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Self-control and Problematic Social Media Use: A Meta-Analysis

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Abstract

Failure to exercise self-control is one of the leading causes of substance and behavioral addictions. Problematic social media usage (PSMU), a type of behavioral addiction, has become an increasingly serious problem with a significant impact on the lives of individuals of all generations. Therefore, it is crucial to understand the underlying mechanism of PSMU to effectively address the issue. This study performed a meta-analysis, which systematically synthesized existing research in the field, to establish the current empirical state of the relationship between self-control and PSMU. The study included 57 independent samples that met the inclusion and exclusion criteria (N = 29.576). The analysis results indicated a moderate negative association between self-control and PSMU (r = -.29). Furthermore, the moderator analysis outcomes suggested that the association between self-control and PSMU did not differ significantly based on variables such as developmental period, educational stage, geographic region, and publication status. The study's findings are expected to inspire future investigations and therapeutic approaches.

Introduction

Social media use has transformed into an essential element of everyday life, thanks to technological advancements in the digital age (Cheng et al., 2021; Yıldız Durak, 2020). People can easily visit social networking sites from portable tools like laptops, tablets, or smartphones whenever and wherever they want (He et al., 2021; Hofmann et al., 2017). They take part in a variety of actions on social media sites, including social interaction (i.e., establishing new relationships and keeping in touch with existing social members of the network), entertainment, shopping, marketing, and professional purposes (Huang, 2022; Hyun et al., 2022; Lyvers et al., 2018; Utz & Breuer, 2016). Additionally, through these platforms, they access information and news, give information about themselves or share posts that express their political and social view, and receive feedback from their followers (Boulianne, 2015; Pempek et al. 2009). Online forums, blogs, and sites for social networking websites such as Instagram, WhatsApp, Twitter, and Facebook are examples of popular social media platforms (Hawn, 2009; Huang, 2022; Sharifi Bastan, 2022).

Social networks are currently used by billions of people worldwide across numerous platforms (Sharifi Bastan, 2022). The number of people using social media is growing every day, and the COVID-19 pandemic has increased this growth (Kemp, 2021; We Are Social, 2022). Nowadays, 4.76 billion people utilize social media globally or a little under 60% of the world's population. Even worse, the average internet user now spends more than 2.31 hours per day on social media, which is longer than they typically spend on sleeping, eating, and exercising (We Are Social, 2023). This dramatic rise in usage of social media implies problematic social media use (PSMU), which resembles addiction in many ways (Lyvers et al., 2018). PSMU is described as uncontrolled use of social media (such as compulsive or addicted use) that has an adverse impact on one's personal, social, familial, and career life (Schou Andreassen & Pallesen, 2014; Sun & Zhang, 2020). PSMU is referred to by a variety of terms, such as social media addiction (Cheng et al., 2021), social networks use disorder (Wegmann & Brand, 2019), disordered social media use (Lyvers et al., 2018), social media dependence (He & Yang, 2022), and compulsive social media use (Aladwani & Almarzouq, 2016). Because it is a broader concept, the term problematic social media use was selected for this research.

PSMU has been recognized as a type of behavioral addiction that shares features with other excessive or compulsive non-drug behaviors including internet addiction, video game addiction, compulsive shopping, exercise addiction, and workaholism (Grant et al., 2010; Griffiths, 2013). Similar to addictions caused by substances, it appears that some PSMU sufferers experience the typical signs of addiction, such as mood changes, salience, tolerance, and symptoms of withdrawal (Griffiths, 2013). The negative impact of PSMU on mental health has been extensively studied in the literature (e.g., Cerniglia et al., 2019; Huang, 2022; Przepiórka et al., 2021). Studies have also shown that PSMU can damage individuals' well-being and psychosocial

functioning (Cudo et al., 2020; Koç et al., 2023; Meier et al., 2016). Accordingly, it's crucial to understand the underlying reasons for PSMU.

One of the most difficult desires to withstand for social media users is the urge to use these platforms (Hofmann et al., 2017). They therefore commonly fail to exercise self-control (Du et al., 2018). In the literature, self-control failure has consistently been identified as the primary cause of PSMU (Du et al., 2018; Koç et al., 2023; Üztemur & Dinç, 2022). Previous research has found a positive association between PSMU and low self-control (Barbar et al., 2021; Cudo et al., 2020; Kandee et al., 2022; Wang et al., 2022). Studies, however, have shown inconsistent findings; they have discovered a low, moderate, or high association between self-control and PSMU. Furthermore, no meta-analysis study was realized even though there are numerous studies investigating the link between self-control and PSMU. This study aimed to realize the listed objectives below to fill in these significant gaps in the literature:

(i) to synthesize empirical evidence on the relationship between self-control and PSMU,
(ii) to explore potential moderator roles of developmental period, educational stage, geographic region, and publication status in this relationship.

Literature Review

The Relationship between Self-Control and Problematic Social Media Use

Since self-control research is addressed by various theoretical traditions, a variety of definitions have been produced in the literature and are used interchangeably with a number of terms (Duckworth & Kern 2011; Hofmann et al., 2017; Şimşir Gökalp & Haktanir, 2022). Some concepts used interchangeably with self-control include self-discipline, self-regulation, conscientiousness, and impulsivity (Baumeister et al., 2007; Duckworth & Kern, 2011; Duckworth et al., 2019; Şimşir & Dilmaç, 2021). Although there is controversy regarding the nature and characteristics of self-control (Duckworth et al., 2019; Gillebaart & de Ridder, 2015; Şimşir & Dilmaç, 2021; Şimşir Gökalp & Haktanir, 2022), the following definition is the most typical: the capacity to manage one's responses such as emotions, impulses, thoughts, and actions in order to accomplish personally valued long-term objectives (Baumeister et al., 2007; Duckworth et al., 2019; Metcalfe & Mischel, 1999). People commonly need self-control when confronted with self-control dilemmas, which entail the resolution of a conflict between two distinct behavioral inclinations. The struggle between the want to indulge in a bag of chips in front of the TV after a difficult day and the desire to eat healthily is a typical instance of this dilemma (Gillebaart & de Ridder, 2015). The following example may be employed to illustrate this dilemma when it comes to social media use: The decision to study for a math exam or to browse the newest Instagram photographs is a self-control dilemma for a student. While browsing through Instagram may provide immediate pleasure, it lacks long-term value. On the other hand, studying for a math test may not be enjoyable at the moment, but it holds long-term importance (Duckworth et al., 2019). In sum, it can be quite difficult for people to maintain self-control when they are tempted to use social media.

Hofmann et al. (2017) suggested that three features of communication and media technologies, especially instant satisfaction, habituated usage, and ubiquitous accessibility, raise the probability that users will succumb to temptation. Furthermore, a fourth factor that appears to be crucial for exercising self-control concerning mobile information and communication technologies like mobile phones is the attention requirements of messages and push notifications. In other words, social media platforms have features that can easily activate impulses. Duckworth et al.'s (2014; 2019) process model of self-control outlines the generation of impulses and, in connection, the various approaches to managing these impulses. According to this model, impulses are inclinations to act that gradually develop and can be reinforced or weakened through a recursive sequence involving situational factors, attentional focus, evaluation, and response. Initially, a person comes across a specific circumstance (e.g., the student goes into his dormitory), then he/she focuses on specific aspects of this circumstance in a particular manner (e.g., directs attention toward his buzzing smartphone rather than their math books), and subsequently evaluates the circumstance in a way (e.g., considers how succeeding in mathematics will make it possible to pursue a career as a doctor later in life.) that ultimately produces an urge or inclination to respond (e.g., this idea encourages the student to grab a pencil and start working). The progression of events in this sequence only goes in one direction, both in terms of time and cause-effect relationship. The earlier stages have a causal impact on the later stages, but the opposite is not true.

Previous studies have well-documented the importance of self-control in media activities (Panek, 2014; Turel & Qahri-Saremi, 2016; Yıldız Durak, 2020; Zahrai et al, 2022). For instance, the research by Ekşi et al. (2019)

determined that undergraduates with poor self-control and a tendency to procrastinate are more prone to acquiring social media addiction. Yıldız Durak (2020) reported that failure to exercise self-control resulted in adolescents using the internet more problematically, which in turn, enhanced PSMU. According to the meta-analysis conducted by Li and colleagues (2021), there is a positive correlation between impulsivity and internet addiction, while a negative correlation exists between self-control and internet addiction. Furthermore, Du et al. (2018) created a scale called the Social Media Self-Control Failure Scale to evaluate how frequently individuals succumb to social media enticements.

The Role of the Developmental Period

Regarding the association between PSMU and age, there is no agreement among the research in the literature. For instance, some studies highlighted that emerging adults (Holmgren et al., 2017; Koç et al., 2022) and adolescents (Cerniglia et al., 2019; Yıldız Durak, 2020) are more prone to PSMU, whereas others have found no such correlation (Koc & Gulyagci, 2013) or indicated that older users (Barbar et al., 2021) have a greater tendency to engage in such behavior. On the other hand, according to the Digital 2023 report, social media users between the ages of 16 and 24 utilize 7.7 platforms per month on average, while users between the ages of 25 and 34 use 7.9. With aging, these numbers are decreasing (We Are Social, 2023)

When the current literature is reviewed in terms of self-control, there is no consensus regarding how self-control changes with age. According to Gottfredson and Hirschi (1990), self-control is a stable disposition that does not alter throughout life. On the other hand, many researchers asserted that self-control develops throughout life (Murray & Rosanbalm, 2017; Tao et al., 2014; Tarullo et al., 2009; Zondervan-Zwijnenburg et al., 2020). Tao and colleagues investigated the self-control levels of 2135 children between the ages of three and nine. The research's findings showed that levels of self-control significantly increased, particularly between the ages of five and six. Additionally, the development of self-control between the ages of 13 and 19 was investigated in the longitudinal study by Zondervan-Zwijnenburg et al. (2020). The researchers concluded that self-control improved during adolescence.

The development of self-control capacity is dependent on brain growth. Self-control-related brain areas are not sufficiently formed at birth and steadily mature during development (Tarullo et al., 2009). The prefrontal cortex is a crucial area for self-control and is placed directly behind the forehead (Gajos & Beaver, 2016; Tarullo et al., 2009). Several researchers suggested that doing intervention studies with high school and university students may be more effective because the brain regions responsible for self-control develop with age (e.g., Duckworth et al., 2016). In this regard, this study hypothesized that the developmental period (adolescence, adulthood) may have a moderator role in the relationship between self-control and PSMU.

The Role of Education Stage

The majority of studies on problematic social media use have been conducted with student participants. Studies have put forth that middle school (Üztemur & Dinç, 2022), high school (Cerniglia et al., 2019), or college students (Koç et al., 2022) may be at higher risk for PSMU than other groups. However, to the best of the authors' knowledge, there is no evidence on which education stage has a higher frequency of PSMU among students. In a similar vein, studies have noted that self-control improves with age (Tarullo et al., 2009), but no research on how self-control varies with the education stage has been identified. Based on these limitations, this study investigated whether the level of education affected the association between self-control and PSMU.

The Role of Geographic Region

PSMU is influenced by both individual and contextual factors (Marino et al., 2018). Cross-cultural changes in PSMU have been identified by previous studies. The study carried out by Cheng and colleagues (2021) to investigate the incidence of social media addiction in 32 regions has yielded startling findings. According to analyses by geographic location, it is most prevalent in Africa (37%), followed by Asia (31%) and the Middle East (29%). It was found that Western/Northern Europe (8%) scored last. In sum, collectivist nations are more prone to PSMU than individualist nations. When we review meta-analysis studies in the literature, Huang (2022) found that the moderator role of the country in the relationship between self-control and life satisfaction is significant. According to the findings, the link was weak for the US and medium for Turkey. In their investigation of the country's effect on the relationship between problematic Facebook use and distress, Marino

et al. (2018) reported that studies from Western countries were more likely to find a correlation than those from Asian nations. Furthermore, Li et al.'s (2021) research showed that individuals in East Asia had a more adverse relationship with self-control and internet addiction than individuals in Western Europe and North America. In this context, the moderator role of the geographic region may moderate the relationship between self-control and PSMU in this study.

Publication Status

The heart of competent meta-analysis studies is comprehensive literature reviews. Publication bias endangers systematic reviews and meta-analyses (Şen & Yıldırım, 2020). Publication bias occurs when the studies included in a particular analysis are not representative of the entire pool of relevant studies, which can be attributed to factors such as their availability and accessibility (McShane et al., 2016). The absence of publications such as theses and conference presentations from the analysis is the primary cause of publication bias. It is crucial to resolve these problems in order to eliminate the possibility of publication bias (Şen & Yıldırım, 2020). Therefore, the research included the theses that were published and examined the moderator role of publication status (e.g., article, and thesis).

Method

This study aimed to determine the mean effect size of the relationship between self-control and PSMU using meta-analysis. Meta-analysis allows combining different research results in a valid/effective way to obtain holistic results (Tsagris & Fragkos, 2018). While conducting the meta-analysis, the guidelines of the American Psychological Association (2010) and the PRISMA guidelines of Moher, Liberati, Tetzlaff, Altman, and Prisma Group (2009) were followed.

Selection and Coding of Studies

The first literature search for the meta-analysis study was conducted in December 2022, and the complementary search was conducted in January 2023. The main searches were carried out in English language, and complementary searches were also conducted in Turkish. Both articles and theses were included in the scope of the study. In order to reach these studies, searches were carried out on Web of Science, EBSCO Host Google Scholar, PsycINFO, PsycARTICLES and ProQuest Dissertations & Theses Global databases ("self-control" OR "self control" OR "self-regulation" OR "self regulation" OR "self discipline" OR "self-discipline" OR impulse* OR "low self-control" OR "executive function" OR "delay of gratification" OR "delayed gratification") AND ("social medi*" OR "social network* site" *" OR SNS OR "online networking site*" OR "online social network*" OR instagram OR youtube OR facebook OR twitter OR snapchat OR whatsapp OR wechat OR tiktok) AND (addict* OR dependenc* OR problematic OR disorder OR misuse OR overuse * OR excess* OR compulsi* OR abuse OR patholog*). In the end, 1336 studies examining the variables in the research scope were recorded. The recorded studies were processed into a coding key created by the researchers. This coding key includes the study author, study type, developmental period, educational level, and geographic region.

When the studies processed in the coding key were examined, criteria were determined for the inclusion of the 1336 studies that were coded based on the theoretical foundations of the research for meta-analysis: (i) It must aim to determine the relationship between self-control and problematic social media use perceptions, (ii) Studies must be in the form of articles or theses (doctoral and master's theses), (iii) The data collection tools used in the research must be aimed at determining self-control/impulsivity and PSMU, (iv) The research findings must include sample size and correlation values or the necessary statistics to calculate these values. (v) The study must be conducted on normal participants (non-clinical). These criteria have also been used as exclusion criteria; studies that did not meet the identified criteria were not included in the study. In addition, there was no limitation in terms of publication year or age of participants in the searches.

After determining the inclusion and exclusion criteria, all complementary searches were performed with "advanced search". In addition, the references of the studies recorded in the first search were reviewed, and studies that could meet the inclusion criteria were also examined. Moreover, in studies where the correlation coefficient value (r) was not provided, the authors were contacted by email to request missing data, and the studies of authors who provided feedback were included in the research. In this context, 72 studies were found as a result of the first complementary search (December 2022), and no new studies on the subject were found as

a result of the second complementary search (January 2023). After the complementary searches, a total of 72 studies were entered into the coding key. Based on the inclusion criteria, 57 (55 articles and 2 theses) of the 72 individual studies were included in the meta-analysis. The remaining 15 articles were excluded because they did not include/calculate the correlation between the variables. The flowchart of the search and review process according to PRISMA [Preferred Reporting Items for Systematic reviews and Meta-Analyses (Moher, Liberati, Tetzlaff, Altman and The PRISMA Group, 2009)], which explains the principles of reporting meta-analysis studies and was used throughout the study, is shown in Figure 1.

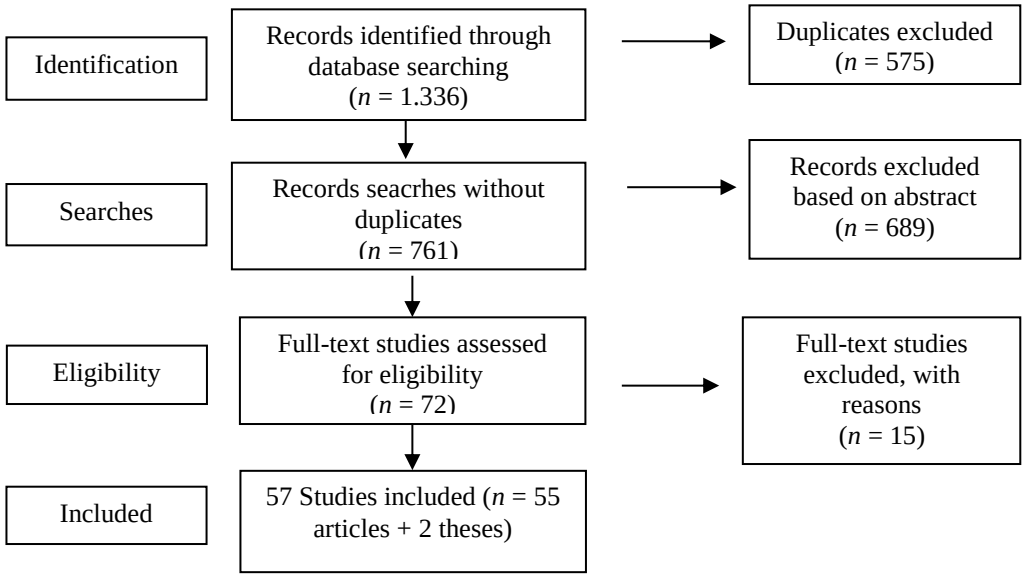

Figure 1. Flowchart of the search and review process

It is important that the studies included in the meta-analysis are searched correctly and checked by the coders in terms of validity-reliability-completeness (Stewart & Kamins, 2001). In this context, the studies were first searched by researchers from different fields (Guidance and Psychological Counseling, Educational Management) from the Department of Educational Sciences, and then the studies obtained were integrated and entered into the coding key created by the researchers. Thus, studies that met the inclusion criteria were taken into account. The data for these studies were independently entered into a second coding key by two researchers, and the intra-group correlation coefficient of the values was determined as .94. As a result of the systematic interviews carried out for the differences between the coded effect size values, all the data were correctly and completely coded (r = 1.00). In addition, the data related to the determined subgroups were added to the coding key independently by two researchers, and the intragroup correlation coefficient of these values was determined as .97. As a result of the systematic interviews conducted for the data belonging to the subgroups, all data were correctly and completely coded (r = 1.00).

Table 1. Characteristics of the studies included in the meta-analysis

Variable	**Category**	***N* (=57)**
Study Type	Article	55
	Thesis	2
Developmental period	Adolescent	11
	Adult	46
Education level	Middle school	3
	High school	8
	University	19
Geographic region	Europe	14
	East Asia	10
	South Asia	2
	South America	2
	North America	11
	New Zealand-Australia	3
	Middle East	12
	Interregional/International	3

Included Studies

57 studies were included in the meta-analysis regarding the relationship between self-control and PSMU. The total sample size of the studies included in the analysis is 29.576. The characteristics of the included studies are given in Table 1.

Model Selection

After determining the publication bias in the current meta-analysis study, the statistical model to be used in the calculation of the mean effect size was selected. There are two models of mean effect size in the traditional meta-analysis literature; fixed effects model and random effects model. The model "fixed effect", which assumes that the parameter measuring the effect size or experimental effect is the same in all studies. The model that allows this parameter to act as a random variable that takes different values from study to study is defined as the "random effects" model. If working with a single population, the "fixed effect" model should be used, and if working with multiple populations, the "random effects" model should be used (Sen & Yıldırım, 2020). In meta-analysis studies conducted in the field of social sciences, it is recommended to use random effects model for effect size analysis, since sample characteristics are affected by different parameters and mostly vary between effect sizes (Field & Gillett, 2010). The conditions for selecting the statistical model and the model selection should be determined prior to the analysis, taking into account the structure of the meta-analysis study to be conducted (Borenstein et al., 2007). In this context, it was decided to use the random effects model, considering the different cultural and demographic characteristics, scopes and designs of the samples of individuals of different ages and groups included in the meta-analysis.

Heterogeneity

After determining the mean effect size in meta-analysis, the heterogeneity distributions of the studies included in the analysis were examined. It is crucial to assess heterogeneity in meta-analyses since high heterogeneity may arise from the existence of different true effects in the data or the presence of more sub-group studies (Harrer et al., 2021). To control for inter-study heterogeneity, many methods have been recommended. The most commonly recommended ones are creating graphics (such as forest plots), obtaining Q-statistics, and calculating the I^2 value (Şen & Yıldırım, 2020). If the Q value exceeds the $\chi 2$ value calculated based on the degrees of freedom, it indicates that the average effect sizes are heterogeneous (Card, 2011). For I2, values of 25%, 50%, and 75% are considered to indicate low, moderate, and high heterogeneity, respectively (Higgin et al., 2003).

When heterogeneity is encountered in the studies included in the meta-analysis, the causes of heterogeneity can be examined depending on some characteristic features of individual studies, namely moderator (subgroup) variables. Features that may be related to heterogeneity between studies can be interpreted through moderator/subgroup analyses (Deeks et al., 2008). In the current meta-analysis, it was assumed that heterogeneity in the relationship between self-control and PSMU could be explained by study type, developmental period, educational level, and geographical region. In this context, subgroup analyses were conducted on the highlighted variables.

Interpretation of the Mean Effect Size Value

In meta-analysis studies, when variance is affected by correlation coefficients (Pearson r) (Borenstein et al., 2009) and the correlation values in the combined studies are close to each other, the Pearson correlation value is converted to Fisher's z-value for analysis (Makowski et al., 2019). In the present study, the correlation coefficients were first converted to Fisher z values for analysis. For the reporting/interpretation of relationships and confidence intervals, it was converted back to Pearson r after analysis. The mean effect size analysis was reported in the form of correlation (Pearson r) coefficient. Lipsey and Wilson (2001) suggest that the criteria that can be used for correlation are as follows: Small effect=0.10, medium effect=0.25, large effect=0.40. The differentiation status of the subgroups of the study type, developmental period, education level, and geographical region was determined by the $Q_{between}$ test, the χ^2 value determined according to the degree of freedom and the p value. Analysis of research data was performed with CMA v2 (Comprehensive Meta-Analysis Software Version 2).

Findings

Publication Bias Analysis

Before determining the average effect size of the relationship between self-control and PSMU, publication bias was examined. Publication bias was evaluated visually with the "funnel plot" and the "trim and fill method". The evaluation was made in terms of the relationship between self-control and PSMU. Figure 2-3 shows the funnel scatter plots.

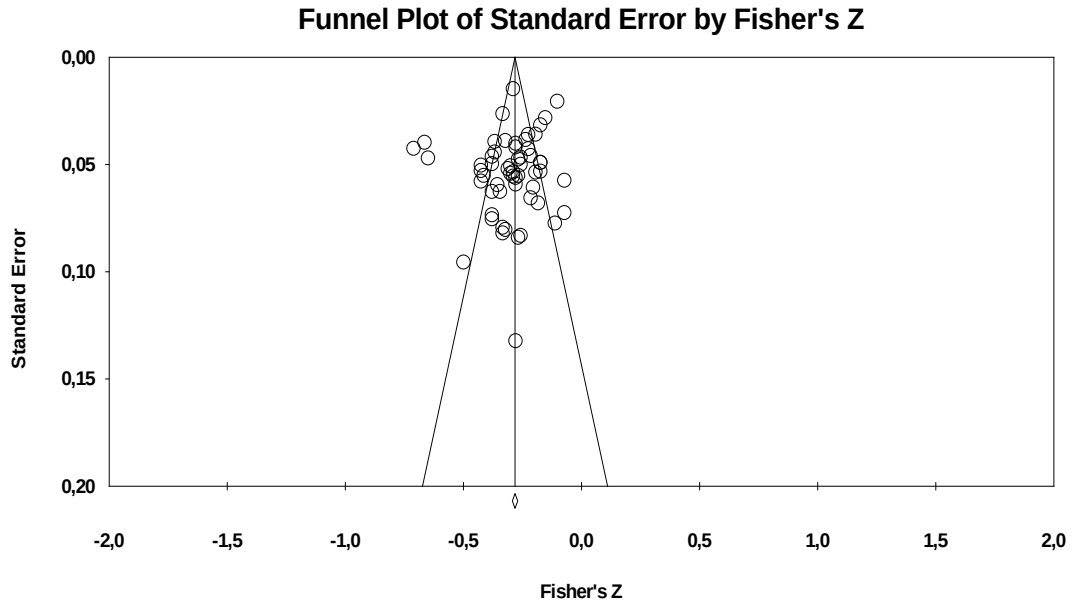

Figure 2. Funnel plot with observed studies only

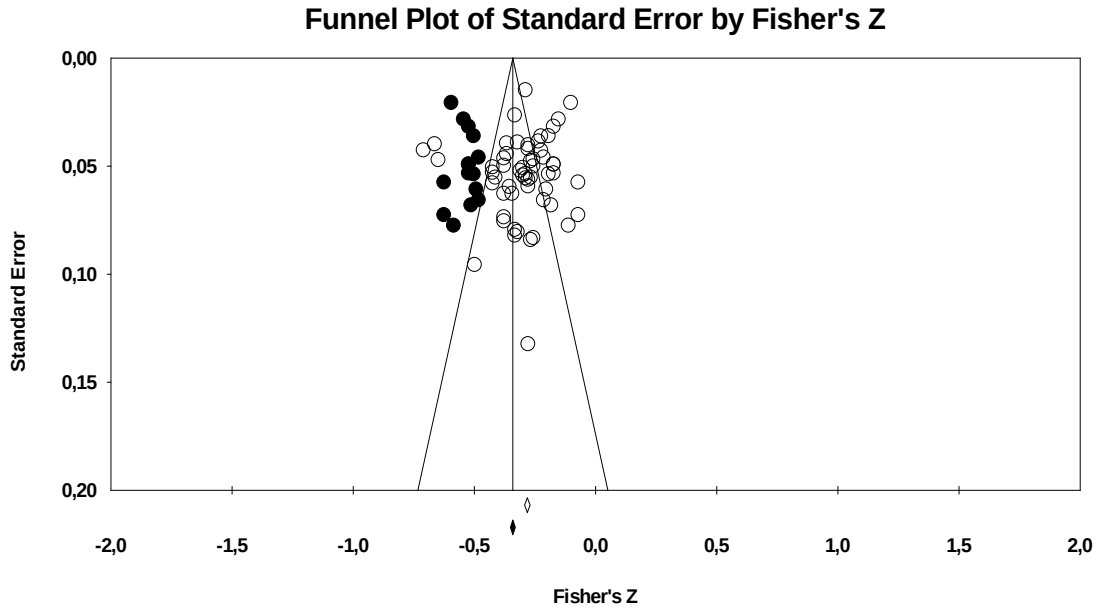

Figure 3. Funnel plot including filled (black dots) studies (Random-effects model-to the left of mean)

In order to assume that there is no publication bias according to the funnel scatter plot, the effect sizes are distributed symmetrically on both (right-left) sides of the standard error axis of the mean effect size (Borenstein et al., 2009). Additionally, in the funnel plot, large studies appear at the top of the graph and cluster around the average effect size, while smaller studies are located at the bottom of the graph (Şen & Yıldırım, 2020). When examined for publication bias, Figure 2 shows that the studies are clustered near the top of the graph, but the effect sizes are distributed relatively symmetrically around the standard error axis. Due to the subjectivity of the interpretations made about the symmetry of funnel plots (Card, 2011) and the difficulty in deciding whether

there is publication bias only based on funnel plots (Pigott, 2012), different methods should also be examined. Empty circles in the funnel plot created according to the trim and fill method in Figure 2 show the studies included in the meta-analysis (existing), while the filled circles (with black dots) show the studies that should be included in the meta-analysis in order to reduce the publication bias (missing/added). According to Figure 3, the inclusion of 15 studies in addition to the existing studies in terms of the relationship between self-control and PSMU in the meta-analysis is sufficient to reduce publication bias. Considering the inclusion of 57 individual studies in the meta-analysis and other publication bias analyses regarding the relationship between self-control and PSMU, additional studies that could be included are negligible.

The trim and fill method may also reveal the new/corrected center of the funnel plot when conducting a meta-analysis that includes these studies (Duval & Tweedie, 2000). The trim and fill method helps both to reveal publication bias and to correct it (Sen & Yıldırım, 2020). According to Figure 2, it can be stated that there is no change in the center of the symbols. However, further analysis was performed using Orwin's fail-safe N analysis, Duval and Tweedie's trim and fill method, Egger's regression test, and Begg and Mazumdar's rank correlation method to obtain more information about publication bias (Table 2).

Table 2. Publication bias analyzes and results

Relationship Between Variables	**Orwin Safe N** (.01 Fisher *z*)*	**Duval and Tweedie** Trimed	Observed/Rectified	**Egger Test** (*p*)	**Begg and Mazumdar** (*p*)
Self-control and PSMU	5993	15	-.281/-.341	.17	.44

* .01 was taken as the criterion value.

According to Table 2, Orwin Safe N analysis indicates the number of studies required to reduce the mean effect size below a certain insignificant value (Orwin, 1983). In this framework, the large number of N indicates that the average relationship will not be zero if some studies are excluded, and the publication bias is very low (Sen & Yıldırım, 2020). In the current study, the fact that the N value is above the tolerance value ($N > 5k + 10$) formed by the number of effect sizes (Mullen et al., 2001) indicates that there is no publication bias. According to Duval and Tweedie trim-and-fill method, the inclusion of 15 individual studies thought to be incomplete in the meta-analysis study (added to the right of the funnel plot) shows that the mean effect size value is relatively reduced but not significantly differentiated. The fact that the results of the Egger and Begg and Mazumdar analyses are not statistically significant also indicates that there is no publication bias. The results of the publication bias analysis conducted for this meta-analysis indicate that the studies included in the meta-analysis on the relevant topic are sufficient and the internal validity of the mean effect sizes is high.

Mean Effect Size and Heterogeneity Analysis

In the context of the first question of the research, the mean effect sizes and heterogeneity test results of the relationship between self-control and PSMU are given in Table 3.

Table 3. Effect sizes (pearson r) and heterogeneity test results

Model	***k***	ES_{mean}	**S.E.**	***Z***	***p***	**%95 CI**		***Q***	***df***	***p***
						Low. limit	**Up. limit**			
Fixed	57	-.275	.006	-48.283	.000	-.285	-.265	485.256	56	.000
Random	57	-.288	.018	-16.520	.000	-.319	-.257			

* k=Number of studies

Subgroup Analysis

In the context of the second research question, Table 4 presents the results of analogue ANOVA regarding the extent to which the mean effect size of the relationship between self-control and PSMU differs in terms of study type, developmental period, education level, and geographic region subgroups. The random effects model was used and reported accordingly because analyses were conducted to investigate the source of between-group variance.

Study name	Fisher's Z	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Assunçao & Matos, 2017	-0,224	0,036	0,001	-0,295	-0,152	-6,158	0,000
Awad et al., 2022	-0,172	0,049	0,002	-0,268	-0,075	-3,480	0,001
Barbar et al., 2021	-0,377	0,046	0,002	-0,468	-0,286	-8,110	0,000
Bąber et al., 2022	-0,224	0,043	0,002	-0,308	-0,140	-5,212	0,000
Bernal-Ruiz & Rosa-Alcázar, 2022	-0,662	0,040	0,002	-0,741	-0,584	-16,588	0,000
Blachnio & Przepiorka, 2016	-0,354	0,060	0,004	-0,471	-0,237	-5,936	0,000
Boer et al., 2022	-0,332	0,027	0,001	-0,384	-0,280	-12,480	0,000
Bouna-Pyrrou et al., 2018a	-0,070	0,073	0,005	-0,213	0,072	-0,964	0,335
Bouna-Pyrrou et al., 2018b	-0,100	0,021	0,000	-0,141	-0,060	-4,825	0,000
Burnell et al., 2016	-0,377	0,063	0,004	-0,500	-0,254	-5,995	0,000
Cerniglia et al., 2019a	-0,321	0,039	0,002	-0,397	-0,244	-8,191	0,000
Cerniglia et al., 2019b	-0,365	0,040	0,002	-0,443	-0,288	-9,245	0,000
Chen & Roberts, 2019	-0,070	0,058	0,003	-0,183	0,043	-1,216	0,224
Cudo et al., 2020a	-0,213	0,066	0,004	-0,342	-0,084	-3,240	0,001
Cudo et al., 2020b	-0,234	0,039	0,001	-0,310	-0,158	-6,062	0,000
Cudo et al., 2021	-0,172	0,032	0,001	-0,234	-0,109	-5,396	0,000
Davey et al., 2020	-0,255	0,050	0,003	-0,354	-0,157	-5,089	0,000
Du et al., 2018	-0,377	0,050	0,002	-0,475	-0,279	-7,557	0,000
Efrati et al., 2021	-0,213	0,046	0,002	-0,303	-0,123	-4,626	0,000
Ekþi et al., 2019	-0,424	0,051	0,003	-0,523	-0,325	-8,377	0,000
Fýrat, 2017	-0,277	0,132	0,018	-0,536	-0,017	-2,090	0,037
Foroughi et al., 2019	-0,424	0,053	0,003	-0,528	-0,320	-7,982	0,000
Fowler et al, 2020	-0,277	0,056	0,003	-0,387	-0,166	-4,914	0,000
Gugushvili et al., 2022	-0,332	0,082	0,007	-0,493	-0,171	-4,035	0,000
Guo et al., 2022	-0,288	0,056	0,003	-0,397	-0,178	-5,162	0,000
He & Yang, 2022	-0,192	0,036	0,001	-0,263	-0,121	-5,316	0,000
He et al., 2021	-0,182	0,068	0,005	-0,316	-0,048	-2,668	0,008
Holmgren & Coyne, 2017	-0,266	0,048	0,002	-0,360	-0,173	-5,576	0,000
Iranmanesh et al., 2021	-0,192	0,054	0,003	-0,298	-0,087	-3,573	0,000
Kandee et al., 2022	-0,709	0,043	0,002	-0,793	-0,625	-16,580	0,000
Khan et al., 2021	-0,277	0,059	0,004	-0,393	-0,160	-4,658	0,000
Khosravani et al., 2022	-0,424	0,058	0,003	-0,537	-0,310	-7,301	0,000
Khoury et al., 2019	-0,172	0,049	0,002	-0,268	-0,075	-3,484	0,000
Koessmeier & Büttner	-0,412	0,055	0,003	-0,520	-0,303	-7,435	0,000
Lee et al., 2022	-0,110	0,078	0,006	-0,263	0,042	-1,423	0,155
Lerema, 2021	-0,203	0,061	0,004	-0,322	-0,083	-3,331	0,001
Lyvers et al, 2020	-0,321	0,081	0,006	-0,478	-0,163	-3,978	0,000
Lyvers et al., 2019	-0,255	0,083	0,007	-0,419	-0,092	-3,065	0,002
Meier et al., 2016	-0,172	0,053	0,003	-0,276	-0,067	-3,216	0,001
Nicole Wilke et al., 2020	-0,277	0,040	0,002	-0,356	-0,198	-6,855	0,000
Orosz et al., 2016	-0,343	0,063	0,004	-0,466	-0,220	-5,453	0,000
Osatuyi & Turel, 2018	-0,332	0,080	0,006	-0,488	-0,176	-4,169	0,000
Panek, 2014	-0,255	0,047	0,002	-0,347	-0,164	-5,448	0,000
Pilatti et al., 2021	-0,365	0,044	0,002	-0,453	-0,278	-8,220	0,000
Przepiórka et al., 2021	-0,288	0,015	0,000	-0,317	-0,258	-19,281	0,000
Quinn, 2018	-0,266	0,084	0,007	-0,431	-0,101	-3,160	0,002
Rebecca & Blanca, 2019	-0,277	0,042	0,002	-0,359	-0,194	-6,575	0,000
Sahranç & Duç-Urhan, 2021	-0,266	0,055	0,003	-0,375	-0,158	-4,805	0,000
Savci et al., 2017	-0,377	0,074	0,005	-0,521	-0,232	-5,112	0,000
Sharifi Bastan et al., 2022	-0,288	0,054	0,003	-0,393	-0,182	-5,359	0,000
Ting & Essau, 2021	-0,377	0,076	0,006	-0,525	-0,229	-4,986	0,000
Turel & Qahri-Saremi, 2016	-0,299	0,054	0,003	-0,405	-0,192	-5,489	0,000
Üztemur & Dinç, 2022	-0,310	0,052	0,003	-0,412	-0,207	-5,930	0,000
Wang et al., 2022	-0,151	0,028	0,001	-0,207	-0,095	-5,311	0,000
Wegmann et al., 2020	-0,497	0,096	0,009	-0,685	-0,310	-5,192	0,000
Yildiz Durak, 2020	-0,648	0,047	0,002	-0,740	-0,555	-13,705	0,000
Zahrai et al., 2022	-0,299	0,051	0,003	-0,398	-0,199	-5,866	0,000
	-0,297	0,018	0,000	-0,332	-0,262	-16,520	0,000

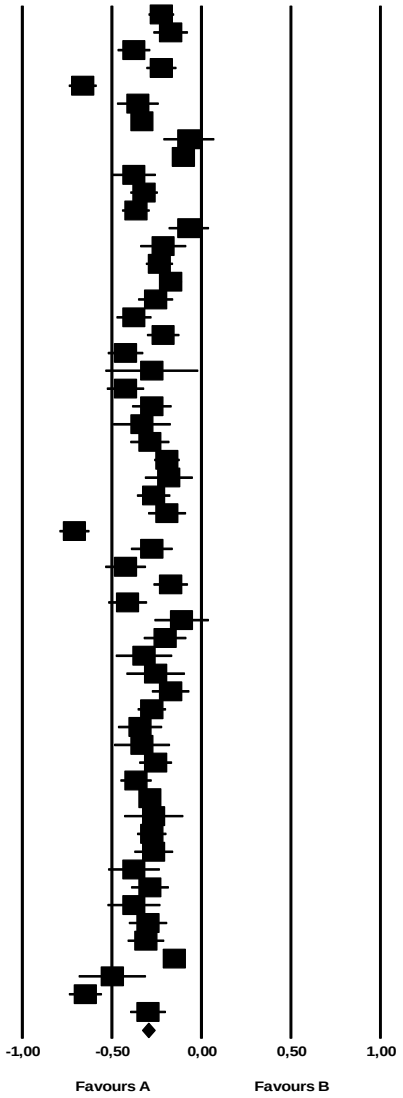

Figure 4. Forest plot obtained with random effects model

Table 4. Effect sizes (pearson r) and heterogeneity test results

Variable	**Category**	***k***	***r***	***95%CI* [low.-up. limit]**	Q_B	***df***	***p***
Study type	Article	55	-.289	[-.321, -.258]	1.994	1	.158
	Thesis	2	-.220	[-.310, -.127]			
Developmental	Adolescent	11	-.293	[-.358, -.225]	0.029	1	.866
period	Adult	46	-.287	[-.322, -.251]			
Education level	Middle school	3	-.286	[-.335, -.235]	0.54	2	.973
	High school	8	-.297	[-.399, -.188]			
	University	19	-.293	[-.368, -.215]			
Geographic	Europe	14	-.262	[-.295, -.227]	12.809	7	.077
region	East Asia	10	-.251	[-.300, -.198]			
	South Asia	2	-.343	[-.404, -.279]			
	South America	2	-.491	[-.639, -.308]			
	North America	11	-.305	[-.385, -.221]			
	New Zealand-Australia	3	-.362	[-.551, -.137]			
	Middle East	12	-.262	[-.338, -.194]			
	Interregional/International	3	-.232	[-.340, -.117]			

When Table 4 is examined; according to the type of study variable, the relationship between self-control and PSMU does not differ statistically, as the heterogeneity value (Q_B) does not exceed the value of χ^2 (3.841) determined according to the degree of freedom ($p > .05$). The Q test results show the homogeneity of the relationships between self-control and PSMU in terms of the type of studies. According to the developmental period variable, the relationship between self-control and PSMU does not differ statistically, as the heterogeneity value (Q_B) does not exceed the χ^2 (3.841) value determined according to the degree of freedom ($p > .05$). The Q test results show the homogeneity of the relationships between self-control and PSMU in terms of the developmental periods of the participants.

The relationship between self-control and PSMU according to the level of education variable does not differ statistically, as the heterogeneity value (Q_B) does not exceed the value of χ^2 (5.991) determined according to the degree of freedom ($p > .05$). The Q test results show that the relationships between self-control and PSMU are homogeneous in terms of educational levels in which independent studies are conducted. The relationship between self-control and PSMU according to the geographical region variable does not differ statistically, as the heterogeneity value (Q_B) does not exceed the χ^2 (14.067) value determined according to the degree of freedom ($p > .05$). Q test results show that the relationships between self-control and PSMU are homogeneous in terms of geographic regions where independent studies were conducted.

Discussion

Poor self-control has long been documented as a factor contributing to behavioral addictions such as multi-screen addiction (Şimşir Gökalp, 2022), internet addiction (Li et al., 2021), internet gaming disorder (Cerniglia et al., 2019), smartphone addiction (Davey et al., 2020), and social media addiction (He et al., 2022; Koç et al., 2022). The present study employed meta-analysis to investigate the associations between self-control and PSMU and quantitatively synthesized the findings of studies performed between 2014 and 2022. A total of 29.576 people were included in the analyses, which were based on 57 research from 8 distinct geographical locations. The study's findings revealed that self-control was moderately negatively correlated with PSMU.

Previous cross-sectional studies in the literature have commonly reported a negative relationship between self-control and PSMU (e.g., Boer et al., 2022; Koç et al., 2023; Pilatti, et al., 2021; Zahrai et al., 2022). The strength of this study is that it combines the previous studies and presents a more comprehensive and summarized result. Another advantage of this study is that it is the first study in the literature to examine the relationship between self-control and PSMU using the meta-analysis method. The result of this meta-analysis regarding the connection between self-control and PSMU is consistent with the findings of earlier reviews addressing the role of control behavior on addictive tendencies. The study conducted by Li et al. (2021) revealed a negative relationship between self-control (impulsivity, and restraint) and internet addiction. Lee and colleagues (2019) investigated the impact of impulsivity on addictive behaviors, including drug and behavioral addictions in their quantitative meta-analysis study. The researchers showed that impulsivity was linked to alcohol addiction, tobacco usage, and gambling disorders. Drug dependence on psychostimulants such as cocaine and MDMA was also observed to be most frequently correlated with impaired inhibitory control. Results from a meta-analysis study by Dezhkam et al. (2022) showed that impulsivity positively influences addictive tendencies and behaviors (such as internet and social network addiction, sex addiction, and shopping addiction). Additionally, other meta-analysis studies in the research literature reported that impulsivity positively correlated with addictive behaviors including gambling disorder (Ioannidis et al., 2019), mobile phone addiction (Li et al., 2020), and adolescent alcohol use (Coskunpinar et al., 2013). In conclusion, a low level of self-control makes people more susceptible to addictive behaviors across a range of drug and behavior use.

The findings of this review showed that the developmental period had no moderating impact on the connection between self-control and PSMU. To put it another way, there's not much difference in the relationships between self-control and PSMU throughout age groups. Although these results appear to conflict with the research findings in the literature (e.g., Li et al., 2021), they are in accordance with the theoretical perspective. The body of research suggests that self-control improves with age (e.g., Tao et al., 2014; Tarullo et al., 2009) and social media addiction diminishes (Cheng et al., 2021). In this direction, the associations obtained across all age groups will be similar. In other words, the reports suggest that people will exhibit self-control at a rate consistent with their age and that their propensity for social media addiction will decline at a similar rate. It implies a linear inverse proportion mathematically. Furthermore, the moderator role of the educational stage was found to be insignificant in the relationship between self-control and PSMU. These results may be interpreted akin to the developmental period.

Additionally, the study's findings revealed that the anticipated moderator role of the geographical location between self-control and PSMU was insignificant. Research in the literature has shown that social media addiction varies by geographic location (Boer et al., 2020; Cheng et al., 2021; Marino et al., 2018).The prevalence of PSMU has shown to be higher in regions such as Africa, Asia, and the Middle East and lower in regions such as Western and Northern Europe (Cheng et al., 2021). The fact that the countries within the geographical regions (i.e., Asia and Europe) differ from one another may be the cause of the similarities in the correlations between the researches variables in the regions studied in this study. For instance, research by Boer et al., 2020 showed that PSMU varies across Europe. Spain has the highest incidence of PSMU, while the Netherlands has the lowest rate. In this regard, reviewing the PSMU country-by-country may be more beneficial. Lastly, it has been found that publication status does not affect the association between self-control and PSMU. The research includes a total of 57 studies, 55 articles, and 2 theses. The lack of distinction between the thesis articles might be interpreted as the absence of publication bias.

Limitations, Implications, and Future Studies

While interpreting the research findings, some limitations need to be taken into account. The study was unable to incorporate papers published in other languages because the databases could only be searched in Turkish and English. There could be variations in the usage of various social media platforms across different nations or the prevalence of PSMU may vary at different rates. Second, since the studies included in the meta-analysis did not examine the links between self-control and PMSU in children and older people, the moderator analysis based on developmental periods was categorized into adolescents and adults. Future studies may investigate the relationships between self-control and PSMU in children and the elderly. Third, since self-report scales were employed in the research that comprised the study, there is a high probability that subjectivity and personal biases were included in the assessments. Fourth, the studies that made up the study used a variety of scales, such as Facebook addiction and social media addiction. It is debatable how accurately the scales employed measure PSMU. Thus, when evaluating the findings, this restriction should not be overlooked. Future studies might also examine how different social media platforms affect PSMU. Fifth, the study comprised studies with normal subjects who did not have any clinical problems. Hence, it is important to avoid generalizing to clinical populations (i.e. with attention deficit hyperactivity disorder) when drawing interferences. Lastly, while this study presents robust findings by combining relational studies from the literature, it does not establish a causal relationship between variables. To address this issue, it might be beneficial to undertake experimental and longitudinal studies in the future.

Notwithstanding these limitations, the study significantly enhances our comprehension of the underlying mechanism of PSMU. Even while the Diagnostic and Statistical Manual of Mental Disorders (5^{th} Edition) does not classify social media addiction as a behavioral addiction, research on the topic is growing daily. A new one was also added to the body of knowledge by this study. The findings of the research may be helpful to psychiatrists, psychologists, counselors, educators, and researchers. For example, educators, school counselors, and psychologists can develop and implement self-control intervention programs for students or clients to prevent and reduce PSMU. Furthermore, the fact that the study presents a summarized result by bringing together many studies in the literature using the meta-analysis method may facilitate researchers to make inferences and guide future research.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in JESEH journal belongs to the authors

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