

Leveraging Instagram to enhance self-esteem: A self-affirmative intervention study and multilevel mediation analysis

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Published in *Computers in Human Behavior* (2024), 150, 107972. DOI: 10.1016/j.chb.2023.107972

Abstract: Although studies have consistently indicated that heavier use of social networking sites (SNS) perpetuates poorer self-esteem outcomes, no study has examined potential intervention methods that can yield positive effects from SNS use. We hypothesized that viewing one's Instagram profile would have self-affirmative effects on self-perception because the profile typically showcases curated instrumental positive aspects of self. Furthermore, these self-affirmative effects would indirectly improve state self-esteem via enhanced clarity of self-concept. To test our hypothesis, we designed an experimental intervention study where one group viewed their Instagram profile regularly, while another group viewed a neutral abstract art profile. Using multilevel latent variable path analyses, we found that participants who viewed their own Instagram profiles felt more positive about themselves (i.e., higher state self-esteem), and their enhanced self-concept clarity mediated the relations between self-affirmative SNS use and state self-esteem. Our findings provide preliminary evidence for the guided use of SNS to boost self-esteem.

Keywords: Intervention, Multilevel latent variable path analyses, Self-affirmation, Self-concept clarity, Social networking, State self-esteem

1. Introduction

There are 4.2 billion social media users around the globe, and this number is increasing at an average of 15.5 new users every second (DataReportal, 2021). Such a booming phenomenon has undoubtedly attracted much research attention concerning the implications of social media use, specifically social networking (Charoensukmongkol, 2016; Cheng et al., 2021; Huang, 2017; Nongpong & Charoensukmongkol, 2016; Yoon et al., 2019). A large body of research has alluded to the adverse psychological outcomes of the use of social networking sites (SNS) because of its tendency to perpetuate upward social comparisons and negative self-evaluations (de Vries et al., 2018; Feinstein et al., 2013; Midgley et al., 2020; Vogel et al., 2014). However, no study has investigated strategies that individuals can employ to harness positive self-esteem effects through their SNS use.

Given the role of self-affirmation as a classic self-concept defense mechanism that buffers against threats to self (Tesser, 2001; Tesser & Cornell, 1991), our primary research goal was to examine whether an intervention of naturalistic self-affirmation, implemented through guided SNS use, could yield positive effects on individuals' state self-esteem. Our second goal was to examine a theoretically and empirically plausible mediator that accounts for the link between self-affirmative SNS use and state self-esteem. Past studies

have shown that self-affirmation (Cerully, 2011) and SNS use (Valkenburg & Peter, 2011) influence self-concept clarity—the clarity and coherence of one's perception of self. Additionally, separate research has shown that self-concept clarity is positively related to self-esteem (e.g., Appel et al., 2018; Vess et al., 2011). Therefore, we aimed to elucidate the mechanism by which self-affirmative SNS use influences state self-esteem by examining self-concept clarity as a mediator. Our third goal was to address the mixed findings regarding the relationship between SNS use and self-esteem in previous cross-sectional analyses (Huang, 2017; D. Liu & Baumeister, 2016; Saiphoo et al., 2020). A recent review identifies various person-specific factors (e.g., trait self-esteem, social comparison orientation) that complicate the relations between SNS use and state self-esteem (Cingel et al., 2022). This underscores the importance of conducting longitudinal diary studies and employing multilevel perspectives to disentangle their intricate relations. Since SNS use and state self-esteem are key constructs in our intervention study, we therefore undertook a longitudinal and multilevel approach to examine the

hypothesized mechanism underlying the relation between self-affirmative SNS use and state self-esteem, via enhanced self-concept clarity.

1.1. SNS use and self-esteem

Social networking sites (SNS) are a subset of social media and specifically refers to communities where users can create individual profiles, interact with real-life friends, and connect with other people based on shared interests (Kuss & Griffiths, 2017). Importantly, the use of these SNS platforms has been found to implicate considerable negative self-esteem consequences (Charoensukmongkol, 2016; Cramer et al., 2016; de Vries et al., 2018; Gonzales & Hancock, 2011; Nongpong & Charoensukmongkol, 2016). Self-esteem is instrumental to individuals' well-being because it concerns an individual's sense of self-worth and self-respect (Lee-Flynn et al., 2011). Therefore, it is critical that we do not simply relent to the prevalently investigated negative effects of SNS use, but instead explore ways to harness its potential to promote positive self-esteem effects. A recent systematic review by Krause et al. (2021) suggests three specific self-related processes that can explain various effects of SNS use on self-esteem: social comparison, self-reflection, and social feedback processing. Social comparison during SNS use mainly results in adverse effects on self-esteem (e.g., Midgley et al., 2020; Saiphoo et al., 2020; Vogel et al., 2014). Conversely, SNS-facilitated self-reflective processes have been identified as having the best potential to boost individuals' self-esteem. Social feedback processing, on the other hand, has both positive and negative impacts on one's self-esteem, depending on the nature of feedback received. Given the lack of studies on the positive impact of SNS use on self-esteem, the present study aimed to examine the effectiveness of self-reflective processes, specifically self-affirmation via guided SNS use, as a robust intervention to enhance self-esteem.

To assess the impact of our hypothesized intervention on self-esteem more accurately, we adopted a longitudinal design and multilevel analysis. This approach was necessary due to the nuanced and person-specific nature of the relation between SNS use and self-esteem (for a review, see Cingel et al., 2022). Typical cross-sectional studies often fail to capture the complexity of these relations, which may explain why meta-analytic work found a small effect size ($r = -.079$) between SNS use and self-esteem (Saiphoo et al., 2020), despite many studies suggesting a strong negative impact of SNS use on self-esteem (e.g., Midgley et al., 2020; Vogel et al., 2014). Given that our study's primary focus is the intervention effect of self-affirmative SNS use on self-esteem, it is essential that we capture possible within-person fluctuations and separate them from the between-persons intervention effects. Therefore, we employed multilevel structural equation modeling (MSEM) to disentangle the effects of the intervention on self-concept clarity and state self-esteem from the daily fluctuations of these constructs by decomposing the between-persons and within-person effects. Furthermore, by incorporating the modeling of latent variables within the MSEM framework, we aimed to obtain more precise estimates of our constructs of interest by accounting for measurement errors.

1.2. Self-affirmative SNS use as an intervention to boost self-esteem

According to the self-affirmation theory (Steele, 1988), an individual can affirm some important aspects of the self that are unrelated to the threatened domain to maintain or restore one's global positive self-image. Specifically, self-affirmation serves to reduce the psychological discomfort that stems from the cognitive dissonance between one's positive self-image and a threat to self (McQueen & Klein, 2006; Steele, 1988). In support of this, Tesser and Cornell (1991) found that self-affirmation diminished the use of defensive strategies in a threatening social comparison situation such that self-affirmed participants were more helpful to their counterparts who had supposedly excelled in a previous task than unaffirmed controls. However, it is worth noting

that although the widely used paradigms such as writing an essay about one's important values often effectively elicit self-affirmation in an experimental setting, they are deemed remote and irrelevant for daily practice (McQueen & Klein, 2006).

Considering the prevalence of SNS use in daily living, it is, therefore, critical that we examine whether self-affirmation can be applied in a more natural way within the context of SNS use. Accordingly, one study investigated whether spending time on Facebook profiles could elicit self-affirmative effects (Toma & Hancock, 2013). The rationale behind this stemmed from the belief that Facebook profiles meet the three criteria required for self-affirmation: (a) Facebook profiles represent domains of self that determine self-worth; (b) they offer a positive and desirable self-representation; and (c) they are an accurate representation of individuals. Facebook users often curate their profile posts to reflect positive (Denti et al., 2012), essential (e.g., meaningful relations, cherished personal characteristics), and accurate aspects of self-concepts (Michikyan et al., 2015), all of which could satisfy one's fundamental need for self-worth (Sherman & Cohen, 2006; Steele, 1988). Toma and Hancock (2013) found that participants who looked at their personal Facebook profile for 5 min were less defensive and more receptive to negative feedback, compared to those who viewed a stranger's Facebook profile. Their results also indicate that participants who were affirmed by viewing Facebook profiles were similarly receptive to negative feedback as those who were affirmed by the classic manipulation of writing an essay about their core values. Consistently, several studies have found that updating and viewing one's own SNS profile have positive effects on one's self-esteem (Gentile et al., 2012; Gonzales & Hancock, 2011).

Despite these promising findings that self-affirmative SNS use benefits one's self-esteem (Gentile et al., 2012; Gonzales & Hancock, 2011), the previous studies did not control or account for trait-level self-esteem in their assessment of state self-esteem changes. Given that interindividual differences in trait self-esteem account for up to 93% of the differences in momentary changes in state self-esteem (Hank & Baltes-Götz, 2019), there is a possibility that the intervention effect is inflated by differences in trait self-esteem in the groups. Furthermore, an individual's trait self-esteem influences the impacts of self-esteem updating processes (e.g., self-affirmation, social comparison) on one's state self-esteem (Krause et al., 2021; Midgley et al., 2020). For instance, self-affirmative tasks that remind individuals of their positive self-aspects are more beneficial for individuals with lower trait self-esteem because they have less immediate access to positive self-feelings (Düring & Jessop, 2015). To address this issue, it is critical that we account and control for one's trait-level self-esteem. This would allow us to examine self-affirmative intervention effects on state self-esteem that are beyond the influence of trait self-esteem. Therefore, we implemented a 7-day longitudinal intervention and employed a multilevel mediation modeling approach while controlling for notable covariates including trait self-esteem.

1.3. Self-concept clarity as a mediator

Our second research goal was to elucidate a possible mechanism by which self-affirmative SNS use would improve one's state self-esteem. Although a number of studies have found that self-affirmation is positively related to both self-concept clarity (Cerully, 2011; Wakslak & Trope, 2009) and self-esteem (Gentile et al., 2012; Gonzales & Hancock, 2011; Krause et al., 2021), little is known about the possible mediating role of self-concept clarity between self-affirmation and self-esteem. Self-concept clarity refers to the extent to which self-beliefs are clearly and confidently defined, internally consistent and stable (Campbell et al., 1996). We propose that engaging in self-affirmative SNS use prompts a form of cognitive priming that leads individuals to perceive a heightened level of coherence and structure in their self-concepts. This, in turn, enhances self-concept clarity (Wakslak & Trope, 2009), which then affords greater resilience against self-threats and results in higher

state self-esteem (DeHart & Pelham, 2007). Two lines of empirical evidence provide theoretical and empirical support for our hypothesized mediational effect of self-affirmative SNS use on state self-esteem via self-concept clarity.

First, theoretical and empirical support suggests that self-affirmation engenders a form of cognitive priming that positively influences an individual's self-concept clarity (Cerully, 2011; Wakslak & Trope, 2009). Engaging in self-affirmation requires individuals to reflect on their most central characteristics. This process serves as a procedural information processing prime that activates higher-level construal thinking and prompts individuals to similarly consider other information in its most core and essential elements (Trope & Liberman, 2003). Consequently, individuals tend to think about themselves at a higher-level and more structured manner, which strengthens their self-concept clarity (Wakslak & Trope, 2009). In support of this notion, studies have found that high-level construal thinking is associated with a coherent and structured self-representation that emphasizes the core characteristics of the self, while low-level construal thinking is associated with a more contextualized self-representation that is less structured and consistent (Wakslak et al., 2008). Similarly, studies have found that individuals who are self-affirmed by writing about their most important values engage in a higher-level construal thinking regarding the self and report higher ratings of self-concept clarity (Cerully, 2011; Wakslak & Trope, 2009). Together, these studies suggest that self-affirmation can activate a higher-level construal of information processing that facilitates the perception of greater coherence and structure within one's self-representations, i.e., higher self-concept clarity.

Despite this plausible link between self-affirmation and higher self-concept clarity, there is a lack of empirical research investigating SNS use as a viable self-affirmative intervention method to enhance self-concept clarity. Further, most research on this subject has primarily focused on the negative implications of SNS use on self-concept clarity, supporting the fragmentation hypothesis. Specifically, the fragmentation hypothesis posits that online activities allow users to portray multiple possible selves, resulting in a diverse range of self-expressions that hinder the development of a consistent and stable self-concept (Valkenburg & Peter, 2011). However, Valkenburg and Peter (2011) also introduced the self-concept unity hypothesis which posits that online activities provide users with the opportunity to express positive and authentic aspects of their multiple selves and receive validations for these self-aspects, thereby fostering a stronger and more coherent sense of self (Valkenburg & Peter, 2011). This implies that, contrary to the fragmentation hypothesis, online activities could aid in the development of a more unified and clearer self-concept. Notably, previous studies, which have largely focused on the negative impact of SNS use on self-concept clarity, may not have adequately tested these contrasting perspectives because they have focused on either the frequency/intensity of SNS use (e.g., "SNS is part of my everyday activity," Appel et al., 2018; Liu et al., 2019) or the passivity of its use (e.g., "I often browse social network sites but don't post status updates"; Lin et al., 2021). Considering that SNS activities predominantly involve extensive viewing of content posted by others rather than self-generated content which is more appropriate to induce self-affirmation, it is critical to differentiate these vital aspects of SNS activities when studying the link between self-affirmative SNS use and self-concept clarity. In particular, we propose that viewing one's own Instagram profile would provide individuals with opportunities to reflect on positive and important self-aspects, facilitating a clearer sense of self. Therefore, we hypothesized that self-affirmative SNS use through the intervention of viewing one's own Instagram profile would positively predict self-concept clarity (Hypothesis 1).

The second line of empirical support for our mediation model stems from evidence suggesting that higher self-concept clarity engenders higher self-esteem (Campbell, 1990; Stinson et al., 2008; Osborne & Taylor, 2010). Individuals who have greater confidence in their trait self-ratings and maintain congruent self-concept tend to have higher

self-esteem (Campbell, 1990). This is because when individuals possess a clear sense of self-aspects, it is easier to recall their positive traits when facing a threat to self. As a result, their self-esteem becomes more resilient against external influences (Campbell & Lavallee, 1993; Dodgson & Wood, 1998). Accordingly, existing evidence suggests that higher self-concept clarity attenuates the sensitivity of self-esteem to negative self-threats such as social comparisons (DeHart & Pelham, 2007; Vess et al., 2011). For instance, a study found that individuals with higher self-concept clarity are better able to maintain their state self-esteem in the face of high volume of negative events, compared to those with lower self-concept clarity (DeHart & Pelham, 2007). In line with this notion, other studies have shown that the higher-level construal mindset, which facilitates higher self-concept clarity, can act as a protective buffer against self-threats. Vess et al. (2011) found that participants who adopted a high-level construal mindset did not experience decreases in their self-esteem following negative feedback, in contrast to those who were primed with a low-construal mindset. Given this, we hypothesized that higher self-concept clarity would predict more positive state self-esteem (Hypothesis 2).

Taking all these together, it is plausible that self-affirmative SNS use prompts higher-level construal thinking and engenders a perception of greater coherence and structure in one's self-concepts (i.e., higher self-concept clarity). Consequently, this strengthened self-concept clarity protects an individual's self-esteem against negative self-threats and results in elevated state self-esteem. Therefore, we hypothesized a mediation model in which self-affirmative SNS use indirectly predicts one's state self-esteem via enhanced self-concept clarity (Hypothesis 3; see Fig. 1).

1.4. Present study

In our study, we specifically concentrated on Instagram as the primary SNS platform to examine and test our hypotheses. Instagram was launched in 2010 as a SNS platform that allows picture sharing, and has since evolved to allow video sharing, instant messaging, live streaming, and video-calling etc. ("Instagram," 2023). Similar to other SNS users, Instagram users share photos—especially selfies (Caliandro & Graham, 2020)—videos, and stories about things that are important to themselves in a positive and desirable way (Yau & Reich, 2019). To illustrate, the top two posted photos on Instagram are selfies and friends, which are conceivably instrumental aspects of self (Y. Hu et al., 2014). Given that an individual's Instagram profile represents a curated collection of their positive self-aspects, we hypothesized that a relatively short (7-day) intervention via guided SNS use, which prompts participants to view their own Instagram profile, would lead them to feel self-affirmed and thus experience better self-esteem outcomes.

Our research goals were threefold. First, we aimed to investigate whether a naturalistic self-affirmative SNS intervention (i.e., viewing one's own Instagram profile) would benefit one's state self-esteem. Second, we sought to elucidate the mechanism between self-affirmative SNS use and state self-esteem by examining self-concept clarity as a mediator. Third, we aimed to fill a gap in the literature by providing longitudinal evidence and multilevel perspectives of the relation between SNS use and state self-esteem, while controlling for important covariates such as trait self-esteem.

Using an intensive longitudinal design, we repeatedly exposed participants to a 7-day intervention (in comparison to the control), and participants completed daily questionnaires. To examine our

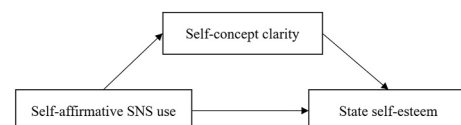


Fig. 1. Hypothesized mediation model.

hypotheses, we used multilevel modeling (MLM) that provides unbiased estimates of the hypothesized 2-1-1 mediation effect (Krull & MacKinnon, 2001): A 2-1-1 effect means that the self-affirmative intervention via guided SNS use is a level 2 (i.e., group) construct, while self-concept clarity (i.e., the mediator) and state self-esteem (i.e., the outcome variable) are repeatedly measured as level 1 constructs. Level 1 variables are individual-level variables and typically have both Between and Within components (see Fig. 2). Importantly, recent methodological studies indicate that multilevel structural equation modeling (MSEM) is more suitable to examine a mediation effect based on multilevel data because it addresses several limitations of traditional MLM for mediation analysis (cf. Preacher et al., 2010, 2011). For instance, the use of traditional MLM for a mediation effect that involves a link between Level 1 variables (e.g., the Mediator – Outcome effect in a 2-1-1 design) often results in conflation of Within and Between components of an effect (Preacher et al., 2011) and thus biases estimates. Specifically, the use of group means of Level 1 predictors to represent their group standings on Level 2 in a traditional MLM biases *Between* effects (e.g., resulting in low intraclass correlations and small cluster sizes) and consequently biases *Between*-level indirect effects. On the other hand, MSEM separates the *Between* and *Within* parts of all variables and allows for an examination of direct and indirect effects at each level (Preacher et al., 2011). Given this, it is vital that we examine the hypothesized mediational effects using a specific type of MSEM called multilevel latent variable path analysis (Sadikaj et al., 2019).

2. Method

2.1. Participants

Two-hundred and fifty-three participants were recruited from a local university through convenience sampling; they signed up for the study through a research subject recruitment portal provided by the university. Participants who completed the entire study were compensated through course credits or monetary means (\$30). Only participants who regularly use Instagram on smartphones (i.e., using the app at least once a day) were recruited for the study. Participants were randomly assigned to the two conditions (self-affirmation *versus* control). 32 participants did not complete the study, resulting in a final sample size of 221 ($M_{age} = 21.71$ years, $SD_{age} = 2.20$ years; Female = 80.5%; $n_{control} = 50.2\%$).

2.2. Procedure

The study consisted of two parts. All participants completed Part 1 two days prior to Part 2. Part 1 consisted of the briefing, an informed consent form, and a demographics and personality questionnaire. Part 2 consisted of daily surveys that were completed once a day within a 2-h period between 9:30–11:30 p.m. for seven consecutive days (Monday – Sunday).

Half the participants were instructed to spend 5 min on their own Instagram profile (e.g., posts, tagged posts, highlights; self-affirmative condition) and the other half on a neutral abstract art profile (i.e., @abstract.mag; control condition; see Supplementary materials for detailed instructions). Participants responded in writing to questions about the profile they viewed (e.g., “Amongst the content you have just

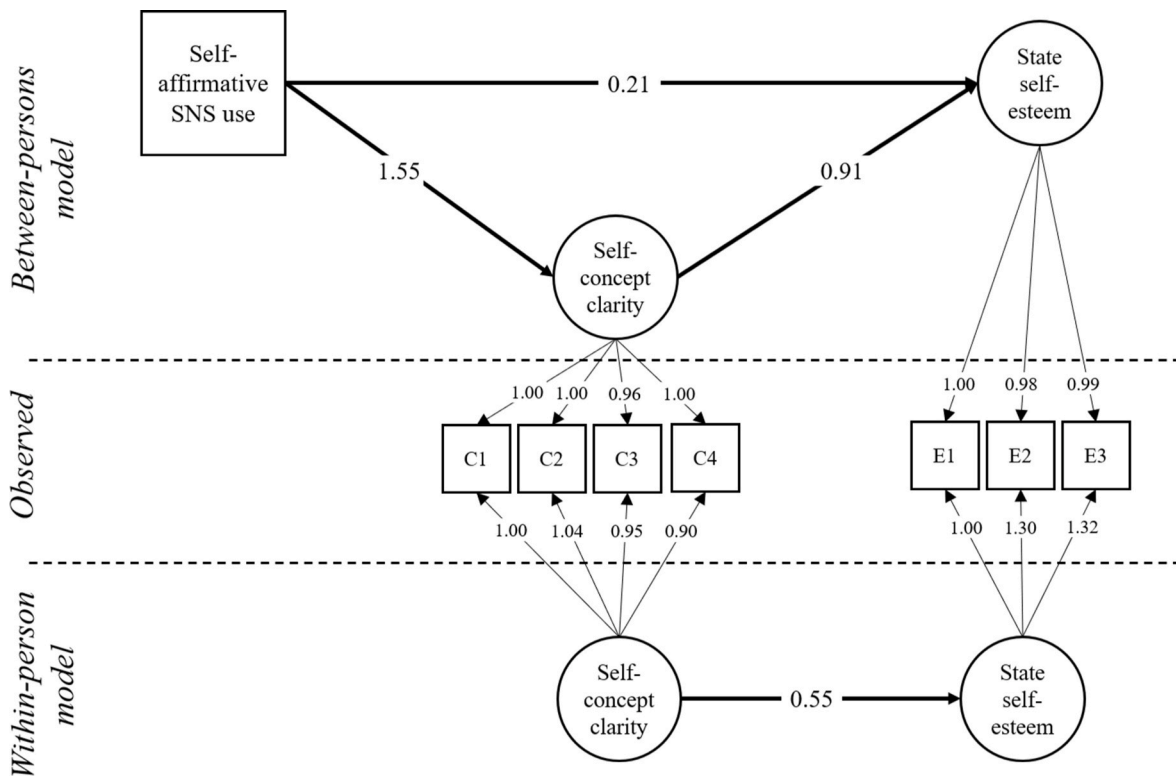


Fig. 2. Multilevel Latent Variable Path Analysis of Self-concept Clarity Mediating Between Self-affirmative SNS Use and State Self-esteem (Adjusted Model)
Note. Squares represent observed variables; circles represent latent variables. C1 – C4 and E1 – E3 represent scale items of self-concept clarity and state self-esteem, respectively. Thicker arrows represent regression paths and values on them signify unstandardized pathway coefficients. Values on thinner arrows represent unstandardized factor loadings for the observed variables (i.e., indicators) that load onto their respective latent variables. Model was adjusted for covariates (i.e., age, sex, monthly household income, social comparison orientation, trait self-esteem, and Instagram screen time). Covariates and residual variances were excluded from the figure for brevity.

viewed, please describe the content (e.g., post, tagged post, highlight etc.) that holds the most personal importance to you in 3–5 sentences”), after which they uploaded relevant screenshots of their Instagram to ensure that they carefully viewed the assigned profiles.

2.3. Demographics and personality questionnaire

Participants provided demographic information about their age, sex, and monthly household income. They also completed questionnaires on personality traits including social comparison orientation (Gibbons & Buunk, 1999) and trait self-esteem ($\alpha = 0.896$; Rosenberg, 1965). Social comparison orientation consists of two subscales of ability ($\alpha = 0.798$; e.g., “I always pay a lot of attention to how I do things compared with how others do things”) and opinion ($\alpha = 0.656$; e.g., “I often try to find out what others, who face similar problems as I face, think”). These variables served as covariates in the analyses because they influence SNS use and its effects (He et al., 2021; Stănculescu & Griffiths, 2022; Vogel et al., 2014, 2015; Yang, 2016; see Table 1).

2.4. Daily surveys

2.4.1. Manipulation check

As a manipulation check to ensure that the viewed profile reflects the elements required for self-affirmation (Toma & Hancock, 2013), participants responded to four items using a 7-point scale (1 = *Strongly disagree*; 7 = *Strongly agree*); (a) whether the viewed Instagram profile represented different aspects of themselves that are important to them, (b) made them think about positive aspects of themselves, (c) was an accurate representation of themselves, and (d) made them feel good about themselves.

2.4.2. Self-concept clarity

Participants responded to four items adapted from Campbell et al.’s (1996) self-concept clarity scale (1 = *Strongly disagree*; 7 = *Strongly agree*). Sample items include “The contents on my Instagram profile (in the profile) helped me to consider various aspects of myself in a coherent way.” and “The contents on my Instagram profile (in the profile) helped me gain a clearer picture of myself as a person.” Participants were asked to think about what they felt at the moment when answering the questions.

2.4.3. State self-esteem

A shortened five-item Rosenberg’s Self-Esteem Scale (1 = *Strongly disagree*; 7 = *Strongly agree*; Monteiro et al., 2021) was adapted to assess state self-esteem (e.g., “The contents on my Instagram profile (in the profile) helped me to feel satisfied with myself,” “The contents on my

Table 1
Bivariate correlations.

Level 2 (Between-level)	Self-concept clarity		State self-esteem	
	<i>r</i>	<i>SE</i>	<i>r</i>	<i>SE</i>
Self-affirmative SNS use ^a	.60	.04	.60	.05
<i>Covariates</i>				
Age	-.03	.07	-.02	.07
Sex ^b	-.03	.07	-.04	.07
Socioeconomic status	-.08	.07	-.05	.07
Social comparison (ability)	-.04	.07	-.09	.07
Social comparison (opinion)	.02	.07	.01	.07
Trait self-esteem	.09	.07	.20	.06
Level 1 (Within-level)				
<i>Covariate</i>				
Instagram screen time	.04	.04	-.02	.04

Note. Significant statistics at $p < .05$ level appear in bold.

^a Self-affirmative condition was coded as 1 = *Control condition*, 2 = *Self-affirmative condition*.

^b Sex was coded as 1 = *Male*, 2 = *Female*.

Instagram profile (in the profile) made me think that I am no good at all”). Participants were asked to think about what they felt at the moment when answering the questions.

2.4.4. Instagram use duration

Participants provided screenshots of a Screen Time application that tracked their daily use of Instagram. iPhone users used the built-in Screen Time application on their smartphones (Apple Inc., 2019), while Android users used a free screen-time monitoring application called *Screen Time-Restrain Yourself & Parental Control* (Iridium Dust Limited, 2020).

2.5. Ethics consent

All procedures and research materials comply with the legislation of the country where the research was carried out and were approved by the university’s institutional ethics review board (IRB-21-115-A094-M2 (821)).

3. Results

3.1. Data analysis

Little’s (1988) missing data analysis showed that the missing data are missing completely at random, $\chi^2(251) = 275.67, p = .136$. All modeling analyses were conducted using Mplus 8.8 (L. K. Muthén & Muthén, 1998–2017) with a full information maximum likelihood (FIML) estimation procedure that is robust to non-normality of observations. FIML also handles missing values by estimating a likelihood function for each individual based on all the available data. FIML has been demonstrated to be superior to other missing data methods (e.g., listwise and pairwise deletion) by demonstrating lower proportions of convergence failures and near-optimal Type 1 error rates (Enders & Bandalos, 2001).

To examine our hypothesis regarding the mediating role of self-concept clarity between self-affirmative SNS use and state self-esteem, we performed a multilevel latent variable path analysis using our longitudinal data. Following the steps suggested by Sadikaj et al. (2019), we first conducted a multilevel confirmatory factor analysis (MCFA) to examine the reliability of the measures and model fit of each construct at each level of analysis. MCFA was performed only for the level 1 variables (i.e., self-concept clarity and state self-esteem) that were analyzed as latent factors. The within-person reliability indicates the extent to which within-person variation in item scores across days represent true within-person changes (i.e., how reliably individual differences in within-person changes in item scores across days can be measured). The between-persons reliability assesses the degree to which between-persons differences in item mean scores reflect true individual differences in the construct that the items purport to measure (e.g., one’s self-concept clarity or state self-esteem). In particular, McDonald’s (1999) omega (ω) statistic was used to evaluate the measures’ reliability (Geldhof et al., 2014). At each level, ω was calculated as the ratio of “true score” variation (i.e., squared sum of factor loadings) over the total variation (i.e., squared sum of the factor loadings plus the sum of item residual variances). This ratio reflects the percentage of total variability that is accounted for by the latent factor. Factor variances were fixed to one in this procedure (Sadikaj et al., 2019).

To evaluate within-person model fit, the models were saturated at the between-persons level (i.e., estimating all correlations among the set of indicators; Ryu & West, 2009). Similarly, to evaluate between-persons model fit, the models were saturated at the within-person level. The fit indices of the models were assessed based on standards set by Hu and Bentler (1999): root mean square error of approximation (RMSEA) values equal to or below 0.08 and 0.06 indicate acceptable and good fit, respectively; comparative fit indices (CFI) close to or greater than 0.95; and standardized root mean squared residual (SRMR) values equal to or below 0.08. A good fitting model indicates that it reproduces the

structure of the data reasonably well.

Next, we performed a multilevel latent variable path analysis to examine our hypothesized mediational effects. Given that our goal is to examine a mediational relation that lies on level 2 (indirect between-persons effect of self-affirmative SNS use), we fitted a fixed-effects model at level 1 (i.e., modeling the same regression slope for all persons).

3.2. Manipulation check

We conducted *t*-test for each manipulation check item on each of the 7 days (i.e., 28 *t*-tests). Results from *t*-tests with Bonferroni correction ($ps < .001$) indicated that participants in the self-affirmative condition felt that the contents in their profiles (a) represented different aspects of themselves that were important to them, (b) made them think about positive aspects of themselves, (c) was an accurate representation of themselves, and (d) made them feel good about themselves, significantly more than participants who viewed a neutral profile in the control condition.

3.3. Multilevel confirmatory factor analyses (MCFA)

3.3.1. Self-concept clarity

We fitted a single-factor model for self-concept clarity with four scale items as indicators. However, the model contained errors due to small and nonsignificant negative residual variance for one item (see Table A1 in Appendix); therefore, we constrained its residual variance to zero (Muthén, 2005) and found acceptable model fit (see Table 2). The standardized factor loadings ranged from 0.68 to 0.81 at the within-person level and 0.94 to 1.00 at the between-persons level ($ps < .001$). The within-person and between-persons ω for self-concept clarity were excellent at 0.82 and 0.99, respectively. The between- and within-level models had excellent model fit.

3.3.2. State self-esteem

We fitted a single-factor model for state self-esteem with five scale items as indicators. The model fitted the data poorly, and two items did not significantly load onto the latent factor (see Table 2 and Table A1 in Appendix). These two items are negatively worded and past studies suggest that a method effect contaminates the unidimensional construct of self-esteem (Corwyn, 2000). Therefore, we dropped those two items and refitted the model, which became fully saturated (i.e., model fit cannot be evaluated). The standardized factor loadings ranged from 0.65 to 0.86 at the within-person level, and 0.97 to 1.00 at the between-persons level ($ps < .001$). The within-person and between-persons ω for state self-esteem were excellent at 0.85 and 0.99 respectively. The models at the within- and between-level were also fully saturated.

Table 2
Model fit indices and reliability statistics.

	χ^2 ^b	<i>df</i>	RMSEA	CFI	TFI	SRMR Within	SRMR Between	Ω Within	Ω Between
Self-concept clarity									
Four items ^a	32.50***	5	0.059	0.99	0.98	0.018	0.007	0.818	0.987
Between-level	10.65*	3	0.040	1.00	0.99	0.003	0.006	–	–
Within-level	16.94***	2	0.068	1.00	0.97	0.018	0.001	–	–
State self-esteem									
Five items	1263.25***	10	.280	.700	.400	.165	.220	.634	.892
Three items ^b	0.00	0	.00	1.00	1.00	.000	.000	.835	.992

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

^a The residual variance for one item (negative, small, and nonsignificant) was constrained to zero. See Table A1 in Appendix for details on the specific item.

^b Between- and within-level model fit statistics were omitted because the model was saturated and thus its model fit could not be evaluated.

3.4. Mediational analyses using multilevel latent variable path analysis

We modeled an indirect effect of self-affirmative SNS use on state self-esteem, with self-concept clarity as a mediator. The model fit was acceptable: $\chi^2 (df = 32) = 106.761, p < .001$; RMSEA = 0.038; CFI = 0.990; and SRMRWithin/SRMRBetween = 0.021/.014. Importantly, the results showed that self-concept clarity was a significant mediator between self-affirmative SNS use and state self-esteem ($B = 1.438, SE = 0.144, p < .001$). We re-ran the analyses, while controlling for age, sex, monthly household income, trait self-esteem, social comparison orientation at the between-persons level and Instagram screen time at the within-person level (see Fig. 2). The model fit was acceptable: $\chi^2 (df = 73) = 146.97, p < .001$; RMSEA = 0.025; CFI = 0.990; and SRMRWithin/SRMRBetween = 0.020/.052. The indirect effect of self-affirmative SNS use on between-persons state self-esteem remained significant ($B = 1.399, SE = 0.140, p < .001$; supporting Hypothesis 3). Self-affirmative SNS use positively predicted between-persons self-concept clarity ($B = 1.546, SE = 0.141, p < .001$; supporting Hypothesis 1), which in turn positively predicted between-persons state self-esteem ($B = 0.905, SE = 0.039, p < .001$; supporting Hypothesis 2). The direct effect of self-affirmative SNS use on between-persons state self-esteem was significant ($B = 0.208, SE = 0.090, p = .021$), indicating a partial mediation. Within-person self-concept clarity positively predicted within-person state self-esteem ($B = 0.546, SE = 0.033, p < .001$). These results provide support for our hypotheses that self-affirmative SNS use improves state self-esteem.

4. Discussion

We found that guided SNS use (i.e., viewing one's Instagram profile) elicits self-affirmative effects and improves state self-esteem via enhanced self-concept clarity. Our study is one of the pioneering works that provides novel experimental evidence (using a robust multilevel modeling approach) on how SNS, specifically Instagram, can be used to evoke naturalistic self-affirmative effects that boost individuals' self-esteem. These results corroborate in part with Krause et al.'s (2021) self-esteem updating framework, which posits how three processes—self-affirmation, social comparison, social feedback processing—explain the effect of SNS use on individual's self-esteem. Our findings demonstrate that the positive effects of self-affirmative SNS use on state self-esteem can be observed despite exposure to normative social comparison during daily SNS use. These findings are especially important because most studies that have focused on upward social comparison have only shown that SNS use is linked to poorer self-esteem outcomes (e.g., Krause et al., 2021; Midgley et al., 2020; Vogel et al., 2014). Further, given that the majority of studies have relied on remote experimental manipulations such as writing about one's values or receiving artificial feedback to induce self-affirmation (McQueen & Klein, 2006), our study showed that simply viewing one's important and positive self-aspects in a naturalistic setting can have similar self-affirmative effects. Importantly, these findings contribute to the

growing literature about the potential of user-generated SNS content in promoting self-affirmation (e.g., [Toma & Hancock, 2013](#)). Considering the prevalence of SNS use and its adverse psychological repercussions, unlocking this one-tap self-affirming resource can provide SNS users with great psychological benefits. Furthermore, our study suggests that self-affirmative SNS use can be flexibly extended to other SNS platforms (e.g., Facebook, TikTok), as long as their user-generated contents satisfy the criteria required for self-affirmation ([Toma & Hancock, 2013](#)).

Our study provides notable theoretical contributions about the elusive mechanism behind self-affirmation by demonstrating that self-affirmative SNS use improves one's state self-esteem through improved self-concept clarity, at least in part. Specifically, our findings lend support to the self-concept unity hypothesis that online activities provide opportunities for individuals to present positive and authentic aspects of themselves that could foster a stronger sense of self ([Valkenburg & Peter, 2011](#)). In our study, self-affirmed participants viewed their own curated Instagram profiles which reflected important self-aspects. Viewing such content not only affirms the individual's positive aspects of self, but also serves as a procedural prime that activates higher-level construal thinking in the individuals ([Cerully, 2011](#); [Wakslak & Trope, 2009](#)). This mode of thinking leads one to sense greater coherence in one's self-aspects (e.g., having a clear image of oneself and experiencing less conflict between various self-aspects) and entails a stronger self-concept clarity. Accordingly, stronger self-concept clarity enables people to hold a more positive self-image that is resilient against external influences, boosting state self-esteem ([Campbell & Lavelle, 1993](#); [DeHart & Pelham, 2007](#)). Given concerns regarding the deleterious effect of SNS use on self-esteem among adolescents and young adults (e.g., [Ehmke, 2023](#); [Vogel et al., 2014](#)), our findings provide nuanced insights by suggesting that not all types of SNS use are detrimental to self-esteem; instead, self-affirmative SNS use may benefit one's state self-esteem by enhancing self-concept clarity.

More importantly, our study plugged an important gap in the existing literature by providing longitudinal and multilevel perspectives on the relation between SNS use and state self-esteem. Our findings showed that even a short 7-day intervention of self-affirmative SNS use could yield positive gains in one's state self-esteem. Although future studies are warranted to examine if the observed effects would last beyond 7 days, our findings provide optimistic evidence that self-affirmative SNS use can be impactful in the short term. In addition, our multilevel modeling separated the between-persons and within-person changes, emphasizing that our between-groups self-affirmative intervention has a robust influence on self-concept clarity which, in turn, is associated with changes in state self-esteem. Although both between- and within-person effects between self-concept clarity and state self-esteem are positive, it is still important to decompose these effects for an accurate estimate of the mediational effect of self-affirmative SNS use on state self-esteem. Since our study focused on state-level changes in self-esteem, future studies can explore how these changes influence trait-level self-esteem in the longer run.

Our study is not without its limitations. First, we restricted our participants in the experimental (self-affirmation) condition to use their main Instagram accounts only; Instagram users frequently have multiple Instagram accounts. Given that our study focused on the effect of viewing positive self-aspects on Instagram, our study does not address instances when Instagram users create accounts for the sole purpose of venting or posting of negative self-aspects (usually to a small group of close friends). Thus, future studies should explore different types of Instagram accounts as a potential moderator of this effect. Second, despite the rigor of the longitudinal design and multilevel latent variable analyses in testing the mediational effect, we are unable to infer a causal relation between the mediator and outcome variable ([Berli et al., 2021](#)).

Therefore, future studies are warranted to employ specific experimental designs to examine the causal relations between self-concept clarity and self-esteem ([Selig & Preacher, 2009](#)). Third, although our findings allude to self-concept clarity as a mediator, self-affirmative SNS use may alternatively influence state self-esteem through the experience of positive emotion. For instance, self-affirmative SNS use may engender positive emotions which, in turn, potentially promote feelings of higher self-esteem ([Crocker et al., 2008](#); [Valkenburg et al., 2006](#)). Correspondingly, more work is needed to disentangle the two competing mechanisms that could account for the link between self-affirmative SNS use and state self-esteem. Fourth, our sample consisted of only young adults, and therefore the effects may not be generalized to other age groups such as children or older adults. Furthermore, as there are cultural differences in self-affirmation ([Heine & Lehman, 1997](#)) and social comparison ([Guimond et al., 2007](#); [White & Lehman, 2005](#)), it would be interesting to examine if our findings are replicable in other cultural contexts.

Despite the limitations of our study, our findings still provide crucial practical implications. First, given that previous studies suggest that preemptive self-affirmation has stronger protective effects against self-diminishing forces ([Critcher et al., 2010](#)), technology application designers could consider making one's own profile the first thing that appears when launching an SNS app. This would ensure that individuals are prompted to spend time affirming their self-aspects through their own positively curated profiles before being exposed to and subconsciously subjected to upward social comparison. Second, our findings echo the well-established link between self-concept clarity and self-esteem. Thus, educators or counsellors aiming to help and support heavy SNS users with low self-esteem can implement interventions that emphasize guided SNS use to improve self-concept clarity.

In conclusion, individuals' SNS use can be guided to yield beneficial effects on their self-esteem. Further, our findings indicate a promising potential of SNS use for mobile-health purposes, which emphasizes self-care through mobile devices ([Singh & Landman, 2017](#)). Given the protective effects of high self-esteem on psychological and physical health ([Mann et al., 2004](#)), individuals may be able to improve their self-perceptions and well-being by leveraging familiar SNS apps.

Funding statement

This study was supported by a Presidential Doctoral Fellowship awarded to the first author Shuna Shiann Khoo by Singapore Management University, and a Lee Kong Chian Fellowship awarded to the second author Hwajin Yang.

Author contribution

Shuna Shiann Khoo: Conceptualization (leading), Methodology, Project administration, Data Collection, Formal analysis, Writing – Original draft preparation, review & editing, Fund acquisition; Hwajin Yang: Conceptualization (supporting), Supervision, Writing – review & editing, Fund acquisition; Wei Xing Toh: Formal analysis (supporting), Writing – review & editing.

Declaration of competing interest

There is no conflict of interest.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chb.2023.107972>.

Appendix

Table A1

Multilevel Confirmatory Factor Analysis (MCFA) Parameters

Parameter	Within-person		Between-persons		ICC
	Unstandardized (SE)	Standardized	Unstandardized (SE)	Standardized	
<i>Factor loadings</i>					
Self-concept clarity					
C1 (Item 11 ^a)	0.673 (0.02)	0.745	1.294 (0.06)	1.000	0.672
C2 (Item 1)	0.703 (0.02)	0.805	1.304 (0.06)	0.995	0.693
C3 (Item 8)	0.632 (0.02)	0.683	1.237 (0.07)	0.940	0.669
C4 (Item 4)	0.616 (0.02)	0.678	1.284 (0.07)	0.964	0.682
State self-esteem (5-item)					
E1 (Item 5)	0.593 (0.02)	0.653	1.320 (0.07)	0.974	0.690
E2 (Item 1)	0.771 (0.02)	0.853	1.315 (0.07)	0.999	0.679
E3 (Item 10)	0.782 (0.02)	0.861	1.316 (0.07)	0.993	0.680
E4 (Item 2)	-0.012 (0.03) n.s.	-0.013 n.s.	0.089 (0.07) n.s.	0.089 n.s.	0.538
E5 (Item 9)	-0.029 (0.03) n.s.	-0.032 n.s.	0.066 (0.07) n.s.	0.068 n.s.	0.537
State self-esteem (3-item)					
E1 (Item 5)	0.592 (0.02)	0.652	1.320 (0.07)	0.974	0.690
E2 (Item 1)	0.771 (0.02)	0.852	1.315 (0.07)	0.999	0.679
E3 (Item 10)	0.784 (0.02)	0.862	1.314 (0.07)	0.993	0.680

Note. All loadings are significant at $p < .001$ level, unless indicated otherwise (n.s.). Item numberings in parentheses are adapted from the respective original scales.

^a The scale item's residual variance (negative, small and nonsignificant) at the between-level was constrained to zero.

References

- Appel, M., Schreiner, C., Weber, S., Mara, M., & Gnambs, T. (2018). Intensity of Facebook use is associated with lower self-concept clarity: Cross-sectional and longitudinal evidence. *Journal of Media Psychology: Theories, Methods, and Applications*, 30(3), 160–172. <https://doi.org/10.1027/1864-1105/a000192>
- Apple Inc.. (2019). *Use Screen Time on your iPhone, iPad, or iPod touch*. Apple Support <https://support.apple.com/en-us/HT208982>.
- Caliandro, A., & Graham, J. (2020). Studying Instagram beyond selfies. *Social Media + Society*, 6(2), Article 205630512092477. <https://doi.org/10.1177/2056305120924779>
- Campbell, J. D. (1990). Self-esteem and clarity of the self-concept. *Journal of Personality and Social Psychology*, 59(3), 538–549. <https://doi.org/10.1037/0022-3514.59.3.538>
- Campbell, J. D., & Lavalley, L. F. (1993). Who am I? The role of self-concept confusion in understanding the behavior of people with low self-esteem. In R. F. Baumeister (Ed.), *Self-esteem* (pp. 3–20). Springer US. https://doi.org/10.1007/978-1-4684-8956-9_1
- Campbell, J. D., Trapnell, P. D., Heine, S. J., & Katz, I. M. (1996). Self-concept clarity: Measurement, personality correlates, and cultural boundaries. *Journal of Personality and Social Psychology*, 70(1), 141–156.
- Cerully, J. L. (2011). *Exploring the relationship among self-affirmation, self-concept clarity and reduced defensiveness to threats*.
- Charoensukmongkol, P. (2016). Exploring personal characteristics associated with selfie-linking. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, 10(2). <https://doi.org/10.5817/CP2016-2-7>
- Cheng, C., Lau, Y., Chan, L., & Luk, J. W. (2021). Prevalence of social media addiction across 32 nations: Meta-analysis with subgroup analysis of classification schemes and cultural values. *Addictive Behaviors*, 117, Article 106845. <https://doi.org/10.1016/j.addbeh.2021.106845>
- Cingel, D. P., Carter, M. C., & Krause, H.-V. (2022). Social media and self-esteem. *Current Opinion in Psychology*, 45, Article 101304. <https://doi.org/10.1016/j.copsyc.2022.101304>
- Corwyn, R. F. (2000). The factor structure of global self-esteem among adolescents and adults. *Journal of Research in Personality*, 34(4), 357–379. <https://doi.org/10.1006/jrpe.2000.2291>
- Cramer, E. M., Song, H., & Drent, A. M. (2016). Social comparison on Facebook: Motivation, affective consequences, self-esteem, and Facebook fatigue. *Computers in Human Behavior*, 64, 739–746. <https://doi.org/10.1016/j.chb.2016.07.049>
- Critcher, C. R., Dunning, D., & Armor, D. A. (2010). When self-affirmations reduce defensiveness: Timing is key. *Personality and Social Psychology Bulletin*, 36(7), 947–959. <https://doi.org/10.1177/0146167210369557>
- Crocker, J., Niiya, Y., & Mischkowski, D. (2008). Why does writing about important values reduce defensiveness?: Self-affirmation and the role of positive other-directed feelings. *Psychological Science*, 19(7), 740–747. <https://doi.org/10.1111/j.1467-9280.2008.02150.x>
- DataReportal. (2021). *Global social media stats*. <https://datareportal.com/social-media-users>.
- DeHart, T., & Pelham, B. W. (2007). Fluctuations in state implicit self-esteem in response to daily negative events. *Journal of Experimental Social Psychology*, 43(1), 157–165. <https://doi.org/10.1016/j.jesp.2006.01.002>
- Denti, L., Barbopoulos, I., Nilsson, I., Holmberg, L., Thulin, M., Wendeblad, M., Andén, L., & Davidsson, E. (2012). *Sweden's largest Facebook study*. Gothenburg Research Institute.
- Dodgson, P. G., & Wood, J. V. (1998). Self-esteem and the cognitive accessibility of strengths and weaknesses after failure. *Journal of Personality and Social Psychology*, 75(1), 178–197. <https://doi.org/10.1037/0022-3514.75.1.178>
- Düring, C., & Jessop, D. C. (2015). The moderating impact of self-esteem on self-affirmation effects. *British Journal of Health Psychology*, 20(2), 274–289. <https://doi.org/10.1111/bjhp.12097>
- Ehmke, R. (2023). *How using social media affects teenagers*. Child Mind Institute. <https://childmind.org/article/how-using-social-media-affects-teenagers/>.
- Enders, C., & Bandalos, D. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling: A Multidisciplinary Journal*, 8(3), 430–457. https://doi.org/10.1207/S15328007SEM0803_5
- Feinstein, B. A., Hershenberg, R., Bhatia, V., Latack, J. A., Meuwly, N., & Davila, J. (2013). Negative social comparison on Facebook and depressive symptoms: Rumination as a mechanism. *Psychology of Popular Media Culture*, 2(3), 161–170. <https://doi.org/10.1037/a0033111>
- Geldhof, G. J., Preacher, K. J., & Zyphur, M. J. (2014). Reliability estimation in a multilevel confirmatory factor analysis framework. *Psychological Methods*, 19(1), 72–91. <https://doi.org/10.1037/a0032138>
- Gentile, B., Twenge, J. M., Freeman, E. C., & Campbell, W. K. (2012). The effect of social networking websites on positive self-views: An experimental investigation. *Computers in Human Behavior*, 28(5), 1929–1933. <https://doi.org/10.1016/j.chb.2012.05.012>
- Gibbons, F. X., & Buunk, B. P. (1999). Individual differences in social comparison: Development of a scale of social comparison orientation. *Journal of Personality and Social Psychology*, 76(1), 129–142. <https://doi.org/10.1037/0022-3514.76.1.129>
- Gonzales, A. L., & Hancock, J. T. (2011). Mirror, mirror on my Facebook wall: Effects of exposure to Facebook on self-esteem. *Cyberpsychology, Behavior, and Social Networking*, 14(1–2), 79–83. <https://doi.org/10.1089/cyber.2009.0411>
- Guimond, S., Branscombe, N. R., Brunot, S., Buunk, A. P., Chatard, A., Désert, M., Garcia, D. M., Haque, S., Martinot, D., & Yzerbyt, V. (2007). Culture, gender, and the self: Variations and impact of social comparison processes. *Journal of Personality and Social Psychology*, 92(6), 1118–1134. <https://doi.org/10.1037/0022-3514.92.6.1118>
- Hank, P., & Baltes-Götz, B. (2019). The stability of self-esteem variability: A real-time assessment. *Journal of Research in Personality*, 79, 143–150. <https://doi.org/10.1016/j.jrp.2019.03.004>
- Heine, S. J., & Lehman, D. R. (1997). Culture, dissonance, and self-affirmation. *Personality and Social Psychology Bulletin*, 23(4), 389–400. <https://doi.org/10.1177/0146167297234005>
- He, Z.-H., Li, M.-D., Ma, X.-Y., & Liu, C.-J. (2021). Family socioeconomic status and social media addiction in Female college students: The mediating role of impulsiveness and inhibitory control. *The Journal of Genetic Psychology*, 182(1), 60–74. <https://doi.org/10.1080/00221325.2020.1853027>

- Huang, C. (2017). Time spent on social network sites and psychological well-being: A meta-analysis. *Cyberpsychology, Behavior, and Social Networking*, 20(6), 346–354. <https://doi.org/10.1089/cyber.2016.0758>
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Hu, Y., Manikonda, L., & Kambhampati, S. (2014). What we Instagram: A first analysis of Instagram photo content and user types. *Proceedings of the Eighth International AAAI Conference on Weblogs and Social Media*, 8, 4. <https://www.aaai.org/ocs/index.php/ICWSM/ICWSM14/paper/viewPaper/8118>
- Instagram. (2023). Wikipedia. <https://en.wikipedia.org/w/index.php?title=Instagram&oldid=1033535056>
- Iridium Dust Limited. (2020). *Screen Time—Restrain yourself & parent control [Android]*. https://play.google.com/store/apps/details?id=master.app.screentime&hl=en_SG
- Krause, H.-V., Baum, K., Baumann, A., & Krasnova, H. (2021). Unifying the detrimental and beneficial effects of social network site use on self-esteem: A systematic literature review. *Media Psychology*, 24(1), 10–47. <https://doi.org/10.1080/15213269.2019.1656646>
- Krull, J. L., & MacKinnon, D. P. (2001). Multilevel modeling of individual and group level mediated effects. *Multivariate Behavioral Research*, 36(2), 249–277. https://doi.org/10.1207/S15327906MBR3602_06
- Kuss, D. J., & Griffiths, M. D. (2017). Social networking sites and addiction: Ten lessons learned. *International Journal of Environmental Research and Public Health*, 14(3). <https://doi.org/10.3390/ijerph14030311>. Article 3.
- Lee-Flynn, S. C., Pomaki, G., DeLongis, A., Biesanz, J. C., & Puterman, E. (2011). Daily cognitive appraisals, daily affect, and long-term depressive symptoms: The role of self-esteem and self-concept clarity in the stress process. *Personality and Social Psychology Bulletin*, 37(2), 255–268. <https://doi.org/10.1177/0146167210394204>
- Lin, S., Liu, D., Liu, W., Hui, Q., Cortina, K. S., & You, X. (2021). Mediating effects of self-concept clarity on the relationship between passive social network sites use and subjective well-being. *Current Psychology*, 40(3), 1348–1355. <https://doi.org/10.1007/s12144-018-0066-6>
- Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association*, 83(404), 1198–1202. <https://doi.org/10.2307/2290157>. JSTOR.
- Liu, D., & Baumeister, R. F. (2016). Social networking online and personality of self-worth: A meta-analysis. *Journal of Research in Personality*, 64, 79–89. <https://doi.org/10.1016/j.jrp.2016.06.024>
- Liu, Y., Liu, H., & Jiang, Y. (2019). Influence of college students' use of social networking sites on self-concept clarity: Mediating role of social comparison. *Proceedings of the 2018 International Workshop on Education Reform and Social Sciences (ERSS 2018)*. In *Proceedings of the 2018 international workshop on education reform and social sciences (ERSS 2018)*. <https://doi.org/10.2991/erss-18.2019.130>. Qingdao, China.
- Mann, M., Michelle, Hosman, C. M. H., Schaalma, H. P., & de Vries, N. K. (2004). Self-esteem in a broad-spectrum approach for mental health promotion. *Health Education Research*, 19(4), 357–372. <https://doi.org/10.1093/her/cyg041>
- McDonald, R. P. (1999). *Test theory: A unified treatment*. Erlbaum.
- McQueen, A., & Klein, W. M. P. (2006). Experimental manipulations of self-affirmation: A systematic review. *Self and Identity*, 5(4), 289–354. <https://doi.org/10.1080/15298860600805325>
- Michikyan, M., Dennis, J., & Subrahmanyam, K. (2015). Can you guess who I Am? Real, ideal, and false self-presentation on Facebook among emerging adults. *Emerging Adulthood*, 3(1), 55–64. <https://doi.org/10.1177/2167696814532442>
- Midgley, C., Thai, S., Lockwood, P., Kovacheff, C., & Page-Gould, E. (2020). When every day is a high school reunion: Social media comparisons and self-esteem. *Journal of Personality and Social Psychology*. <https://doi.org/10.1037/pspi0000336>
- Monteiro, R. P., Coelho, G. L. de H., Hanel, P. H. P., de Medeiros, E. D., & da Silva, P. D. G. (2021). The efficient assessment of self-esteem: Proposing the brief Rosenberg self-esteem scale. *Applied Research in Quality of Life*. <https://doi.org/10.1007/s11482-021-09936-4>
- Muthén, B. O. (2005). Mplus discussion >> negative residual variance. *Statistical Modelling*. <http://www.statmodel.com/discussion/messages/11/555.html?1358188287>
- Muthén, L. K., & Muthén, B. O. (1998). *Mplus user's guide* (8th ed.). Los Angeles, CA: Muthén & Muthén https://www.statmodel.com/download/usersguide/MplusUserGuideVer_8.pdf
- Nongpong, S., & Charoensukmongkol, P. (2016). I don't care much as long as I Am also on Facebook: Impacts of social media use of both partners on romantic relationship problems. *The Family Journal*, 24(4), 351–358. <https://doi.org/10.1177/1066480716663199>
- Preacher, K. J., Zhang, Z., & Zyphur, M. J. (2011). Alternative methods for assessing mediation in multilevel data: The advantages of multilevel SEM. *Structural Equation Modeling: A Multidisciplinary Journal*, 18(2), 161–182. <https://doi.org/10.1080/10705511.2011.557329>
- Preacher, K. J., Zyphur, M. J., & Zhang, Z. (2010). A general multilevel SEM framework for assessing multilevel mediation. *Psychological Methods*, 15(3), 209–233. <https://doi.org/10.1037/a0020141>
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton University Press.
- Ryu, E., & West, S. G. (2009). Level-specific evaluation of model fit in multilevel structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, 16(4), 583–601. <https://doi.org/10.1080/10705510903203466>
- Sadikaj, G., Wright, A. G., Dunkley, D., Zurroff, D., & Moskowitz, D. (2019). *Multilevel structural equation modeling for intensive longitudinal data: A practical guide for personality researchers*. <https://doi.org/10.31234/osf.io/hwj9r>
- Saiphoo, A. N., Dahoah Halevi, L., & Vahedi, Z. (2020). Social networking site use and self-esteem: A meta-analytic review. *Personality and Individual Differences*, 153, Article 109639. <https://doi.org/10.1016/j.paid.2019.109639>
- Selig, J. P., & Preacher, K. J. (2009). Mediation models for longitudinal data in developmental research. *Research in Human Development*, 6(2–3), 144–164. <https://doi.org/10.1080/15427600902911247>
- Sherman, D. K., & Cohen, G. L. (2006). The psychology of self-defense: Self-affirmation theory. In *Advances in experimental social psychology* (Vol. 38, pp. 183–242). Elsevier. [https://doi.org/10.1016/S0065-2601\(06\)38004-5](https://doi.org/10.1016/S0065-2601(06)38004-5)
- Singh, K., & Landman, A. B. (2017). Chapter 13—mobile health. In A. Sheikh, K. M. Cresswell, A. Wright, & D. W. Bates (Eds.), *Key advances in clinical informatics* (pp. 183–196). Academic Press. <https://doi.org/10.1016/B978-0-12-809523-2.00013-3>
- Stănculescu, E., & Griffiths, M. D. (2022). Social media addiction profiles and their antecedents using latent profile analysis: The contribution of social anxiety, gender, and age. *Telematics and Informatics*, 74, Article 101879. <https://doi.org/10.1016/j.tele.2022.101879>
- Steele, C. M. (1988). The psychology of self-affirmation: Sustaining the integrity of the self. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 21, pp. 181–227). Academic Press.
- Stinson, D. A., Wood, J. V., & Doxey, J. R. (2008). In search of clarity: Self-esteem and domains of confidence and confusion. *Personality and Social Psychology Bulletin*, 34(11), 1541–1555. <https://doi.org/10.1177/0146167208323102>
- Tesser, A. (2001). On the plasticity of self-defense. *Current Directions in Psychological Science*, 10(2), 66–69. <https://doi.org/10.1111/1467-8721.00117>
- Tesser, A., & Cornell, D. P. (1991). On the confluence of self processes. *Journal of Experimental Social Psychology*, 27(6), 501–526. [https://doi.org/10.1016/0022-1031\(91\)90023-Y](https://doi.org/10.1016/0022-1031(91)90023-Y)
- Toma, C. L., & Hancock, J. T. (2013). Self-affirmation underlies Facebook use. *Personality and Social Psychology Bulletin*, 39(3), 321–331. <https://doi.org/10.1177/0146167212474694>
- Trope, Y., & Liberman, N. (2003). Temporal construal. *Psychological Review*, 110(3), 403–421. <https://doi.org/10.1037/0033-295X.110.3.403>
- Usborne, E., & Taylor, D. M. (2010). The role of cultural identity clarity for self-concept clarity, self-esteem, and subjective well-being. *Personality and Social Psychology Bulletin*, 36(7), 883–897. <https://doi.org/10.1177/0146167210372215>
- Valkenburg, P. M., & Peter, J. (2011). Online communication among adolescents: An integrated model of its attraction, opportunities, and risks. *Journal of Adolescent Health*, 48(2), 121–127. <https://doi.org/10.1016/j.jadohealth.2010.08.020>
- Valkenburg, P. M., Peter, J., & Schouten, A. P. (2006). Friend networking sites and their relationship to adolescents' well-being and social self-esteem. *CyberPsychology and Behavior*, 9(5), 584–590. <https://doi.org/10.1089/cpb.2006.9.584>
- Vess, M., Arndt, J., & Schlegel, R. J. (2011). Abstract construal levels attenuate state self-esteem reactivity. *Journal of Experimental Social Psychology*, 47(4), 861–864. <https://doi.org/10.1016/j.jesp.2011.02.014>
- Vogel, E. A., Rose, J. P., Okdie, B. M., Eckles, K., & Franz, B. (2015). Who compares and despairs? The effect of social comparison orientation on social media use and its outcomes. *Personality and Individual Differences*, 86, 249–256. <https://doi.org/10.1016/j.paid.2015.06.026>
- Vogel, E. A., Rose, J. P., Roberts, L. R., & Eckles, K. (2014). Social comparison, social media, and self-esteem. *Psychology of Popular Media Culture*, 3(4), 206–222. <https://doi.org/10.1037/ppm0000047>
- de Vries, D. A., Möller, A. M., Wieringa, M. S., Eigenraam, A. W., & Hamelink, K. (2018). Social comparison as the thief of joy: Emotional consequences of viewing strangers' Instagram posts. *Media Psychology*, 21(2), 222–245. <https://doi.org/10.1080/15213269.2016.1267647>
- Wakslak, C. J., Nussbaum, S., Liberman, N., & Trope, Y. (2008). Representations of the self in the near and distant future. *Journal of Personality and Social Psychology*, 95(4), 757–773. <https://doi.org/10.1037/a0012939>
- Wakslak, C. J., & Trope, Y. (2009). Cognitive consequences of affirming the self: The relationship between self-affirmation and object construal. *Journal of Experimental Social Psychology*, 45(4), 927–932. <https://doi.org/10.1016/j.jesp.2009.05.002>
- White, K., & Lehman, D. R. (2005). Culture and social comparison seeking: The role of self-motives. *Personality and Social Psychology Bulletin*, 31(2), 232–242. <https://doi.org/10.1177/0146167204271326>
- Yang, C. (2016). Instagram use, loneliness, and social comparison orientation: Interact and browse on social media, but don't compare. *Cyberpsychology, Behavior, and Social Networking*, 19(12), 703–708. <https://doi.org/10.1089/cyber.2016.0201>
- Yau, J. C., & Reich, S. M. (2019). "It's just a lot of work": Adolescents' self-presentation norms and practices on Facebook and Instagram. *Journal of Research on Adolescence*, 29(1), 196–209. <https://doi.org/10.1111/jora.12376>
- Yoon, S., Kleinman, M., Mertz, J., & Brannick, M. (2019). Is social network site usage related to depression? A meta-analysis of facebook–depression relations. *Journal of Affective Disorders*, 248, 65–72. <https://doi.org/10.1016/j.jad.2019.01.026>