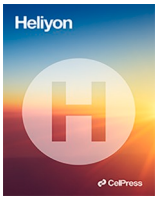
Heliyon 10 (2024) e32463

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Research article

Relationships between social networking sites use and subjective well-being--- a meta-analysis and meta-analytic structural equation model

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ARTICLE INFO

Keywords:
Meta-analysis
Meta-analytic structural equation model
Perceived social support
Self-esteem
Social networking site
Subjective well-being

ABSTRACT

During the last decade, the amount of research on the relationship between social networking sites (SNS) use and users' subjective well-being (SWB) has increased, leading to discrepancies regarding the results. Our review of the literature generated 73 independent samples and indicated that considerable inconsistent results may be attributed to different measurements of SNS use, moderation effects, or media response states and their effects. In this study, meta-analytic procedures were used to assess the strength of the relationships between SNS use indicators, perceived social support (PSS), self-esteem and SWB. The results showed that PSS and self-esteem had stronger effects on SWB than SNS use indicators. Furthermore, a meta-analytic structural equation model was conducted to assess the strength of the relationships between SNS use indicators, PSS, self-esteem, and SWB. The results did not support the proposition SNS use is associated with SWB. Compared with SNS use indicators, media response states such as self-esteem and PSS, had more effects on SWB.

1. Introduction

Social media, as described by Kaplan and Haenlein [1], refers to a collection of internet-based apps that operate on the principles and technology of Web 2.0. These applications allow users to create and share content that they generate themselves [1]. The social media industry has experienced an extraordinary surge in popularity, resulting in social network sites (SNSs)like Instagram, Facebook, WeChat, and QQ reaching every corner of the world, with billions of users spending a large amount of time on SNSs daily [2]. Social networking sites (SNSs) are online platforms that allow users to establish personal profiles, establish connections with other users, and navigate their relationships within a defined system [3]. According to global social media statistics, there were more than 4.47 billion SNS users worldwide by the end of October 2022 [4].

Due to the popularity and prominence of SNSs, researchers are highly interested in the mental health consequences of SNS use. The following catchall terms are often used in this field: well-being, mental health, psychological well-being (PWB), and subjective well-being (SWB). Although they are closely related constructs and often used interchangeably in the literature, they are empirically distinct concepts. Well-being refers to the whole state of individuals' lives, encompassing several aspects such as social connections, physical health, material resources, and personal satisfaction [5,6]. Mental health, according to the World Health Organization, encompasses

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https://doi.org/10.1016/j.heliyon.2024.e32463
Received 24 September 2023; Received in revised form 30 May 2024; Accepted 4 June 2024
Available online 7 June 2024

an optimal condition of wellness where individuals are able to recognize and fulfill their personal potential, effectively manage life's challenges, engage in productive and meaningful work, and make positive contributions to their community [7]. Within this field of study, researchers frequently examine two main perspectives: one centered on psychopathology and the other on psychological well-being (PWB) [6]. The term PWB refers to the state of achieving optimal psychological functioning and experience [6,8], which has two main dimensions: hedonic well-being, and eudaimonic well-being [6,8,9]. The eudaimonic perspective extends beyond mere pleasure and enjoyment. It emphasizes the realization of human potential [6,8]. From a hedonic standpoint, well-being is characterized by experiencing pleasure, life satisfaction, and pleasant emotions with minimal negative emotions [7,10]. Diener and colleagues describe SWB as a key way to measure this idea, focusing on how people think and feel about their lives [7,10,11]. This includes assessing life satisfaction, experiencing positive emotions, and having few negative emotions [12,13]. Currently, as people worldwide fulfill more basic material needs, they attribute greater importance to SWB [10]. Although SWB is not enough to sustain a good life [14], people who report higher SWB are at lower risk for various psychological and social problems [15]. If SNS use does not bring people happiness or, to the contrary, generates a negative mood more often than a positive mood, methods should be adopted to prevent the drawbacks of SNS use. Therefore, the examination of the influence of SNS use on SWB is a fundamental inquiry that social scientists must undertake, as its findings might have significant policy consequences.

Several studies have indicated that using SNSs positively affects SWB directly or indirectly through mediators such as more interpersonal relationships, social capital, and self-esteem [16–20]. In contrast, some studies have highlighted that SNS use hurts users' SWB [21–24]. For instance, empirical research has found that Facebook use can lead to a decline in both components of SWB (affect and life satisfaction) over time [25,26]. Similarly high SNS intensity has been found to decrease individuals' levels of SWB(23). However, some researchers have proposed that there is a nonsignificant correlation between SNS use and SWB [27,28].

Umbrella reviews or meta-analyses have seen a significant surge, aiming to systematically and comprehensively identify both consistencies and inconsistencies within reported outcomes. However, most of these studies consider either PWB or one specific negative psychological indicator (e.g., depression or loneliness). From 2010 to 2022, twelve meta-analytical studies tested the association between SNS use and various indicators of individuals' well-being, such as depression, loneliness, self-esteem, and life satisfaction. Out of these, five meta-analyses have focused only on the negative indicators of well-being such as depression and loneliness [29–33]. Seven meta-analyses use the terms mental health, well-being, or PWB in the title. Most of the above research used a comprehensive and even boundless definition of PWB, incorporating numerous outcomes, such as loneliness, life satisfaction, and/or depression [6,30,34–38].

Although these meta-analyses provided much information to understand the correlation between SNS use and individual well-being, uncertainties persist as a result of the papers' limitations. First, life satisfaction is the sole meta-analyzed indicator that falls within the category of SWB thus far [6]. In other words, no quantitative summary was available that quantified the relationship between SNS use and hedonic wellness across various research.

Second, although there are several methods to define and assess SNS use, such as considering factors beyond only the amount of time spent on SNSs and the frequency of checks, research in these specific areas is relatively limited. As a result, there is not enough data available to conduct a separate meta-analysis. After reviewing relevant research, emotional involvement, or use intensity, has also been the usual measurement of SNS use.

Additionally, in current meta-analyses on the relationship between SNS use and SWB, the media response factors such as perceived social support (PSS) and self-esteem [39] were not taken into account. Prior research has declared that SNS use provides supportive interaction [16,20], which subsequently plays a significant function in diminishing stress and enhancing users' mental health [40–43]. External validation of one's self-esteem is a reliable indicator of an individual's well-being [44–47]. PSS and self-esteem have been widely studied in empirical studies as factors affecting SWB and have been proven to be significant [48,49]. However, the present meta-analyses only concerned the average bivariate association of self-esteem and PSS with SNS use [50,51] and neglected to synthesize multivariate factors such as SNS use, PSS, self-esteem, and SWB to explore the underlying relationship among these variables.

A potent research technique called meta-analysis makes it possible to synthesize the results of several studies and provide a thorough picture of the connection between the use of SNS and SWB. Through the consolidation of impact sizes from various studies, meta-analysis improves the accuracy and applicability of study outcomes. This study utilized meta-analysis in this work to provide a thorough comprehension of the complex correlation between SNS use and SWB, highlighting both the advantages and disadvantages. This paper aims to measure the correlation between SNS use variables and SWB by using meta-analysis to overcome the effects of measurement errors within a single study [52]. The validity of conclusions is strengthened by this technique, which offers a broader view by combining findings from various groups and circumstances.

Afterward, the combination of meta-analysis and structural equation modeling (MASEM) is employed to examine the serial mediating function of two media response states (self-esteem and PSS). To further delve into the nature of SNS use in SWB, this research presents an analysis of effect sizes that compares the mediating effects of PSS and self-esteem.

Compared with previous studies, our research tests a theoretical model of SNS users' SWB rather than isolated disconnected relationships between SNS use and SWB, which could change if considered in concert with other variables. Second, we show that sequential relationships exist between PSS and self-esteem, and assess the comparative strength of the three indirect effects. The findings may enhance our understanding by expanding our comprehension of the mechanism that associates SNS use with SWB.

2. Literature review

2.1. The association between SNS use and SWB

In recent decades, the association between SNS use and SWB has been widely researched and has produced inconsistent results. SNS is regarded as an effective channel to establish new connections and maintain existing ones [53], which may provide sufficient information to influence people's evaluation of their lives [3,54]. Following this rationale, recent studies suggest that the measurements of general SNS use, number of friends, use intensity, and use frequency can positively affect SWB [26,55–57].

In contrast, some researchers have posited a subtle negative correlation between SNS use and SWB, indicating social media's relatively modest adverse influence on happiness. The research results indicated that various factors, including the frequency of Facebook interactions [52], time spent on SNSs [53,54], passive engagement with SNSs [21,55], and the persistence of Facebook use [26], may marginally predict heightened levels of loneliness or depression. Notably, a longitudinal study by Kross et al. [23] revealed a gradual decline in life satisfaction levels over time with increased Facebook usage. Similarly, Faelens et al. [57] observed a slight increase in subsequent social comparison, along with a marginal decrease in self-esteem and positive effects associated with Facebook use [58]. Intriguingly, despite these findings, some researchers have suggested that insufficient evidence supported the notion that SNS use negatively affected users' well-being [59,60], life satisfaction, or happiness [58], implying that any adverse effects are relatively inconsequential.

One possible cause of the above inconsistency is that most of these studies had different measurements for SNS use, which may have different effects on SWB. For instance, Huang [61] and Chai et al. [26] measured SNS use with the Facebook Intensity Scale and found that SNS use is positively related to SWB [62,63]. Banjanin et al. [64] used time spent on SNSs as the indicator and found a favorable correlation between time spent on SNSs and depression. Other measurements of SNS use ranged from the purposes of SNS use (e.g., social use, instrumental use, and leisure use) to specific behaviors (e.g., active use, passive use, interaction, posting, and SNS status updates) [65]. Such myriad definitions might significantly impede the understanding of how SNS use affects individuals' mental health. In order to prevent the inclusion of research that cannot be compared and may complicate the interpretation, this study estimates the effect of three global indicators (time spent on SNSs, use frequency, and use intensity) on SWB individually, which are the most popularly used indicators and can provide sufficient literature for meta-analysis.

The other possible cause of inconsistency is the individual difference proposed by Valkenburg and Peter [39]. The impact of media use on individuals' psychology and behaviors is contingent upon several factors, such as gender, temperament, and social context variables. This implies that the direction and intensity of the influence fluctuate based on individual differences [58]. These variables are called moderators [58]. Extending this rationale to SNSs, it is reasonable to anticipate that the influence of SNS use on users' SWB may be moderated by users' national culture, age, and gender [58]. This research elaborates on these moderators' effects in the next section.

The third cause of inconsistent results in previous research is the complexity of the working mechanism of SNS use. Abundant studies have indicated that SNS users experience positive effects on their well-being, mostly due to the social support they receive from online connections [66] and the self-esteem they gain [67]. These factors, in turn, contribute to their overall SWB [22,26]. To verify whether PSS and self-esteem influence the impact of SNS use on SWB, this study conducted path analyses by using a meta-analytic correlation matrix.

2.2. Potential moderators

Existing studies have shown the presence of significant cultural disparities among social media users leads to different patterns of SNS use and subsequent consequences [68,66]. Individualism and collectivism are two important dimensions of cultural values [69]. Individualistic cultures emphasize goals such as self-sufficiency and self-glorification; collectivist cultures emphasize the good of the ingroup [70]. Diener et al. [44] proposed that people may have higher levels of SWB in individualistic cultures than in collectivistic cultures. Generally, Western nations such as the USA, Canada, Australia, and European countries are considered individualistic countries, while Asian nations such as Japan, Korea, Singapore, and China are considered collectivistic countries [38,71]. Research has demonstrated that in collectivistic countries, using SNS is significantly associated with positive mental health indicators [38], but in individualistic countries, SNS use is significantly related to negative mental health indicators [63]. Therefore, the correlation between the three global indicators of SNS use and SWB is moderated by the cultural context of each nation.

Age also moderates the strength of the relationship between SNS use and SWB [72]. First, young people and older people have very different habits in terms of their SNS use. Sponcil and Gitimu [73] reported that young people had a greater propensity for self-disclosure on SNSs than older adults. Correa et al. [74] suggested that compared with older people, young people allocated a greater amount of time engaging with social media. Second, the magnitude of the effects of SNS usage on SWB varies between younger and older groups. Younger adults use Facebook more regularly and have a greater emotional effect from it compared to older ones [75,76]. Third, even the same SNS activity may impact SWB differently in different age cohorts. Empirical research found that social media may enhance younger individuals' well-being, but the opposite relationships were produced for middle-aged and older persons [77]. Likewise, regarding sharing activities on SNSs, younger adults had higher life satisfaction and lower loneliness, while older adults had the opposite [78]. However, previous meta-analyses found no substantial moderation in the association between time spent on SNSs and PWB [34,79]. It's necessary to examine how age influences the connection between global indicators of SNS use and SWB [80].

There are scholars who believe that gender plays a crucial role in determining the impact of social media on an individual's SWB. First, men and women tend to use social media platforms differently [62]. Women primarily use them to maintain relationships, while

men use them for information gathering [81–84]. Secondly, research indicates that there are gender differences in the impact of SNS use on the development of depressive symptoms. For example, studies suggest that social media use is more strongly linked to depression in females than males [81], as women tend to engage in more social comparison, which can lead to depressive symptoms [85]. However, some scholars remain skeptical about the link between gender and the impact of SNS use on depression [86]. Two meta-analyses have found no evidence of gender differences in the association between depression symptoms and time spent on SNSs or use frequency [33,35]. With regard to positive mental indicators, there is insufficient evidence to suggest that gender plays a significant role. Three meta-analyses have shown that gender does not significantly moderate the correlation between social media use and PWB, which includes life satisfaction as one indicator [34–36]. Only one study found that gender affects the correlation between SNS use and negative indicators but not positive indicators [38]. Further research is necessary to determine if gender plays a role in the relationship between SWB and SNS use.

2.3. Self-esteem and perceived social support

Self-esteem refers to an individual's overall assessment of their worth [87]. Research has shown that self-esteem has a positive correlation with life satisfaction [44], happiness [88,89], and social support [90]. However, there are mixed findings regarding the relationship between SNS use and self-esteem. Some researchers suggest that SNSs can boost one's self-esteem [91] by providing social opportunities [87] or a feeling of acceptance [92]. Others argue that SNS use occasionally impairs self-esteem, attributed to social comparison with SNSs [93] or strong face-to-face relationships replaced by weak online relationships [35]. Three meta-analyses have revealed that the amount of time individuals spent on SNSs, the frequency of checking SNSs, and the intensity of SNS use had small, significant, and negative effects on self-esteem [35,51,94].

PSS is the assistance and encouragement received by an individual through social interactions, which can reduce psychological stress responses, alleviate mental pressure, and improve social adaption [95,96]. The use of gratification theory concludes that people can fulfill their connection needs by using information technology. Specifically, people may connect with others and obtain assistance or support from others by using SNSs, which satisfies their related needs and enhances their satisfaction. Empirical investigations consistently show a positive correlation between SNS use, PSS, and SWB. Research demonstrated that individuals who shared personal information, thoughts, and emotions with others online had greater social capital and expected social support, which increased their SWB [97,98]. Other studies also illustrated that time spent on SNSs and use intensity helped establish close interpersonal relationships, decreased stress, and ultimately improved users' SWB [55,87,99–102]. In addition, some studies have documented that PSS may mediate SNS use and SWB [103–105].

Prior studies have shown that self-esteem and PSS are strong predictors of SWB [12,106,107]. They were also proven to be associated with each other by previous empirical studies [107]. Consequently, the sequence of these two potential mediators in the conceptual model should be considered. One potential explanation is that self-esteem impacts SWB by affecting social support and vice versa [108]. However, much debate exists about the cause-and-effect relationship between social support and self-esteem. A longitudinal study revealed that changes in self-esteem preceded alterations in both the quality and quantity of social support networks [90]. Tan et al. [107] investigated the influence of social support and self-esteem on the connection between extroversion and happiness. Their findings demonstrated that extroverts' self-esteem positively influenced their social support, increasing happiness [107,108]. Studies on sociometer theory have shown a contradictory outcome. The sociometer theory posits that self-esteem is contingent upon social feedback, namely the perception of whether others accepted or rejected oneself [109,110], which varies due to social feedback and social exclusion [111,112]. Positive feedback received from SNSs enhanced their self-esteem and well-being, but negative feedback had the opposite effect [91]. When individuals' self-esteem is low, establishing social connections is regarded as an effective way to increase their self-esteem [112]. Empirical research has demonstrated that social support significantly impacts self-esteem and named this model the self-esteem consequence model [47,113,114]. Cao [115] and Kong et al. [49] discovered that self-esteem was a mediator in the relationship between social support and loneliness. Given the theoretical explanation and existing empirical support, it is believed that PSS and self-esteem sequentially mediate the connection between SNS use and SWB(112). Moreover, PSS precedes self-esteem.

After conducting a meta-analysis, theoretical models were tested to verify the sequential mediating roles of PSS and self-esteem. To obtain sufficient bivariate coefficients, we combined the time spent on SNSs and the use frequency as independent variables in Model I, which we named the general use of SNSs. Use intensity was independent of Model II. Drawing from the preceding discussion, we put forward the following hypotheses [108]:

H1a. The general use of SNSs will positively influence PSS.

H1b. Use intensity will positively influence PSS.

H2a. The general use of SNSs will negatively influence self-esteem.

H2b. Use intensity will negatively influence self-esteem.

H3a. PSS will mediate the relationship between the general use of SNSs and SWB.

H3b. PSS will mediate the relationship between use intensity and SWB.

H4a. Self-esteem will mediate the relationship between the general use of SNSs and SWB.

H4b. Self-esteem will mediate the relationship between use intensity and SWB.

H5a. PSS and self-esteem will serially mediate the relationship between the general use of SNSs and SWB.

H5b. PSS and self-esteem will serially mediate the relationship between use intensity and SWB.

3. Method

3.1. Study search

An extended literature search was conducted in August 2022 to identify potential studies exploring the correlation between SNS use and SWB. Two literature searches were conducted. The first search identified studies with SNS use variables and SWB variables. The second search identified articles on PSS and self-esteem in SNS use. The electronic databases Elsevier, ProQuest, Web of Science, and Google Scholar were searched with all possible combinations of the following two groups of terms: 'well-being' or 'SWB' or 'happiness' or 'positive emotions' or 'positive affect' or 'life satisfaction' and 'social media' or 'social network* site*' or 'Facebook' or 'Twitter' or 'Instagram' or 'Myspace' or 'WeChat' or 'QQ' or 'microblog'. A manual search was carried out to capture potential unidentified studies by examining the reference lists of all the retrieved articles and relevant review articles.

A meta-analytic correlation matrix with six pairs of relations was utilized to assess our predicted mediation model. The matrix consisted of the following correlations: SNS use and SWB, PSS and SWB, self-esteem and SWB, SNS use and PSS, SNS use and self-esteem, and PSS and self-esteem. The previous search provided the first three effect sizes in the correlation matrix. A supplementary search to identify the meta-analytic effect sizes between SNS use and PSS, SNS use and self-esteem, and PSS and self-esteem was conducted. We used the same methods as the first search but different search terms. The following subject terms and Boolean terms were entered: ('social support' OR 'self-esteem') AND ('social media' OR 'social network* site*' OR 'Facebook' OR 'Twitter' OR 'Instagram' OR 'Myspace' OR 'WeChat' OR 'QQ' OR 'microblog'). Additionally, we gathered all articles from the first study that contained both PSS and self-esteem variables. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISM) methodology was employed to identify relevant studies. In the initial step, a total of 694 records were identified. After screening titles and abstracts, 442 articles were removed due to duplication and irrelevance. Following the screening procedure, a total of 179 articles were eliminated based on the inclusion and exclusion criteria specified below.

3.2. Inclusion criteria

The inclusion criteria used for the correlation between SNS use and SWB were as follows: 1) articles should report either overall SWB or one positive indicator of SWB (life satisfaction or positive affect must have at least one); 2) articles should report SWB predictors related to SNS use (time spent on SNSs, use frequency, use intensity, PSS or self-esteem); 3) articles should report both sample size and correlation coefficients between predictors of SWB and indicators of SWB, or they should report sufficient statistics to allow conversion to correlation coefficients; 4) articles examining SNS addiction, problematic usage of SNSs, cyberbullying or excessive SNS use were excluded because these terms are different from what we are discussing here [116]; and 5) articles must be written in English. The selection criteria for the second study consisted of the last two criteria of the first study along with one extra criterion: studies should contain a correlation between PSS and self-esteem, correlation coefficients between SNS use indicators and PSS, or correlation coefficients between SNS use indicators and self-esteem.

3.3. Coding procedure

Two researchers independently coded the following variables: 1) the author(s), 2) the publishing year, 3) sample size, 4) basic demographic characteristics of samples (average age and female percentage), 5) SNS use indicators including time spent on SNSs, use frequency, use intensity, PSS, and self-esteem, 6) cultural background, 7) indicators of SWB, and 8) correlation coefficients. In case of any disagreement between the coders, discussions were held to resolve the discrepancies and reach a consensus.

SWB was interchanged by the following terms in the selected papers: well-being, psychological well-being, subjective happiness, and happiness. In the coding procedure, we studied the actual measurement items and definitions authors provided to code the indicators of SWB and the overall term of SWB. For those articles examining psychological well-being, we studied the definition and measurement items. If an article covered a broader scope than SWB, it was removed.

We coded cultural types as Western and Eastern according to the research participants' nationality [117]. Research participants from collectivist cultures such as China (mainland China, Hong Kong and Taiwan), Korea, Japan, Malay, and Singapore were coded as Eastern cultures, while participants from individualist cultures such as the USA, Canada, Australia, and European countries were coded as Western cultures [118].

3.4. Meta-analysis procedures

Data analyses were performed with CMA3.0 software. As the correlation coefficient was one of our inclusion criteria, this meta-analysis chose the correlation coefficient as the primary effect size. The correlation coefficient was converted to Fisher's Z scale, and the results were later back-transformed to the correlation coefficient after analysis for easier interpretation [37,119]. The meta-analysis in this investigation used random effects models assuming that each study included was conducted in a population that was likely to yield a unique effect size compared to other studies included in the meta-analysis [120].

When a study reported multiple predictors of SWB, all correlation coefficients between the indicators of SNS use and the indicators of SWB were coded. In this case, six coefficients were coded while analyzing three indicators of SWB (e.g., life satisfaction, positive affect, and negative affect), and two indicators of SNS use (e.g., time spent on SNSs and use intensity) for a single sample. According to Hunter and Schmidt [121], all samples must be independent of each other, so each sample can only contribute one effect size to the relevant relationship. When multiple indicators of SWB were used for a single sample, the mean effect size was calculated. For example, if life satisfaction and positive and negative affect were measured in one sample, their mean effect size was calculated, named SWB, before performing the meta-analysis. If the study did not include SWB as the indicator, life satisfaction was chosen, followed by happiness and positive affect. Following this rule, each study only had one effect value included in the subsequent analysis.

4. Results

4.1. Meta-analysis data description

The first part of this meta-analysis analyzed 73 studies consisting of 74 independent samples with 108 effect sizes included. The random-effects model was adopted. The total sample sizes ranged from 78 to 10,398. Only two studies were published before 2010, and 19 out of 73 studies were published from 2010 to 2015. Others are published from 2016 to 2022. The proportion of females was available in 70 samples and ranged from 33 % to 100 %. The average age was available for 47 samples and ranged from 10.1 to 69, but only four studies included a sample average age over 40 years.

Table 1 summarizes the results showing that time spent on SNS use and use frequency were not significantly related to SWB in the 95 % confidence interval, while all other tested predictors were significantly associated with SWB. According to Cohen's [122] guidelines for interpreting effective size, use intensity ($\beta = 0.066$) had small-magnitude effects on SWB. PSS ($\beta = 0.358$) and self-esteem ($\beta = 0.468$) had medium-magnitude effects on SWB.

4.2. Publication bias

Generally, potential publication bias is tested by using funnel plots, Rosenthal's classic fail-safe N test, Begg and Mazumdar method, and Egger's regression test [123]. Funnel plots are a type of subjective visual inspection. The visual diagram of time, use frequency, use intensity, self-esteem, and PSS showed no evidence of publication bias as a symmetric distribution on the funnel plots. A detailed diagram can be viewed in Appendix 4. Furthermore, Egger's test was also performed for each analysis, and none yielded statistically significant findings. The results are as follows: time spent on SNS, $p = .641$; SNS checking frequency, $p = .601$; use intensity, $p = .308$; self-esteem., $p = .932$ and PSS, $p = .636$. Overall, these studies did not provide any conclusive evidence of publishing bias.

4.3. Moderator analyses

The Q statistic and the I^2 index were used as indicators in this study to determine whether moderator analyses should be performed. The Q test and I^2 statistics reported in Table 1 showed that all tested effect sizes were heterogeneous, and further moderation analyses were necessary.

In this meta-analysis, culture, age, and gender were treated as potential moderators. Culture was a categorical variable and evaluated with subgroup analyses, whereas the average age of the sample and female participants proportion were continuous moderators and examined by using meta-regression. Table 2 shows that the effect of culture was significant only on the correlation between use intensity and SWB. The meta-regression analysis found that the moderating regression coefficient for sample age and female proportion was not statistically significant for the relationship between all tested variables and SWB (Table 3).

4.4. Mediation analysis

In order to investigate the mediating effect of PSS and self-esteem as serial mediators between SNS use and SWB, meta-analytic path analyses were carried out using Mplus 7 software. According to the above meta-analysis, we found that time spent on SNSs and use frequency were both insignificantly associated with SWB, while use intensity had a small but significant effect on SWB. The two variables, time spent on SNSs and use frequency, are both quantitative variables. They were aggregated as one variable to measure SNS

Table 1
Meta-analytic results summary of the relationship between SNSs use and SWB.

Constructs	k	N	r	95%CI	z	*p*-value	Q	I^2	Tau
Time	19	6777	−0.002	[-0.044,0.041]	−0.077	0.939	48.008**	62.506	0.070
Use frequency	9	14542	0.049	[-0.066, 0.163]	0.841	0.400	205.178**	96.101	0.169
Use intensity	24	10483	0.064*	[0.013, 0.114]	2.448	0.014	147.044**	84.358	0.113
Self-esteem	20	20879	0.468**	[0.402, 0.530]	12.089	0.00	510.530**	96.278	0.180
PSS	19	9907	0.340**	[0.264, 0.411]	8.295	0.00	302.990**	94.059	0.177

Note. K = number of studies; N = number of participants; CI = confidence interval **$p < 0.01$ * $p < 0.05$.

Table 2
Moderation by culture.

Constructs	Subgroup	k	r	95%CI	$Q_{between}$
Time-SWB	W	11	0.011	[-0.056, 0.078]	0.697
	E	8	−0.023	[-0.066, 0.020]	
Use frequency-SWB	W	7	−0.032	[-0.098, 0.035]	1.065
	E	2	0.264	[-0.292, 0.687]	
Use intensity- SWB	W	10	−0.001	[-0.080, 0.078]	4.123*
	E	14	0.102**	[0.042, 0.162]	
Self-esteem- SWB	W	13	0.453**	[0.391, 0.510]	0. 212
	E	7	0.495**	[0.314, 0.641]	
PSS- SWB	W	6	0.419**	[0.305, 0.520]	2.399
	E	13	0.302**	[0.200, 0.398]	

**$p < 0.01$ *$p < 0.05$.

Table 3
Moderation by age and female proportion.

Constructs	Age		Female proportion	
	β	Z	β	Z
Time-SWB	0.0067	2.01	0.4976	2.07
Use frequency—SWB	0.0003	0.17	0.309	1.08
Use intensity— SWB	0.0009	0.38	−0.075	−0.33
PSS— SWB	−0.012	−1.33	−0.343	−1.15
Self-esteem—SWB	−0.016	−1.06	0.096	0.11

**$p < 0.01$ *$p < 0.05$.

use in some empirical studies [27,124] and were synthesized into one variable named “operationalized SNS use” in the research by Saiphoo and colleagues [51] or “general use of SNSs” in the research by Yi and colleagues [38]. Use intensity measured by the Facebook intensity scale [87] or modified intensity scale is different from time spent and use frequency, which refers to the degree to which a person feels emotionally involved in or connected to social media [125]. Previous research has suggested that SNS use intensity is a distinct construct [125]. We combined time spent on SNSs and use frequency as independent variables in Model I and named it the general use of SNSs. Use intensity was independent of Model II. When time spent on SNSs and use frequency were used simultaneously for a single sample, the mean effect size was calculated to ensure independence.

First, we conducted random effects meta-analyses to quantify the correlations of all relevant constructs in the model and pooled them into a correlation matrix (Table 4). The effect size for the relationship between use intensity, PSS, self-esteem, and SWB was previously estimated (see Table 1). The meta-analytic effect size of the general use of SNSs and SWB over 27 independent samples was r = 0.07, 95 % CI [−0.048, 0.015]. The meta-analytic effect size of the general use of SNSs and self-esteem over 28 independent samples was r = 0.009, 95 % CI [−0.046, 0.063], and the meta-analytic effect size of the general use of SNSs and PSS over 8 independent samples was r = 0.191, 95 % CI [0.121,0.260]. The meta-analytic effect size of PSS and self-esteem was r = 0.319, 95 % CI [0.272, 0.366]. The meta-analytic effect size of the use intensity and PSS over 9 independent samples was r = 0.157, 95 % CI [0.075, 0.237]. The meta-analytic effect size of the use intensity and self-esteem over 9 independent samples was r = −0.014 95 % CI [−0.080, 0.051]. Subsequently, two meta-analytic correlation matrices formed by the above correlations were subjected to conventional path analysis (see Tables 4 and 5).

The harmonic means of sample sizes were used as the sample size in fitting the structural models (Nmodel I = 8060, Nmodel II = 8756). Two hypothesized models were analyzed serially using the correlation matrix. The statistical results of Model I presented in Fig. 1 show that the general use of SNSs positively predicted PSS (β = 0.191, p < 0.01) but negatively predicted self-esteem (β = −0.054, p < 0.01). Thus, Hypothesis 1a and Hypothesis 2a are supported in Model I. Both PSS and self-esteem have a significant effect on SWB (β = 0.220, p < 0.01 for PSS, β = 0.398, p < 0.01 for self-esteem). After accounting for the impact of PSS and self-esteem, the direct effect of general SNS use on SWB remained significant (β = −0.039, p < 0.01), indicating that PSS and self-esteem partially mediate the relationship between general SNS use and SWB. Thus, Hypothesis 3a and Hypothesis 4a are validated. After testing the serial mediation model, it is evident that the relationship between SWB and the general use of SNSs is serially mediated by PSS and self-

Table 4
Correlation matrix for mediation Model I.

	General use	PSS	Self-esteem	SWB
General use	1			
PSS	0.191 (8/2633)	1		
Self-esteem	0.009(28/20098)	0.319 (16/8417)	1	
SWB	0.007(27/21173)	0.340 (19/9907)	0.468 (20/20879)	1

Note: Each column displays the correlation and k number of effect sizes/N sample size in the bracelet.

Table 5
Correlation matrix for mediation Model II.

	Use intensity	PSS	Self-esteem	SWB
Use intensity	1			
PSS	0.157 (9/4014)	1		
Self-esteem	−0.014 (9/13676)	0.319 (16/8417)	1	
SWB	0.064(24/10483)	0.340 (19/9907)	0.468 (20/20879)	1

Note: Each column displays the correlation and k number of effect sizes/N sample size in the bracelet.

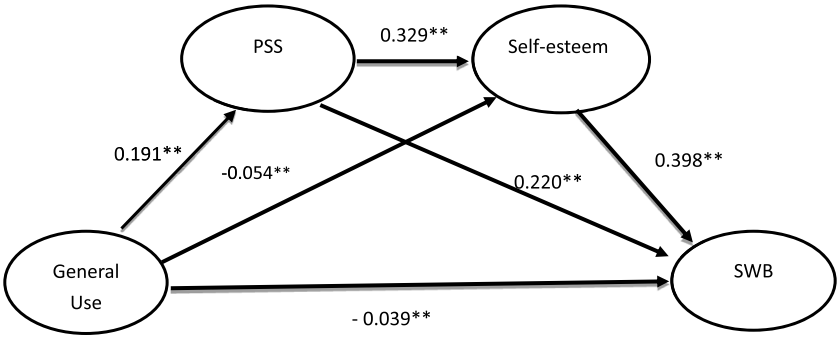

Fig. 1. Serial mediation model showing the effects of general SNS use, PSS, and self-esteem on SWB. The values shown are unstandardized coefficients. **p < 0.01.

esteem (β = 0.025, p < 0.01). Therefore, Hypothesis 5a is supported (see Fig. 1 and Table 6).

Through a comparative analysis of three indirect pathways, it was found that the impact of general SNS use on SWB through PSS is notably stronger than both the combined effect of PSS and self-esteem (β = 0.017, p < 0.01) as well as the influence through self-esteem alone (β = 0.064, p < 0.01). Additionally, the combined mediation effect of PSS and self-esteem on SWB is significantly greater than the influence of self-esteem by itself (β = 0.046, p < 0.01).

Model II, presented in Fig. 2, shows that the connection between use intensity and SWB is partially mediated by PSS and self-esteem (see Fig. 2 and Table 7). However, unlike the general use of SNSs, use intensity positively impacts SWB (β = 0.037, p < 0.01). Use intensity significantly predicted both PSS and self-esteem (β = 0.157, p < 0.01 for PSS; β = −0.066, p < 0.01 for self-esteem). Thus, Hypothesis 1b and Hypothesis 2b are supported. Both PSS and self-esteem have positive effects on SWB (β = 0.440, p < 0.01; β = 0.237, p < 0.01). Thus, Hypothesis 3b and Hypothesis 4b are supported. PSS significantly impacts self-esteem (β = 0.291, p < 0.01), and there is a significant indirect effect on SWB from use intensity through PSS and self-esteem (β = 0.021, p < 0.01). Hypothesis 5b is supported. Among the three indirect paths via PSS, via self-esteem, and via both, the path coefficient through PSS has the greatest indirect effect, while the indirect impact through self-esteem has the weakest effect (shown in Table 7).

5. Discussion

Debates persist about the impact of SNS use on PWB. This meta-analysis aimed to assess the strength of SNS use variables on SWB evidence in support of these arguments. The aim of this study was to perform a quantitative synthesis of the empirical evidence regarding the correlation between SNS use indicators and SWB. Our findings suggest that SNS use, including time spent on SNS, use frequency, and use intensity, is not consistently associated with users' SWB. Specifically, the effect sizes were smaller than the threshold of r = 0.1 considered as hypothesis-supportive. Ferguson and Heene [126] demonstrated that it is particularly pertinent for correlations below r = 0.1, which should not be construed as supportive of the hypothesis, irrespective of their statistical significance. The rationale behind this caution is that such small effect sizes often indicate inaccuracy in social science research [30]. Methodological limitations in the field may explain these small, statistically significant effects. Compared with SNS use indicators, media response states that originated from SNS use, such as self-esteem and PSS, had more effects on SWB. In conclusion, the present results do not provide evidence to support the proposition that SNS use is associated with SWB.

To our knowledge, no other meta-analyses have examined the correlation between SNS use and SWB. However, we can make reference to systematic reviews and meta-analyses that cover similar topics as our reference literature. Our analysis shows that the connection between SNS and SWB is similar to the relationship between computer-mediated communication and life satisfaction [6], the correlation between the amount of time spent on SNSs and life satisfaction [35], and the correlation between overall SNS usage and positive indicators of mental health [38]. When compared with the magnitude of correlations found in these meta-analyses, the current meta-analysis found a similar strength in the correlations between SNS use and SWB.

We also observed considerable diversity in the effect sizes of each construct, which indicated that there might be some moderators affecting the true relationship between the predictors and SWB. Subgroup analysis and meta-regression were used to evaluate the moderating effect of culture, female proportion, and mean age of the sample. The study found that culture only influenced the degree

Table 6
Indirect effects from general use of SNSs to SWB.

Model path	β	SE	P-value
General use ——PSS——SWB (P1)	0.042	0.003	<0.01
General use —Self-esteem——SWB (P2)	−0.021	0.004	<0.01
General use —PSS—Self-esteem—SWB (P3)	0.025	0.002	<0.01
Total indirect	0.046	0.006	<0.01
P1–P2	0.064	0.005	<0.01
P1–P3	0.017	0.003	<0.01
P3–P2	0.046	0.005	<0.01

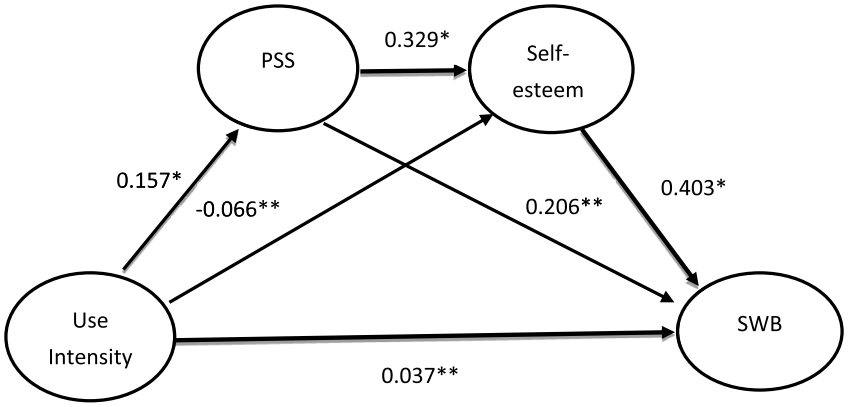

Fig. 2. Serial mediation model showing the effects of SNS use intensity, PSS and self-esteem on SWB. The values shown are unstandardized coefficients. **p < 0.01.

Table 7
Indirect effects from SNSs use intensity to SWB.

Model path	β	SE	P-value
Use intensity ——PSS——SWB (P1)	0.032	0.003	<0.01
Use intensity —Self-esteem——SWB (P2)	−0.026	0.004	0.007
Use intensity —PSS—Self-esteem—SWB (P3)	0.021	0.002	<0.01
Total indirect	0.027	0.006	<0.01
P1–P2	0.059	0.005	<0.01
P1–P3	0.011	0.002	<0.01
P3–P2	0.047	0.005	<0.01

to which use intensity affected SWB. This finding aligns with the previous meta-analysis conducted by Yin et al. [38]. In their research, they found that the mean correlation between SNS use and positive indicators of mental health was greater in a collectivist culture compared to an individualist culture. However, they did not differentiate the measurement of SNS use. Our research extended the present findings to distinguish the general use of SNSs and the emotional investment participants had with SNSs. The study found that different mechanisms may underlie the relationship between SNS use and SWB for the two forms of assessment, which should be considered in future research. The subgroup analysis, revealing that the correlation between the use intensity and SWB in Eastern cultures was stronger compared to Western ones, can be explained by differences in interpersonal relationships between Eastern and Western cultures.

One factor that makes individuals more sensitive to media influences may be their susceptibility to social relationships, which may differ depending on their cultural values. Eastern culture, such as in China, is characterized by a strong emphasis on social interactions and interpersonal connections, which significantly impact people's daily lives [127]. Therefore, users from Eastern countries usually maintain a close social network both online and offline [50,128]. As a result, the involvement of SNSs was a more powerful predictor of SWB for Eastern users. However, the influence of national culture on the impacts of PSS and self-esteem on SWB were both insignificant. A possible reason might be the universal positive effects resulting from PSS or self-esteem on SWB in both Eastern and Western countries.

Gender and age had no moderating effect on the tested variables in our research, which was consistent with a previous meta-analysis [34,35,38]. Age was not a significant moderator in our research. One possible explanation was the uneven age distribution of our samples. We found that the mean age of our samples was below 30 years old; therefore, we lack findings for middle-aged or older populations. We suppose that this is the main reason for the insignificant moderating effect of age.

The second part of this research used MASEM to explore the relationship between SNS use and SWB. The research examined the

indirect effect of both general use of SNSs and use intensity on SWB separately. It helped to explain how different SNS use indicators led to SWB through the mediation of PSS and self-esteem. This research focused on the speculations that PSS and self-esteem acted as joint mediators in the relationship between SNS use variables and SWB.

Our findings illustrated that both the sequential mediating effects of PSS and self-esteem, as well as their individual mediating effect, were significant in both Model I and Model II. These results supported the sociometer theory [109] and the self-esteem consequence model. Regardless of the measurement of SNS use, engaging in interpersonal communication is beneficial for obtaining social support [129]. The feeling of having social support can help individuals cope with difficult life events [130]. This study is consistent with previous research, showing that receiving support from others can boost an individual's confidence and positively impact their cognitive and emotional state. Consequently, individuals who experienced social support had higher self-esteem and higher SWB.

The findings of this study also clarified the varying strengths of influence between PSS and self-esteem. Specifically, the effects of SNS use on SWB through PSS were stronger for both Model I and Model II compared to the other two indirect effect pathways.

While this study primarily provides a meta-analytic overview of empirical evidence regarding the link between SNS use indicators and SWB, it holds substantial theoretical implications. In the current era of increasing concerns about the 'dark side' of SNS usage and its potential health impacts, our findings shed light on the factors that contribute to individuals' well-being in the realm of social media. By emphasizing the significance of PSS and self-esteem, this study contributes to the ongoing discourse on the role of SNSs in individuals' lives.

In addition to its theoretical contributions, the research in this paper has practical implications for a variety of stakeholders, including educators, healthcare professionals, and policymakers. In today's digital society, it is critical to understand the complex interrelationship between SNS use and users' SWB. Educators can use these insights to develop strategies that promote responsible and balanced social media use among students. Healthcare professionals can consider the possible influence of social media on patients' welfare. Policymakers may find our findings valuable when developing regulations or guidelines related to digital engagement. In addition, the study emphasizes the need to advocate for digital literacy and foster healthy online behaviors among users of all ages.

This study had several limitations. First, young participants make up a higher proportion of the sample in this empirical research. Therefore, the influence of age on the constructs of interest was found to be insignificant. Second, our study exclusively examined the mediation effects on the connection between the indicators of SNS use and SWB, specifically focusing on the mediating roles of PSS and self-esteem. While our study aligns with existing literature and theoretical frameworks, it doesn't provide an extensive argument delineating the specific order of variables (e.g., PSS as the primary mediator and self-esteem as the secondary mediator). Further research could benefit from a more comprehensive theoretical justification for the proposed serial mediation model. As with any cross-sectional correlational study, causal interpretations of the relationships among variables should be made with caution. While our analysis provides insights into the associations between SNS use, PSS, self-esteem, and SWB, the correlational nature of the data precludes definitive causal conclusions.[1] It is important to note that while this paper has selected high-quality studies, these studies may have certain biases or methodological limitations. These limitations may include issues with sample size, study design, reported data, etc. For example, the studies measured use frequency and the amount of time spent on SNS. All of them depended on self-reported use, which can be subject to recall bias [123,131,132]. So the reader is expected to remain cautious about the interpreted results. Moreover, it is crucial to acknowledge that this study relies on a meta-analysis of previous studies. Readers are expected to be cautious about generalizing the findings to other contexts, as the results of the study may be subject to variability across cultures, age groups, and social contexts. In addition, we would encourage future studies that can further validate these findings.

6. Conclusion

This study provides a comprehensive summary of the latest research on the correlation between indicators of SNS use and SWB. By doing a meta-analysis, we obtained several findings. First, both PSS and self-esteem had a significant and favorable correlation with SWB. Second, except for use intensity, there were no notable cultural differences in the relationship between SNS use and SWB. Third, quantitative measures of SNS use influenced SWB both directly and indirectly through the sequence of PSS to self-esteem. Finally, PSS and self-esteem are both important factors determining one's SWB. Although the mediation effect of self-esteem on SWB was negative, PSS and self-esteem may simultaneously contribute to an increase in SWB. These findings contribute to our understanding of the complex, multifaceted link between SNS use and SWB. They also expand our knowledge of the mechanism behind the relationship between SNS use and SWB.

Data availability statement

The data pertaining to this study have not been deposited in a publicly accessible repository, given that all relevant data are thoroughly detailed in the article, supplementary materials, or appropriately cited in the manuscript.

[1] We acknowledge the importance of considering alternative mediation models to enhance the robustness of our findings and explored alternative conceptualizations beyond the serial mediation model proposed in this study. Specifically, we conducted analyses to test a parallel mediation model. The detailed analyses and results of these alternative models are available in the supplementary materials.

Ethics statement

Informed consent was not required for this study because this is a meta-analysis. All data were from existing studies.

Funding

This work was supported by Project of Philosophy and Social Science Research in Universities in Jiangsu Province , Jiangsu Education Department, PRC. [Grant No. 2020SJA1602] and National Social Science Found of China [Grant No. 20BTQ047].

CRediT authorship contribution statement

Qiuhong Yang: Writing – original draft, Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Ying Feng:** Project administration, Funding acquisition, Data curation.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Qiuhong Yang reports financial support was provided by Jiangsu Education Department [Grant No. 2020SJA1602]. Ying Feng reports financial support was provided by National Social Science Found of China[Grant No. 20BTQ047].

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e32463.

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