	0.040	0.162	0.096
	Slope								
	Age	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Self-control	0.005	0.007	0.029	0.021	-	-	0.008	0.010
	Time style: Economic time							0.005	0.007
	Time style: Non-organized time							0.003	0.005
	Media multitasking							0.054	0.040

Notes: \*\*\* $p < 0.001$ . \*\* $p < 0.01$ .

= 0.051,  $p < 0.001$ , 95% CI [-0.463, -0.223]), these results indicate partial mediation between self-control and problematic Facebook use via media multitasking.

## Discussion

The study's main purpose was to investigate the mediating roles of media multitasking and time style in the relationship between self-control and digital media addiction. The present research utilized data collected in seven countries. First of all, taking into account the multilevel nature of data from different countries, we found that self-control was negatively related to all measured digital media addiction types. Social media addiction manifests itself in a compulsion to use social media,<sup>56</sup> in a need to be constantly on top of things, and in a desire to be online all the time, which includes automatically checking social media.<sup>57</sup> Thus, high self-control functions as a preventative against uncontrolled and automatic social media checking, whereas low self-control fosters the habit of continuously remaining current.<sup>58</sup> In this context, it seems necessary to give psycho-education to those who have low self-control strategies to regulate their social media interactions.

We predicted that media multitasking would mediate the relationship between self-control and digital media use operationalized as problematic Internet, smartphone, and Facebook use. The results of our study confirm the prediction that low self-control would translate into higher media multitasking and higher digital media addiction. Lopez and colleagues<sup>59</sup> also found that media multitasking was associated with inadequate self-regulation, which manifested itself in a reduced ability to control food stimuli, resulting in weight gain and obesity. This result was explained by an imbalance between brain systems involved in self-regulation and reward.<sup>59</sup> A different study indicated, moreover, that multitasking was strongly related to engaging in various online activities, such as using social media, emailing, and listening to music,<sup>35</sup> and to addictive phone use,<sup>60</sup> leading to addiction to screen devices.<sup>27</sup> This can be explained by the fact that media multitasking reduces task performance<sup>61</sup> and results in tasks taking longer to perform, which in turn increases the time spent using the media when working or studying in their presence. However, the longer a person utilizes media, the greater their likelihood of becoming dependent on them.<sup>60,62</sup>

Further, we hypothesized that time style (economic vs non-organized) would play the role of a mediator in the relationship between self-control and digital media use. We found that economic and non-organized time styles partially mediated the associations between self-control, problematic smartphone, and Facebook uses. However, it should be noted that the results for non-organized time styles may not be entirely conclusive of the low reliability of the subscale

measuring this construct in some countries. Consequently, this result should be approached with caution. Moreover, self-control was positively related to both economic and non-organized time styles. This means that individuals with higher self-control prefer to plan their time and do not like to act without a plan. Moreover, regardless of a person's time style, low self-control is accompanied by a high level of mobile phone addiction. Reference can be made to studies showing that time management is one of the aspects of self-control.<sup>35</sup> Many studies have demonstrated robust relationships between self-control and problematic new media use.<sup>3,63,64</sup>

## Limitations and Future Research

Despite the numerous exciting results that we have obtained, it must be acknowledged that this study is not free from limitations. Its results should be interpreted in light of these limitations. Firstly, the study had a cross-sectional design, so no causal conclusions should be drawn. In the future, it is recommended to conduct longitudinal studies with repeated measurement or diary studies.

Secondly, the reliability coefficients of the Time Styles Scale in some countries were low, which means conclusions regarding time styles should be approached with caution. This may be due to the poor understanding of the items in these countries, an issue that should be addressed in the future. In future studies, time style should be measured using a better method.

Finally, the number of countries was insufficient to allow for calculations with relative country-level models. It is estimated that a couple of dozen to fifty countries are needed for such analyses.<sup>53,65</sup> The model can therefore be analyzed at the individual level, with country error variance taken into account. It should be noted that even though the countries included in the study are located on different continents and have different cultural backgrounds, they represent only a fraction of the cultures that could be considered, giving a broader picture of the phenomenon under investigation.

The results of this study have wide implications, both theoretical and practical. Digital media have been developing for many years, and the way they are used continues to change, which means new data is needed regarding their users. The results presented here may inspire further research on the subject. They advance knowledge on digital media addiction. They can also be useful in the development of education and training programs dealing with human-computer interactions and directed against behavioral addictions. Understanding this topic will help determine the future directions of therapeutic activities. The presented research is of great practical significance, as any successful addiction treatment requires identifying useful and effective focal points for intervention.

## Ethics

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

## Informed Consent

Informed consent was obtained from all individual adult participants included in the study.

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## Disclosure

The authors declare that they have no conflict of interest.

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