Computers in Human Behavior Reports 16 (2024) 100507

Contents lists available at ScienceDirect

Computers in Human Behavior Reports

journal homepage: www.sciencedirect.com/journal/computers-in-human-behavior-reports

Relationship between regulatory processes and problematic social media use: A systematic review

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ARTICLE INFO

Keywords:
Problematic use of internet
Social media
Addictive behavior
Regulation
Health psychology

ABSTRACT

Objective: This review aimed to synthesize and analyze the relationship between regulatory processes (self-regulation, emotion regulation, self-control and impulsivity) and problematic social media use (PSMU) in the general population.
Method: A systematic search was conducted in five databases, and all articles published from May 2013 to April 2024 were identified.
Results: After screening 2655 articles, 45 studies were included in the review. The total sample comprised 34,332 participants. The results confirm the effect of regulatory processes on the PSMU. This relationship is present in all age groups and in different cultures. Furthermore, the mediating effect of regulation on the relationship between PSMU and variables like anxiety, depression, self-esteem or attachment has been observed. Despite the confirmatory nature of these studies, their results should be interpreted with caution because they may be influenced by certain methodological limitations in the research on which they are based.
Conclusion: Regulatory processes play a fundamental role in the PSMU. These findings contribute to a deeper understanding of this behavior and offer insights for the development of effective prevention and intervention strategies.

1. Introduction

1.1. Social media and their problematic use

With the advent of Information and Communication Technologies, society has experienced a great change in the way people communicate and relate to each other. The rapid proliferation of social media has been one of the factors that has contributed most significantly to this social change (Hou et al., 2019). These platforms can be defined as virtual communities formed by users who create their own profiles (public or semi-private) with self-descriptive information. They feature a personalized content feed, frequently updated, where users can communicate, share updates, and meet new people (Drach et al., 2021; Musetti et al., 2022).

Over the past few decades, the popularity and reach of these platforms has increased as has the world's digital population (Dixon, 2024a). In October 2023, statistics show that there are 4.95 billion users of social media, which constitutes 61.4% of the world population (Petrosyan, 2023). Furthermore, a typical user visits on average 6.7 of such platforms per month and spends an average of 151 min per day on them (Dixon, 2024a). Last year's statistics continue to place Facebook as the most used platform (3.065 million monthly active users), followed by YouTube, Instagram and WhatsApp (Dixon, 2024d). However, when preference is analyzed, Instagram is the favorite platform among young people, while older people prefer WhatsApp and Facebook (We Are Social & Meltwater, 2023).

It can be said that the use of social media is a phenomenon that has both positive and negative implications (Nesi & Prinstein, 2015). On the one hand, it brings beneficial effects as it favors social interaction, helps the maintenance of relationships and makes it possible for people to

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https://doi.org/10.1016/j.chbr.2024.100507
Received 22 July 2024; Received in revised form 10 October 2024; Accepted 12 October 2024
Available online 15 October 2024

express themselves (Baccarella et al., 2018). However, an inappropriate use of this type of platforms can lead to detrimental psychological and psychosocial effects (Drach et al., 2021) because it decreases positive emotions while increasing levels of distraction (Moqbel & Kock, 2018), it negatively impacts self-esteem (Hou et al., 2019), and it is associated with less healthy social relationships, decreased life satisfaction and presence of psychological problems related to sleep, depression and anxiety (Sun & Zhang, 2021).

Additionally, social media expose their users to various risks and harms, such as cyberbullying (Giumetti & Kowalski, 2022), exposure to inappropriate sexual content (Thorn & Benenson Strategy Group, 2021), impact of misinformation (Nela & Parruca, 2023), lack of control over what is published, and more (Fox & Moreland, 2015). Certain features of social media increase the likelihood of these effects, including accessibility, anonymity, information retrieval, and editability (Giumetti & Kowalski, 2022). All of these negative consequences of using social media inadequately, in the long term, can affect people's well-being and mental health (Hou et al., 2019).

Research suggests that an excessive consumption of social media can lead to presenting symptomatology similar to that appearing in substance addictive behaviors (Kuss & Griffiths, 2017). Although the two main diagnostic manuals (Diagnostic and Statistical Manual of Mental Disorders, 2014; World Health Organization, 2022) accept the idea that non-substance-related behaviors such as pathological gambling or excessive video game use can also become addictive, they do not include excessive or inappropriate use of social media as an established addictive behavior.

There is currently no consensus in the literature that facilitates the definition and measurement of this problem behavior (Sun & Zhang, 2021) nor is there sufficient information available to conceptualize this behavior as an addiction. Furthermore, one of the aspects that complicates research in this field is that not all social networks have the same impact on people's daily lives. The study by Rozgonjuk et al. (2021) shows that WhatsApp and Instagram have a greater addictive potential than Facebook and Snapchat. These results are consistent with studies that have observed variability in usage patterns and their impact on daily life across different platforms (Rozgonjuk, Sindermann, et al., 2020). Additionally, this condition is related to other technology use behaviors, as the relationship between social media usage frequency and problematic smartphone use patterns has been demonstrated (Rozgonjuk, Pruunsild, et al., 2020). These results suggest that reducing this behavior to the generic framework of addictions can obscure its multifaceted nature and heterogeneity, neglecting the analysis and study of specific psychological processes such as motivational, affective, interpersonal, and social variables (Billieux et al., 2015a; Panova & Carbonell, 2018). As a consequence of this situation, there is a wide variety of terms to refer to inappropriate use of social media.

Taking these aspects into account, in the present review paper, the concept of problematic social media use (PSMU) is used to refer to that pattern of behavior that causes the user to be overly preoccupied and motivated, investing a large amount of time and energy in these platforms, generating an impact on their social, work/school life and on their physical and mental wellbeing (Sun & Zhang, 2021).

1.2. Regulation

Defining the concept of regulation is complex. There is great terminological variability to refer to the processes related to regulation. Given this terminological variety, authors such as Nigg (2017) propose a series of proposals to advance and facilitate the study of the regulation construct: (i) establishing a general domain, (ii) integrating processes, (iii) creating a taxonomy of the types of difficulties associated with each pathology, and (iv) organizing the aspects related to this variable hierarchically. Currently, recent literature considers self-regulation, self-control, emotional regulation, and impulsivity as the four main terms used to study this construct, which are outlined as follows (Inzlicht et al., 2021).

Self-regulation can be defined as those dynamic processes aimed at visualizing a desired end state, or goal, encompassing all those behaviors aimed at achieving that goal, as well as monitoring strategies during the process (Carver & Scheier, 2001). This makes self-regulation a broad term that encompasses a wide variety of underlying processes.

Although some researchers equate the term self-regulation with self-control, most argue that they are two different constructs, and self-control can be considered as a form of self-regulation (Fujita, 2011).

On the other hand, emotional regulation is a construct that is generating great interest in the field of clinical and health psychology. In recent years, there has been an increase in studies that analyze the affective and emotional processes underlying psychopathological problems of the population (Belloch et al., 2020). Emotional regulation comprises those processes aimed at attending, evaluating and redirecting emotions according to the needs and demands of the context, its main objective being the promotion of a change in the system of emotion generation (Gross et al., 2011). According to its definition, emotional regulation can also be included within the umbrella of the term self-regulation, as a dimension specifically focused on emotional aspects. It is important to recognize that emotional regulation strategies are not always effective; at times, they can be maladaptive or counterproductive. To facilitate this distinction, there is a growing tendency to conceptualize emotional regulation strategies as either adaptive (acceptance, reappraisal, and problem-solving) or maladaptive (suppression, avoidance, rumination, and worry) (Belloch et al., 2020).

Another construct associated with regulation is impulsivity. It is framed within the trait models, which are oriented to study the differences between individuals (Inzlicht et al., 2021). In general terms, this construct can be defined as the tendency to carry out risky decisions, to lack of planning, to act prematurely, with low response inhibition and an absence of reflection about the immediate reward (Moeller et al., 2001; Morris et al., 2022).

On the other hand, Bandura (1986) tried to explain self-regulation as a product of the interdependence of cognitive, behavioral and environmental factors. Context regulation refers to the influence of the environment on the subject's behavior. More and more models are trying to highlight the importance of contextual variables in people's behavior. Within the field of regulation, one of the most recent models is the Self-Regulation vs. Hetero-Regulation theory (de la Fuente, Martínez-Vicente, et al., 2022; 2022b), which explains how the combination of internal and external factors predispose the subject to have an adequate behavior and level of motivation when faced with certain situations in different contexts.

1.3. Regulation and problematic use of social media

In recent years, numerous research studies have attempted to analyze the impact of PSMU on well-being in the population. A recent review paper has confirmed the relationship between PSMU and mental health problems in emerging adults, mainly depression, anxiety, and psychological stress (Alonzo et al., 2021). In children and adolescents, evidence has also been collected on the mental health problems associated with PSMU (Keles et al., 2020; McCrae et al., 2017).

The capacity for self-regulation allows people to have control over their thoughts, feelings and behavior (Bandura, 1986). This can lead to low levels of this ability leading to dysfunctional behaviors. In the field of addictions, there is evidence that adequate self-regulation skills predict better self-control in addictive behaviors (Baumeister & Vonasch, 2015; Carey et al., 2004). This argument is supported by LaRose & Eastin (2004) who expound that lack of self-regulation has a direct effect on addictive behaviors related to internet use.

Previous review works also present evidence supporting the association between emotional regulation difficulties and behavioral addictions (López-Guerrero et al., 2023; Velotti et al., 2021). This emotional dysregulation consists in the difficulty to identify, differentiate,

recognize and modulate emotional states with flexibility according to the demands of the environment (Gross, 2013). On the other hand, other research shows that people with problems regulating their emotional states have difficulties in establishing healthy relationships due to the implementation of maladaptive strategies, which leads them to consider the Internet as a space in which they can achieve better self-control and more effective communication styles (Scimeca et al., 2014). At this point, studies emerge such as the one by Helland et al. (2022) which conceptualizes emotional dysregulation as a transdiagnostic factor of vulnerability in the presence of psychopathology in general and, therefore, as a relevant variable when studying and intervening in PSMU. In this same line of reasoning impulsivity is considered a personality trait that plays a relevant role in the emergence, development and maintenance of technology-related addictions (Cerniglia et al., 2019). Another aspect highlighted by some research is that the use of PSMU can become problematic when people turn to these platforms as a means of coping with problems and stressful situations (Kuss & Griffiths, 2017).

In the field of addictions, there is a large body of review work studying the relationship between regulatory variables and substance addictions (e.g., Lannoy et al., 2021; Stellern et al., 2023). However, there is less evidence on the relationship between regulatory constructs and behavioral addictions. Among the research that studies the relationship between these phenomena is the study of Gioia et al. (2021), who focus their review on problems related to emotional regulation and internet use, that of Neophytou et al. (2023), who relate this same variable to gambling disorder, or the review by Lopez-Guerrero et al. (2023), which studies impulsivity and the symptomatology of behavioral addictions in general.

To our knowledge, no general review has been conducted to synthesize the evidence on the relationship between the different components of regulation and PSMU in all population groups. Attending to the most widely used and recent models of addictive behaviors, such as the I-PACE Model (Brand et al., 2016, 2019) the present research considers it relevant to study each type of behavioral addiction in particular, in order to define the specific characteristics of each behavior, to understand each disorder in greater depth and to design effective intervention plans.

1.4. Aims

The main objective of the present review work is to carry out an extensive and systematic analysis of all the studies that have been developed between 2012 and 2023 on the relationship between PSMU and regulation, both internal (self-regulation) and external (including contextual variables).

Secondly, we seek to contribute to the existing body of knowledge on this behavior by providing information that will help to: i) know the current state of research on the subject, ii) analyze the type of relationship that exists between the regulation variable and the PSMU, and iii) obtain a better understanding of the factors involved in the development and maintenance of the PSMU.

2. Material and methods

The present study was designed with reference to the PRISMA guidelines (Page et al., 2021). To ensure the methodological transparency of the research process, the protocol developed for the systematic review is attached in the Supplementary Material (Section 1).

2.1. Sources of information and research strategy

The literature search was first conducted on May 19, 2023 and then updated on April 2, 2024. All articles published in Web of Science, Scopus, PsycINFO, PubMed and the meta-search engine UNIKA (University of Navarra) that met the previously established inclusion and exclusion criteria were collected.

To determine the search strategy, a formula was designed that included a combination of the key elements of interest. This combination of terms was determined after a process of analysis of keywords, synonyms and their combination with the appropriate Boolean operators. Finally, the combination was as follows: ((“self-regulation” OR “self-dysregulation” OR “external-regulation” OR “external-dysregulation” OR “regulation” OR “non-regulation” OR “dysregulation”) AND (“social media” OR “social networking” OR “social network” OR “online networking” OR “Facebook” OR “Twitter” OR “Instagram” OR “Snapchat” OR “TikTok” OR “wechat")) AND (“addict*" OR “problematic*" OR “abus*" OR “overus*" OR “excessive*" OR “disorder”). The search process used this formula in each of the five databases mentioned above.

During all the phases in the process, each publication was independently judged by two of the three judges (LSM, ER or LG). In cases where there was disagreement between the two judges on whether or not to include a particular article, a discussion process was carried out to reach a consensus decision between the two parties.

2.2. Selection criteria

Once the search strategy was designed, the different criteria for inclusion and exclusion of studies found in the database searches were agreed upon. In order to be included in this systematic review studies had to: i) use a quantitative methodology, ii) have a specific and validated measurement instrument to assess regulation, iii) measure PSMU with a specific and validated instrument, iv) present a general population sample (any life stage, country and population group), v) have been published in the previous 10 years in full-text scientific journals, vi) employ English and/or Spanish as their language of publication.

On the other hand, publications were excluded if they: (i) focused their analysis on types of problematic behaviors related to internet use, not including PSMU, (ii) studied specific population groups whose characteristics may modify the strength of the association (e.g., patients with addictions or other mental disorders), (iii) failed to relate the variables under study, iv) investigated populations that had been evaluated using some items of regulation or use of social media specifically designed for the study and/or extracted in isolation from validated scales, v) were case studies, meta-analyses, systematic reviews, book chapters or conference abstracts, vi) employed qualitative or mixed methodology.

2.3. Identification and selection of studies

All the articles collected in the databases were exported to the Covidence application (https://www.covidence.org/). This platform was used in the first phases of selection: firstly, in the detection and elimination of duplicate articles, subsequently, for filtering articles by title and abstract and, finally, for full-text analysis. The Mendeley tool (https://www.mendeley.com/) was used to analyze the included studies to ensure that all articles that met the inclusion criteria and that did not match any of the exclusion criteria.

2.4. Evaluation of quality of articles

For the analysis and assessment of the risk of bias, we used the AXIS tool, designed to perform a critical assessment of the quality and risk of bias in cross-sectional designs (Downes et al., 2016). This instrument consists of 20 items (Supplementary Material, section 2) that were selected from a combination of evidence, epidemiological processes, and the experience of researchers and experts (Downes et al., 2016). The dimensions assessed are grouped into the different sections that are typical in any research: introduction, methods, results, discussion and others. AXIS is a scale that allows the judge to make an assessment of each of the articles based on the items that it includes. However, it does not provide a numerical score, rendering the interpretation subjective to

a certain degree. To facilitate the interpretation of the scores and the overall assessment of each study, guidelines already used in previous reviews were employed (Casale, 2020; Musetti et al., 2022). Each item is scored on the basis of three criteria: "yes" (1 point), "no" (0 points), "do not know/comment" (0.5 points). Once the item scores obtained for each article have been added together, the total score is obtained by establishing the following cut-off points: scores of 1–7 indicate low quality, scores of 8–14 indicate moderate quality, and between 15 and 20 is considered to be of high quality.

3. Results

3.1. Overview of empirical studies

In the first search, conducted in May 2023, a total of 2044 publications were identified. A second update search (April 2024) added 611 new publications to the previous sample. Of all the papers ($N = 2655$), 996 duplicate articles were detected (977 were identified by Covidence and 19 manually). The remaining 1659 studies were subjected to a first screening in which the inclusion and exclusion criteria were applied to the information obtained from reading the title and abstract of each one. As a result of this analysis, 1506 studies were excluded from the sample because they did not meet the established criteria, or because they were

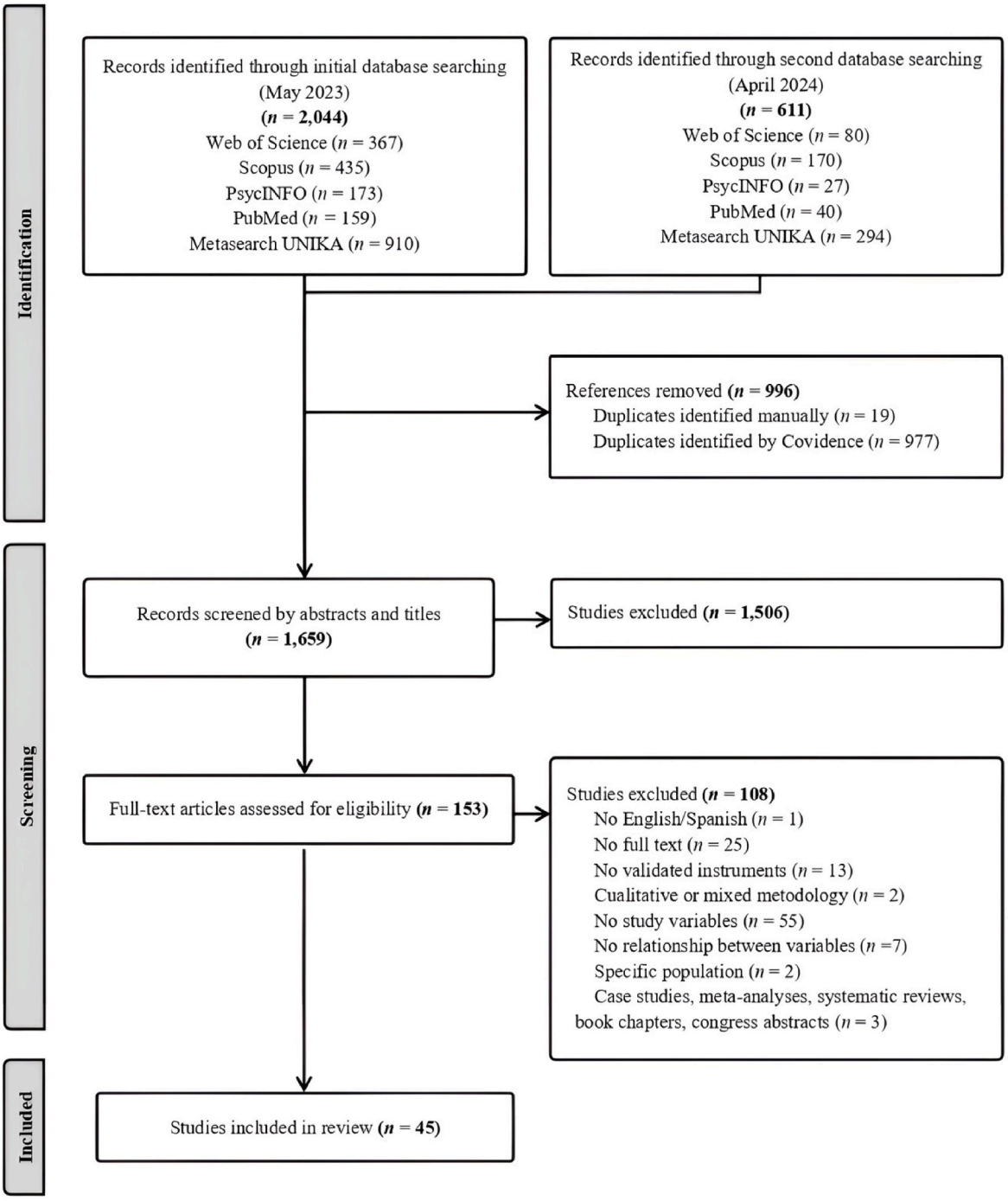

Fig. 1. Flow diagram of the research strategy.

considered irrelevant publications. The full text of the remaining 153 articles was read and analyzed and, finally, a total of 45 studies were included in the final review (Fig. 1).

3.2. Characteristics of studies

The central information was extracted from the articles included in the final sample to carry out the comparison and synthesis process. All the data analyzed in the present review were collected cross-sectionally. The cumulative sample of all studies encompasses a total of 34,332 participants, with sizes ranging from 144 to 12,000 subjects. Women accounted for 58.80% of the total number of participants in the studies, and all of them involved both men and women, except for the one conducted by Alenezi et al. (2023), which included only women. The age of the participants ranged from 10 to 69 years (Mean: 20.85 and *SD*: 4.17) and most of the participants ($n = 26{,}512$) were young people and adolescents.

In relation to the continent of origin of the studies, Europe is the continent with more than half of the studies (25 studies), followed by America (10 studies), Asia (9 studies) and, finally, Africa (1 study). More than half of the studies were published from January 2020 to April 2024. In addition, six of the studies were conducted in populations affected by COVID-19 (Awad et al., 2022; Iannattone et al., 2024; Marino et al., 2023; Peker & Yıldız, 2022; Ting & Essau, 2021; Özmen & Güzel, 2022).

In relation to the variables of interest, a total of 34 investigations analyzed the PSMU in general, while 11 focused only on the use of the social networking site Facebook. Regarding the constructs related to regulation, 27 studies focused on the study of "Emotional Regulation", 10 on "Self-Regulation", 5 on "Impulsivity", 4 on "Self-Control" and 1 on "Mood Regulation". Some papers evaluated more than one regulatory variable in their investigations (Becerra-Guajardo et al., 2021; Błachnio & Przepiorka, 2015; Pilatti et al., 2021).

Table 1 of the Supplementary Material presents the main data for each study: authors, year of publication, country of origin, study design, sample characteristics, variables of interest, statistics and results.

3.3. Measurement instruments

All the studies included in this review use validated scales or subscales to measure the variables of interest. This aspect allows for a more systematized procedure. Table 2 (Supplementary Material) provides a detailed overview of all the scales used by the studies.

3.3.1. Problematic social media use

Different instruments were administered to assess the variable PSMU, but the Bergen Social Media Addiction Scale (BSMAS) (Andreassen et al., 2016) was the most used, with a total of 18 studies. This instrument evaluates the central elements of addiction.

3.3.2. Regulation or related constructs

With regard to the measurement of regulation, there is greater variability, since not all the studies evaluated the same regulation construct. Nevertheless, a total of 15 studies used the Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004), making it the most widely used scale. This instrument was designed to assess problems related to emotional regulation.

3.4. Main findings

The following is a synthesis of the different results obtained. For the sake of clarity and synthesis of the work, the results have been divided and analyzed according to the different variables that study the regulatory construct. In summary, Fig. 2 graphically presents the studies (identified by their ID) that have obtained a significant correlation index when associating PSMU with different regulatory processes.

3.4.1. Problematic social media use and self-regulation

A total of 10 studies analyzed the relationship between the PSMU and the self-regulation construct. Most of the studies developed correlational analyses between the variables, except two (Kandee et al., 2022; Osatuyi & Turel, 2018). All papers point to a significant association

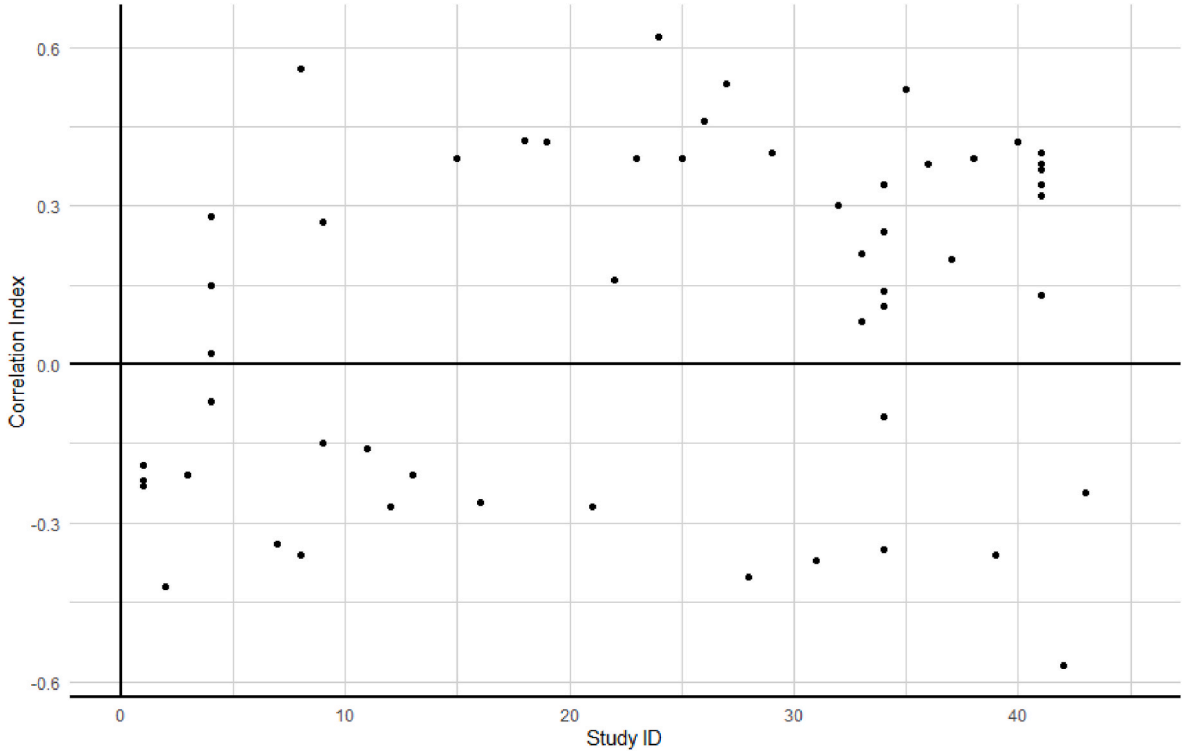

Fig. 2. Scatter plot of the significant correlations between regulatory process and PSMU. Graphical representation of the significant results from the studies presented in Table 1 of the Supplementary Material.

between the two variables, with the exception of the study by Błachnio and Przepiorka (2015), in which no significance is appreciated.

In addition, several of the studies conducted predictive analyses. All of the studies, except for that of Błachnio and Przepiorka (2015), showed the direct negative effect that the variable self-regulation has on the PSMU, indicating that this variable has a direct effect on the presence/absence of symptomatology characteristic of PSMU. One of the studies specifically analyzes online regulation competencies, also showing a significant effect on the PSMU (Ostendorf et al., 2020).

As for the subjects who participated in these studies, three of them employed a sample of children and adolescents (Favini et al., 2023; Ostendorf et al., 2020; Yıldız Durak, 2020), four studied these relationships in college students or emerging adults (Holmgren & Coyne, 2017; Kandee et al., 2022; Khan et al., 2021; Zhang et al., 2024) and, finally, three were carried out in adult population (Błachnio & Przepiorka, 2015; Osatuyi & Turel, 2018; Ting & Essau, 2021).

3.4.2. Problematic use of social-networking sites and emotional-regulation

Of the total of 45 articles, 27 focused on studying the relationship between this dysfunctional behavior and emotional regulation, making it the most studied regulatory variable. This section also includes the work of Maftei & Diaconu-Gherasim (2023), which analyzes the mood regulation variable.

Correlational analyses between both variables were carried out in most of the studies, with the exception of three of them (Becerra-Guajardo et al., 2021; Drach et al., 2021; Hormes et al., 2014). The vast majority of papers point to a significant positive association between difficulties or low levels of emotional regulation and the presence of PSMU symptomatology. However, the study by Arrivillaga et al. (2022) found significance only in women, and the study by Błachnio et al. (2023) did not reach statistical significance.

Regarding predictive analyses, several studies highlighted the direct effect of emotional regulation on PSMU (Alenezi et al., 2023; Błachnio et al., 2023; Giordano et al., 2023; Granados et al., 2020; Hussain et al., 2021; Iannattone et al., 2024; Lim et al., 2020; Liu & Ma, 2019; Maftei & Diaconu-Gherasim, 2023; Marino et al., 2019, 2020, 2023; Nazlıgül et al., 2022; Peker & Yıldız, 2022; Russo et al., 2022; Soares et al., 2023; Varchetta et al., 2023; Zsido et al., 2021). Some obtained predictive effects only for certain dimensions of emotional regulation: difficulties controlling impulses (Drach et al., 2021), goals (Özmen & Güzel, 2022) and the work of Wartberg et al. (2021) also shows the predictive relationship of these two variables (difficulties controlling impulses and goals) in the PSMU. For their part, Arrivillaga et al. (2022) report that this direct relationship only occurs in women. On the other hand, three studies showed no direct effects (Alarcón-Allaín & Salas-Blas, 2022; Pilatti et al., 2021; Pontes et al., 2018). The study by Hormes et al. (2014) compares differences in emotional regulation between groups of subjects with PSMU and those without this feature. Their results point to a significant multivariate main effect of the presence of PSMU and the dimensions: non-acceptance of emotional responses, limited access to emotion regulation strategies, difficulties controlling impulses and difficulties engaging in goal-directed behaviors.

In terms of sample characteristics, eight of the studies analyzed the adolescent population (Arrivillaga et al., 2022; Giordano et al., 2023; Granados et al., 2020; Iannattone et al., 2024; Maftei & Diaconu-Gherasim, 2023; Marino et al., 2020; Peker & Yıldız, 2022; Wartberg et al., 2021), nine focused on emerging adults (Alarcón-Allaín & Salas-Blas, 2022; Becerra-Guajardo et al., 2021; Błachnio et al., 2023; Drach et al., 2021; Liu & Ma, 2019; Nazlıgül et al., 2022; Pilatti et al., 2021; Quaglieri et al., 2021; Soares et al., 2023), and nine selected general adult population (Alenezi et al., 2023; Hormes et al., 2014; Hussain et al., 2021; Lim et al., 2020; Marino et al., 2019, 2023; Pontes et al., 2018; Russo et al., 2022; Özmen & Güzel, 2022).

3.4.3. Problematic social media use and impulsivity

Of the six studies assessing impulsivity and the PSMU, five of them employed correlational analyses (except for Becerra-Guajardo et al., 2021) and four showed a significant association between both variables (Awad et al., 2022; Guo et al., 2022; Hawk et al., 2023; Zhao et al., 2022). On the other hand, the study by Pilatti et al. (2021) also found significant correlations between three of the five dimensions of impulsivity: negative urgency, positive urgency and premeditation.

With the exception of Guo et al. (2022), all studies developed predictive analyses. Two studies showed a direct effect of impulsivity on PSMU symptoms (Hawk et al., 2023; Zhao et al., 2022). On the other hand, two others found direct effects of some of the emotional regulation variables: lack of premeditation and urgency (Awad et al., 2022) and with positive and negative urgency, while the study by Becerra-Guajardo et al. (2021) found no direct effect with any dimension of impulsivity with the PSMU.

Regarding the characteristics of the samples, a study was developed in an adolescent population (Hawk et al., 2023), four used emerging adults or university students (Becerra-Guajardo et al., 2021; Guo et al., 2022; Pilatti et al., 2021; Zhao et al., 2022), and an investigation was carried out with the general adult population (Awad et al., 2022).

3.4.4. Problematic social media use and self-control

All the studies investigating the relationship between these two variables employed samples of adult general population. Furthermore, there were four papers that investigated the association between subjects' self-control ability and the presence of PSMU (Brevers & Turel, 2019; Błachnio & Przepiorka, 2015; Cudo et al., 2019; Mylonopoulos & Theoharakis, 2021). In all of them correlational analyses were performed and showed significant relationships between both variables.

As far as predictive analyses are concerned, the study by Błachnio and Przepiorka (2015) shows the direct effect of the variable self-control on the presence of PSMU. The research carried out by Cudo et al. (2019) suggests the positive direct effect only on one of the dimensions of self-control: impulsivity. For their part, Brevers and Turel (2019) determined that the influence that self-control has on PSMU is mediated by the habit of using social media and the difficulties of carrying out self-control strategies. Finally, Mylonopoulos & Theoharakis (2021) obtained mixed results when testing two models: first, they found direct relationships between the variables, but when they included in their model the effect of passions, defined as those activities that people value and engage in intensely internalizing them as part of their identity, this predictive relationship ceased to exist.

3.4.5. The mediator effect of the regulation

Of the total number of studies included, 16 of them found that the regulation variable has a significant mediating role in the relationship between some variables (e.g., presence of psychopathology, self-esteem, or attachment) and the presence of PSMU. Due to the large amount of evidence on the mediating role of the regulatory construct, we proceed to briefly outline the relationships in this section.

With regard to the variable self-regulation, the research by Osatuyi & Turel (2018) shows the positive indirect relationship between the use of social media and PSMU through self-regulation. A research conducted in the workplace setting (Khan et al., 2021) exposes the mediating role of this variable in the association between PSMU and its negative effect on self-esteem and technological conflict in employees. Other investigations focus on how the variable self-regulation mediates between the different aspects related to psychopathology and PSMU: the study by Holmgren & Coyne (2017) shows the positive effect that the PSMU has on aggressiveness and depression in an indirect way, while the work of Kandee et al. (2022) points out that the depressive symptoms and subjective norms indirectly predispose to the presence of PSMU through self-regulation. Additionally, a study shows the moderating role of self-regulation between the Fear of Missing Out (FoMO) and psychological enhancement variables in PSMU (Zhang et al., 2024).

The vast majority of studies focus on analyzing the mediating role of the variable emotional regulation (10 in total). Two papers show the

significant indirect effect between social anxiety and PSMU by means of this variable (Becerra-Guajardo et al., 2021; Zsido et al., 2021). In addition, relationships are also found between social and self-concept problems and the presence of PSMU by means of emotional regulation (Soares et al., 2023). This mediating relationship has been demonstrated with other psychopathological variables such as: anxiety and insomnia (Błachnio et al., 2023), psychosomatic problems (Soares et al., 2023), and psychopathic and narcissistic personality traits (Hussain et al., 2021). On the other hand, feelings such as guilt, anger (Nazlıgül et al., 2022) and interpersonal guilt (Russo et al., 2022) are also indirectly associated with PSMU through emotional regulation. Having lived through adverse experiences in childhood leads to the presence of PSMU through emotional regulation (Lim et al., 2020). This variable has also been shown to mediate the relationship between the presence of anxious attachment and PSMU (Liu & Ma, 2019; Marino et al., 2023). Additionally, Ostendorf et al. (2020) demonstrate the moderating effect of online regulation strategies on the relationship between age and PSMU.

Awad et al. (2022) analyze the mediating influence of impulsivity on the relationship between desire thinking and the presence of PSMU. On the other hand, in the adolescent population, rules (whole-family and youth-focused) have been found to have a moderating effect on the relationship between impulsivity and PSMU (Hawk et al., 2023): in those with high levels of impulsivity, child-centered norms decrease PSMU, whereas in those with low levels of impulsivity they have lower PSMU with general family norms.

Finally, Brevers and Turel (2019) have found the indirect effect that occurs between social media use habit and PSMU mediated by the presence of difficulties in social media self-monitoring strategies.

By way of synthesis and to facilitate the interpretation of the results, Fig. 2 presents a scatter plot of the significant correlations between regulatory processes and PSMU. Studies that did not provide correlational data were excluded from this figure, as were non-significant coefficients.

3.5. Quality assessment

Table 3 (Supplementary Material) summarizes the overall assessment of the quality and risk of bias of the 45 studies, as well as the score for each particular item after administering the AXIS tool (Downes et al., 2016). The total scores indicate that 32 articles obtained a high quality and 13 a moderate quality index. No study had a low-quality index taking into account the AXIS method (Downes et al., 2016). Regarding the items in particular, those included in the sections on methods and results presented the greatest risk of bias or lower quality of the studies (items 3, 7 and 14). Therefore, this should be taken into consideration when interpreting the results.

4. Discussion

The main objective of the present investigation was to synthesize and analyze the existing evidence on the relationship between regulatory variables and PSMU. After the analysis of the studies included in this review, the association between both variables across life stages and in different cultures is confirmed. In this line, previous research has provided evidence on the relationship between these regulatory constructs and different types of behavioral addictions (López-Guerrero et al., 2023; Velotti et al., 2021). Also, the association with dysfunctional behaviors in the use of technologies has been confirmed (Cerniglia et al., 2019; Gioia et al., 2021). With these results, it can be suggested that regulation may be a common factor present in all types of addictions.

Additionally, a large percentage of studies included in the review analyzed the mediating role of regulatory constructs (self-regulation, emotional regulation and impulsivity) between the PSMU and variables such as: psychopatology, attachment styles, personality traits, adverse childhood experiences, emotional stages, social media use, desire thinking and social norms use. These results are in line with what the I-PACE Model points to (Brand et al., 2016, 2019), one of the most relevant theories currently focused on specific internet use disorders. This theoretical framework focuses on the processes underlying the development and maintenance of this type of dysfunctional behaviors and points to the mediating role of regulation (Brand et al., 2016, 2019). In addition, the high rates of comorbidity that exist between different psychopathological disorders have led to analyze difficulties in regulation from a transdiagnostic perspective (Belloch et al., 2020). All these data highlight the need to promote and implement interventions focused on the common aspects behind the development and maintenance of different mental health problems (Caspi & Moffitt, 2018; Helland et al., 2022). Focusing on the role that variable regulation may have in the onset and maintenance of other clinical disorders may be a key aspect that helps to prevent and treat different conditions and the comorbidity between them.

On the other hand, more and more research are focusing on the effect of the environment (e.g., family, friends, or the community) on the development and maintenance of dysfunctional behaviors related to Internet use (Chemnad et al., 2023; Niu et al., 2023; Tang et al., 2023). However, in the studies analyzed, the vast majority of the variables included are dispositional. At this point, carrying out studies that analyze the effect of the context on PSMU is essential in order to have a better understanding of the problem. This position is also supported by authors such as Brand et al. (2019) who, in subsequent updates of their model, stressed the importance of taking into account the environment-related variables involved in this type of behavior. For their part, de la Fuente et al. (2022a, 2022b), in their General Model of Self-Regulation and Hetero-Regulation, attempt to conceptualize the construct of regulation in a cross-sectional manner, applicable to different fields of study in psychology and understood as an integrating umbrella that studies the subject in interaction with the environment. Specifically in the field of social media, the American Psychological Association (2023) points out that the effects of these platforms depend on the strengths and vulnerabilities of both the person and the context in which they find themselves.

On the other hand, the studies included in this review confirm the increased interest in this research topic. Thirty of the 45 studies included in the sample of this review (66.7%) have been published since January 2021. Another aspect to note is that the vast majority of the studies are focused on young people and adolescents. This could be due to several reasons, like the differences between generations in the use of technology or the place these platforms occupy in the lives of young people and the perception of how problematic their behaviors can be (Kuss & Griffiths, 2017). Also, youth and adolescents present a higher risk of developing dysfunctional behaviors as they use the devices for entertainment and peer interaction purposes, in addition to presenting poorly developed self-control skills (Cilligol Karabey et al., 2023; Keles et al., 2020).

However, after analyzing the studies, there is a lack of clarity and definition of both variables (PSMU and regulation), a factor that hinders research in the field of psychology. In addition, a wide variety of assessment instruments employed are based on different diagnostic criteria and cut-off points, which represents a methodological problem that hampers generalization and comparisons between studies (Inzlicht et al., 2021; Kuss & Griffiths, 2017).

Moreover, a large percentage of the studies administered scales to assess PSMU with instruments originally designed to measure addictive symptomatology. This leads to the assumption that there is a tendency in the research field to consider PSMU as a behavioral addiction, although it is not accepted as such by diagnostic manuals (Diagnostic and Statistical Manual of Mental Disorders, 2014; World Health Organization, 2022). This supports the position of those who suggest that an excessive consumption of social media content can lead to presenting symptomatology similar to that appearing in substance addictive behaviors (Kuss & Griffiths, 2017). Such claim might allow us to frame the problematic use of social media in a common category that helps to systematize its

conceptualization. However, there are those who criticize this position arguing that this perspective may blur the multifaceted nature and heterogeneity of this type of behaviors (Billieux et al., 2015).

5. Conclusions

This review study confirms the effect of regulatory processes on the development and maintenance of PSMU. The direct relationship of regulatory processes on PSMU has been evidenced, as well as their indirect influence, with regulation being a mediating factor between PSMU and other variables.

5.1. Contributions

This study has made some theoretical and practical contributions. The information and evidence obtained helps to understand the characteristics of this behavior in certain age and population groups. These results are useful to solve the limitation regarding the lack of clarity in the conceptualization of this type of behaviors related to the use of the Internet.

Data show that the use of these platforms increases year after year, so studying and addressing this behavior pattern is essential for public health, since it can lead subjects to PSMU, increasing the risk of developing addictive behaviors. PSMU does not have a beneficial or detrimental effect *per se*. Such eventuality depends on the strengths and vulnerabilities that each person has and the environment in which they are (American Psychological Association, 2023). This idea is in line with the theoretical models mentioned above (Brand et al., 2019; de la Fuente et al., 2022a, 2022b), which include the role of context as one of the key factors in understanding the complexity of human behavior.

Moreover, the clear association between regulation and PSMU shows the importance of including and designing prevention and intervention plans that take into account regulatory variables as one of the main axes in the field of both clinical psychology and health psychology. Focusing on the common variables that are present in different pictures can be an effective strategy to optimize the treatment of this problem and prevent the appearance of other underlying ones. However, these intervention plans should be adapted to each population group and to each individual subject, taking into account the dispositional and contextual variables available to each of them.

Research in this field of PSMU and regulation is still recent and future research lines need to be developed to analyze in more detail the relationship between these constructs. In order to have a deeper understanding of such phenomena, future studies should employ complex methodology and aim to replicate previous investigations in different population groups.

5.2. Limitations

Lastly, and before concluding this section, several important limitations to this study must be noted. As all the studies included in this review were cross-sectional, it is not possible to obtain information on the temporal stability of the relationships between variables, nor to determine causality between them. On this point, it is suggested that future research should implement longitudinal studies that provide more complete information on the PSMU phenomenon. On the other hand, all the samples are from the general population, so caution should be exercised when generalizing the results to the clinical population and specific groups of individuals. Although one of the inclusion criteria was to have validated instruments to assess the variables, these are self-report measures, so the data might be subject to response bias. In addition, the vast majority of studies measure PSMU in general, without distinguishing between each type of social media app or site. Statistics indicate that each social network has its particularities of use and audience (Ceci, 2024; Dixon, 2024b, 2024c), which might render interesting to analyze in greater depth the characteristics of users and the specific patterns behind each of them.

CRediT authorship contribution statement

Leyre San Martín Iñiguez: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Elkin Luis García:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Esther Rosado Luna:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation. **Laura Garcia-Rodriguez:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis. **Martín Aoiz Pinillos:** Writing – review & editing, Writing – original draft, Methodology, Investigation. **Jesús de la Fuente Arias:** Writing – review & editing, Writing – original draft, Supervision, Funding acquisition, Conceptualization. **Ignacio Moron Henche:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Conflict of interest

This research was funded by R&D Pgc2018-094672-B-I00; R&D Project Pid2022-136466nb-I00 of Knowledge Generation Projects 2022; University of Navarra and Ministry of Science and Education, the State Research Agency (AEI) and is co-financed by the European Regional Development Fund (ERDF).

All the authors declare that they have no conflict of interest.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

De la Fuente Arias Jesus reports financial support was provided by Ministry of Science and Education, Spain. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chbr.2024.100507.

Data availability

Data will be made available on request.

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