



Active social media use and its impact on well-being — an experimental study on the effects of posting pictures on Instagram

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Abstract

Active use of social networking sites (SNSs) has long been assumed to benefit users' well-being. However, this established hypothesis is increasingly being challenged, with scholars criticizing its lack of empirical support and the imprecise conceptualization of active use. Nevertheless, with considerable heterogeneity among existing studies on the hypothesis and causal evidence still limited, a final verdict on its robustness is still pending. To contribute to this ongoing debate, we conducted a week-long randomized control trial with $N = 381$ adult Instagram users recruited via Prolific. Specifically, we tested how active SNS use, operationalized as picture postings on Instagram, affects different dimensions of well-being. The results depicted a positive effect on users' positive affect but null findings for other well-being outcomes. The findings broadly align with the recent criticism against the active use hypothesis and support the call for a more nuanced view on the impact of SNSs.

Lay Summary

Active use of social networking sites (SNSs) has long been assumed to benefit users' well-being. However, this established assumption is increasingly being challenged, with scholars criticizing its lack of empirical support and the imprecise conceptualization of active use. Nevertheless, with great diversity among conducted studies on the hypothesis and a lack of causal evidence, a final verdict on its viability is still pending. To contribute to this ongoing debate, we conducted a week-long experimental investigation with 381 adult Instagram users. Specifically, we tested how posting pictures on Instagram affects different aspects of well-being. The results of this study depicted a positive effect of posting Instagram pictures on users' experienced positive emotions but no effects on other aspects of well-being. The findings broadly align with the recent criticism against the active use hypothesis and support the call for a more nuanced view on the impact of SNSs on users.

Keywords: social networking sites, social media, Instagram, well-being, experiment, randomized control trial

An extensive body of research has been devoted to whether and how using social networking sites (SNSs) affects well-being. So far, the research discourse has been heavily influenced by the active social media use hypothesis (ASUH). The ASUH posits that active SNS use represents a beneficial type of SNS participation, especially compared to presumably well-being-threatening passive usage (Burke et al., 2010; Verduyn et al., 2017). Active SNS use comprises SNS activities that facilitate social interactions (Verduyn et al., 2015) — whether through content sharing or other types of social exchange. The ASUH assumes positive well-being consequences for this usage type, such as fostering social connections (e.g., Ellison et al., 2014), overcoming perceptions of loneliness (e.g., große Deters & Mehl, 2012), or promoting users' self-esteem (e.g., Krause et al., 2021).

Theoretically, the assumed positive effect of active SNS use can be traced back to two mechanisms. First, the information provided within active SNS use can be a starting point for social interactions, potentially fostering well-being-promoting social outcomes (Verduyn et al., 2017). Second, active use can promote well-being as it requires a certain level of self-reflection, potentially shifting users' attention to positive aspects of their selves or enabling self-affirmation (Vogel & Rose, 2016).

So far, evidence for the ASUH and the overall distinction between active and passive use (henceforth referred to as active/passive dichotomy; e.g., Meier & Krause, 2022) has been mainly consolidated by several narrative reviews (e.g., Ellison et al., 2014; Lin et al., 2020; Verduyn et al., 2017; Vogel & Rose, 2016) that aimed to explain the potpourri of previous findings on SNSs' effects on users' well-being (for umbrella reviews, see Appel et al., 2020; Valkenburg, 2022; Valkenburg et al., 2022a). However, recently the ASUH has faced critique. Specifically, scholars point to the lacking conceptual precision of the active/passive dichotomy, which seems to divide complex SNS actions into artificial categories, too coarse to accurately reflect users' experience on SNSs (Meier & Krause, 2022; Valkenburg et al., 2022b). Most strikingly, the ASUH appears to lack a solid empirical foundation (Valkenburg, 2022; Valkenburg et al., 2022b). For instance, a recent study showed that the hypothesized positive effects of active use could only be confirmed for a small proportion of users (Beyens et al., 2021). Similarly, the effects of active SNS use on numerous well-being outcomes have been found to be minor in a meta-analysis (Liu et al., 2019) or insignificant in a recent scoping review (Valkenburg et al., 2022b). Especially since null findings often remain in the “file drawer” and meta-analyses might

therefore overestimate effects (Ferguson & Heene, 2012; Rosenthal, 1979), the emerging evidence increasingly challenges the robustness of the ASUH.

Nonetheless, these scoping reviews and meta-analyses point to a substantial degree of heterogeneity in the included studies, making it difficult to aggregate the results and make a definitive judgment about the viability of the ASUH (Valkenburg et al., 2022b). Three limitations of previous research on the ASUH are especially critical and deserve detailed explanation:

- 1) A major shortcoming of the existing literature is the ambiguity in conceptualizing and operationalizing active SNS use (Trifiro & Gerson, 2019; Valkenburg et al., 2022b). Active use covers multiple and diverse actions, but most research has not comprehensively accounted for these differences (Trifiro & Gerson, 2019). Instead, diverse operationalizations of active SNS use have been applied, rarely covering the same actions (Trifiro & Gerson, 2019; Valkenburg et al., 2022b). Because different SNS actions are likely driven by different user motivations and needs (Yang et al., 2021), a valid synthesis into a single construct to test the ASUH seems questionable (Kross et al., 2021). Following calls on general SNS research (e.g., Meier & Reinecke, 2021), we propose to focus on concrete and conceptually clear active use actions in testing the ASUH. This granular approach might not allow generalizing findings across other active use actions. Still, it enables isolating effects and combats the risk that inherently different actions synthesized into one construct bias effect estimates and thereby overall claims about the validity of the ASUH.

Similarly, critique has been raised against research's almost exclusive use of self-reported SNS usage data because self-reports are bias-prone (e.g., Parry et al., 2021). Self-reports are certainly warranted whenever the perception of one's own SNS usage is central to the respective research question (e.g., Ernala et al., 2022). However, to test the ASUH, the main aim is to capture participants' actual behaviors. Numerous scholars encourage complementing existing self-report-based findings with more objective methods (e.g., server logs; built-in tracking tools) (Kross et al., 2021; Meier & Reinecke, 2021; Valkenburg, 2022).

- 2) Research investigating the ASUH showed vast diversity in conceptualizing and operationalizing their central outcome: well-being. Subjective well-being is defined as a dyad of satisfaction with one's life and a balance of positive and negative affect (Diener, 1984). A recent meta-review (Meier & Reinecke, 2021) comprehensively outlines the heterogeneity of existing research on the effects of SNS use in operationalizing well-being. For example, some work has focused on the effects of active SNS use on constructs that can benefit or promote well-being (i.e., resilience factors; Meier & Reinecke, 2021), whereas other scholars focused on constructs that can threaten well-being (i.e., risk factors; Meier & Reinecke, 2021). Others directly captured the core dimensions of subjective well-being (i.e., affect and life satisfaction) in their applied operationalization (e.g., Kim et al., 2014; Yang, 2020). Globally, these diverse approaches impede a conclusive picture of how active SNS use affects well-being and leave open whether it contributes exclusively to reducing risk

factors, promoting resilience factors, influences well-being as a whole or is unrelated to any of these factors (Meier & Reinecke, 2021; Valkenburg, 2022).

- 3) However, one of the most severe limitations of the existing literature on the ASUH (e.g., Kross et al., 2021; Verduyn et al., 2017) is the overuse of cross-sectional and correlational research designs. This severely complicates conclusions about causality. To the best of our knowledge, only 10 experimental studies manipulated active use or any of the associated actions and examined their impact on well-being or its risk and resilience factors. Like cross-sectional studies, existing experimental studies draw an ambiguous picture. Approximately half of these experiments reported positive effects of active use on well-being in line with the ASUH (große Deters & Mehl, 2012; Hanley et al., 2019; Pit et al., 2022; Roberts & David, 2022; Tobin et al., 2014). The other half reported null (Verduyn et al., 2015; Yuen et al., 2018) or mixed findings. For instance, positive effects were only reported for specific users (Hunt et al., 2021) or for posting inspiring vs. hedonic content (Janicke-Bowles et al., 2022). One study could only detect a short-term effect on specific appearance-related outcomes (Coulthard & Ogden, 2018). However, these experiments again unite a considerable degree of conceptual and methodological heterogeneity. Most studies applied a mixed operationalization of active use. These often instructed participants to engage actively on SNS for a defined period in line with the original active use definition (Verduyn et al., 2015). Few studies manipulated specific actions, such as Facebook status updates (große Deters & Mehl, 2012), selfies (Coulthard & Ogden, 2018), or other specifics of the content (e.g., if it is inspiring vs. hedonic; Janicke-Bowles et al., 2022). Moreover, studies varied concerning the considered outcomes, either exclusively looking at core aspects of well-being (e.g., Hanley et al., 2019) or at specific risk or resilience factors (e.g., loneliness; große Deters & Mehl, 2012). In addition, most studies investigated the SNS Facebook and only rarely applied objective manipulation checks.

To address the outlined shortcomings of previous literature, the current study investigated the causal effects of active SNS use on well-being using a randomized control trial (RCT). Specifically, we tested in an experiment how increasing the frequency of posting pictures on Instagram over one week impacts users' subjective well-being as well as its risk and resilience factors.

The experimental nature of our study contributes to the rare and much-needed causal evidence (Kross et al., 2021) on the ASUH. The focus on one specific active SNS usage activity (i.e., posting pictures) avoids the vagueness of other active operationalizations and allowed us to fathom effects that can be attributed to this activity alone. Additionally, we used participants' objective Instagram usage data as a manipulation check, thereby avoiding the caveats of self-reported usage data (e.g., Parry et al., 2021). Finally, we considered both the central aspects (i.e., affect and life satisfaction) of well-being and its risk and resilience factors (i.e., self-esteem and loneliness) to attend to its multifaceted nature (Meier & Reinecke, 2021). This allowed us to determine which aspects are affected by active use, either in a beneficial, harmful, or no way at all.

Theoretical background and related work

Active social media use

The ASUH and the active/passive SNS use dichotomy build on the assumption that multiple SNS actions fall into two qualitatively different categories. Initially labeled as *direct communication* vs. *consumption* (Burke et al., 2010), this dichotomization eventually led to the established active/passive use dichotomy (Verduyn et al., 2017).

Active SNS use constitutes a heterogeneous construct subsuming different actions (Valkenburg et al., 2022b). The core element of active use is the facilitation of social interactions between users (Valkenburg et al., 2022b; Verduyn et al., 2017, Verduyn et al., 2022). However, the exact activities accounting for this usage type are yet not commonly defined and span from posting or resharing content to sending connection requests or exchanging private direct messages between users (Valkenburg et al., 2022b). Active SNS use covers such a broad spectrum of actions (see Figure 1) that it was suggested to differentiate them further based on their level of publicness or interactivity, including private or interactive active use actions (e.g., sending direct messages) and public active use actions (e.g., public posting of content) (Valkenburg et al., 2022b; Yang et al., 2021). These actions differ in quality and their frequency of occurrence, additionally challenging a valid synthesis into a global construct of active use (Faelens et al., 2019; Valkenburg et al., 2022b). Moreover, there has been concern over the ambiguity of specific actions (e.g., liking and commenting) seemingly falling into the spectrum of both active and passive use (Ellison et al., 2020; Valkenburg et al., 2022b).

The well-being benefiting effect of active SNS use

The active/passive dichotomy attributes unique social psychological processes to each of the two usage types (Verduyn et al., 2017, Verduyn et al., 2022; Vogel & Rose, 2016),

explaining their hypothesized differential effects on well-being.

While passive use's assumed adverse effect is primarily grounded in SNSs' potential to elicit upward social comparisons (Festinger, 1954; Verduyn et al., 2020), the theoretical grounds of the ASUH are more diverse. So far, researchers have mainly relied on two different dimensions of active SNS use (see Figure 2) to explain its well-being-benefitting effects: the social (Burke et al., 2011; Verduyn et al., 2017) and the self-dimension (Vogel & Rose, 2016).

The social dimension of active SNS use

Social connectedness is a universal need and a strong determinant of individuals' well-being (Baumeister & Leary, 1995; Ryan & Deci, 2000). Active use of SNSs can fulfill this need as it constitutes a fundamentally social act. By sharing information on SNSs, users inevitably reveal something about themselves while simultaneously opening a venue for social discourse, offering others to engage with their digital representations. Indeed, SNSs have been shown to facilitate social feedback in multiple ways (Krause et al., 2021). For example, low-threshold functionalities such as liking or commenting allow others to express their support and engage in a social dialog effortlessly and rapidly (Barasch & Berger, 2014; Oh et al., 2014). By allowing likes, comments, or reshares to one's shared self-presentation, active use of SNSs can directly contribute to the satisfaction of users' need to be liked, accepted, and approved by others (Leary, 1999), which may ultimately positively impact users' self-view or self-esteem (for a review, see Krause et al., 2021). Similarly, research stresses active use's alleviating effects on users' perceived loneliness (Burke et al., 2010; große Deters & Mehl, 2012; Lin et al., 2020; Matook et al., 2015). Further, active use can strengthen existing or create new social connections and promote a sense

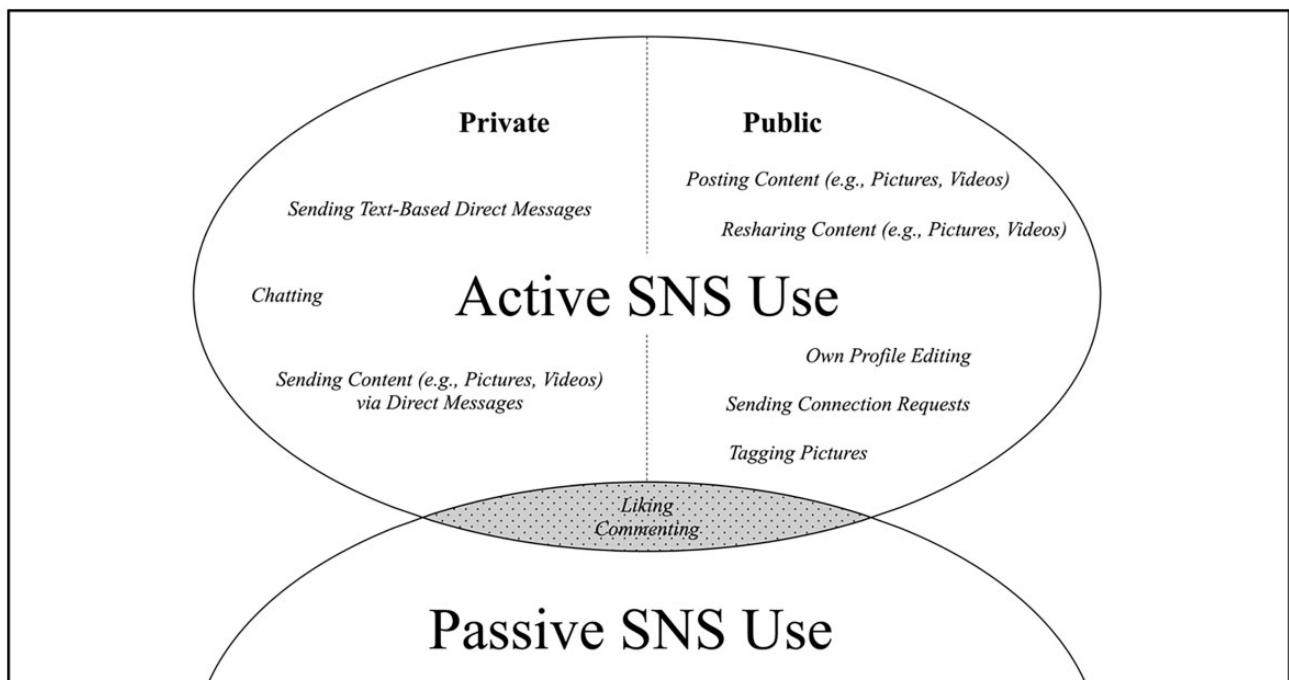


Figure 1. Overview of a selection of different SNS actions and their assignment to the proposed public and private active SNS use categories (Valkenburg et al., 2022b). The dashed area illustrates ambiguity in the assignment of certain actions to the active/passive dichotomy.

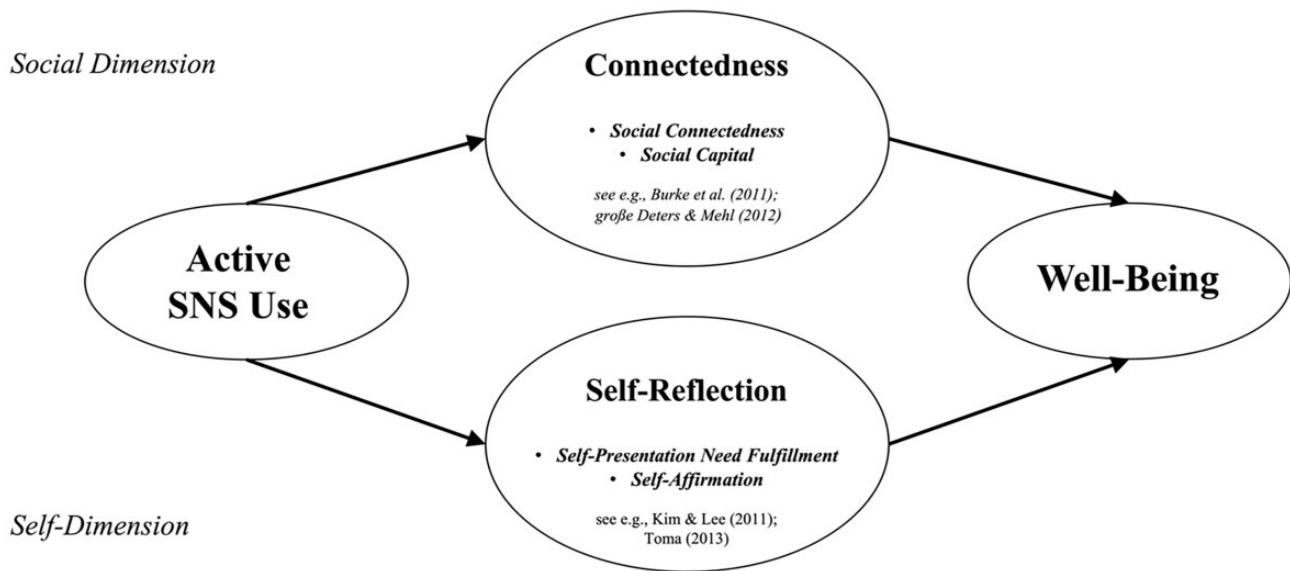


Figure 2. Theoretical framework depicting the two routes under which active SNS use can impact well-being.

of social connectedness, supporting the accumulation of social capital (e.g., Burke et al., 2010; Ellison et al., 2014).

In summary, active use lays the groundwork for social interactions, potentially satisfying users' connectedness needs and facilitating the build-up of social capital. With social connections as a critical determinant of human well-being (for a review, see Diener et al., 2018), the social dimension offers one potential route to explain the benefitting effects of active use, as posited by the ASUH.

The self-dimension of active SNS use

Active SNS use can also involve psychological processes more directed toward users' self (Vogel & Rose, 2016). This type of use inevitably requires a certain degree of self-reflection and can be seen as a form of self-presentation (Vogel & Rose, 2016). As part of social impression management, individuals engage in self-presentation in almost all aspects of daily social life (Baumeister, 1982). SNSs offer users an effective venue to satisfy this need for self-presentation, which can benefit users' well-being (Kim & Lee, 2011). In addition, acts of self-presentation on SNSs also exhibit a unique quality. Well-established platform functionalities such as content-editing tools (e.g., static photo filters, real-time video filters) and the asynchronous nature of computer-mediated communication allow one to carefully construe and present the desired self-impression to others (Ellison et al., 2006; Qiu et al., 2012). This is further supported by the norm of positive self-presentation established on SNSs, which normalizes positive, idealized, and socially desirable self-presentation (e.g., Brunskill, 2013; Harris & Bardey, 2019; Reinecke & Trepte, 2014).

The implicit focus on positive aspects of the self, inherent in active SNS use, is ascribed a vital role in the ASUH (Vogel & Rose, 2016). First, presenting a polished and desirable image of one's life or self on SNSs could get integrated into one's self-concept, benefiting how users see and think about themselves (Gonzales & Hancock, 2011; Vogel & Rose, 2016; Yang & Bradford Brown, 2016). Second, even the mere reflection on positive aspects of the self can be conducive. Self-affirmation (for a review, see McQueen & Klein, 2006) has

been long-discussed as a non-negligible aspect of active SNS use (Toma, 2013; Toma & Hancock, 2013). Shifting attention to positive aspects of oneself — such as when looking at or editing one's SNS profile — can mitigate the effects of self-threatening information (Toma & Hancock, 2013) and boost self-esteem (Toma, 2013).

To summarize, active SNS use can benefit users' well-being in multiple ways. Theoretically, the social dimension of content sharing — especially in terms of enabling social interactions — could satisfy users' social connectedness needs and contribute to growing social capital. In contrast, the self-dimension of active SNS use — as evident in the self-reflection surrounding active SNS use actions — could satisfy users' self-presentation needs, benefit their self-perception and self-esteem, and have self-affirming qualities.

The current study

The solid theoretical rationale of ASUH seems to be at odds with its lack of empirical foundation (e.g., Valkenburg et al., 2022b). Still, previous research on the ASUH exhibits several limitations and a lack of causal evidence, complicating a definitive judgment on the viability of ASUH. Therefore, this study aims to contribute to the ongoing debate on the ASUH, avoiding the caveats of previous research and providing further empirical clarity on the effects of active use.

We conducted an online RCT study using a sample of British adult Instagram users. We tested how an increase in posting pictures on their own Instagram profile over one week impacts different facets of their well-being. We operationalized active use as one concrete and quantifiable action: posting Instagram pictures. Posting pictures is a recurring component in numerous operationalizations of active use (e.g., Jarman et al., 2021; Marengo et al., 2021; Nisar et al., 2019) and, unlike other activities (e.g., liking and commenting; Ellison et al., 2020), can be assigned to the active use complex without objection. Posting pictures is an elementary action for most SNSs and is especially crucial for the mostly picture-based platform Instagram. We further assume that posting Instagram pictures most strongly taps into the two

proposed theoretical mechanisms underlying active use and is, therefore, the most suitable for testing the ASUH.

Regarding the outcome, we considered multiple well-being aspects that have gained attention in the context of SNS use (Valkenburg et al., 2022b). We included core facets of subjective well-being: life satisfaction and affect (Diener, 1984), as well as resilience and risk factors such as loneliness and self-esteem (Meier & Reinecke, 2021). We further captured participants' perceptions of social connectedness and self-affirmation to test for the two theoretically assumed dimensions underlying the well-being profiting effects of active SNS use (i.e., the social and the self-dimension).

Method

Sample and design

The data collection took place in April 2021. The final sample consisted of $N = 381$ British Instagram users recruited via the online platform Prolific. Participants were pre-screened based on their country of residence, nationality (both UK), and whether they use Instagram regularly. All participants received monetary compensation of 7.00£ for full participation in all included questionnaires. Participants' age ranged from 18 to 61 years ($M_{age} = 32.5$, $SD_{age} = 9.6$), and 79.8% were female. Most participants (40%) reported an undergraduate degree, 24% A-levels, and 16% a graduate degree as their highest level of education. Only 23% of the sample were students. Around 53% of the sample reported being in full-time employment (20% part-time, 10% not in paid work, 9% unemployed). The target sample size was determined based on the effect sizes reported by Liu et al. (2019) and große Deters and Mehl (2012), which indicated a small effect (Cohen, 1988) of active SNS use on well-being. A conducted power analysis (G*Power 3.1, Erdfelder et al., 1996) suggested a sample size of $N = 351$ to be able to detect the targeted small effect of active SNS use (i.e., partial $\eta^2 = 0.022$, Cohen, 1988) with a power of 80% ($\alpha = 0.05$).

The online study was designed as an RCT with a pretest/posttest control group design to investigate the causal impact of active Instagram use on well-being over one week. The design included one experimental group (EG) and a control group (CG). The study consisted of a baseline assessment (T1) on the first day of the study, a post-assessment (T2) on the seventh day after the baseline measure, and six shorter daily questionnaires for the days in-between T1 and T2. Subjects were randomly allocated into EG and CG using a stratified randomization procedure.¹ To manipulate active Instagram use as a between-subject factor, participants were instructed to post more pictures on their own Instagram profile than usually throughout the study week (EG) or continue using Instagram as usual (CG).

Procedure and measures

All questionnaires were hosted on the online survey platform SoSci Survey (Leiner, 2019). After registering for the study and providing informed consent, participants completed the baseline questionnaire (T1), including demographics, measures about their Instagram use (e.g., average time spent on Instagram, number of followers), and the baseline outcome measures (i.e., life satisfaction, positive/negative affect, self-esteem, and loneliness).

Life satisfaction was assessed using the Satisfaction with Life Scale (Diener et al., 1985), which consists of five items (e.g., *I am satisfied with my life.*) and assesses participants' general agreement on a seven-point Likert scale (1 = *strongly disagree*; 7 = *strongly agree*, Cronbach's $\alpha = 0.90$, $M = 4.34$, $SD = 1.39$). Participants' positive (10 items; e.g., *active, interested*; Cronbach's $\alpha = 0.91$, $M = 2.54$, $SD = 0.78$) and negative affect (10 items; e.g., *distressed, upset*; Cronbach's $\alpha = 0.92$, $M = 1.48$, $SD = 0.62$) were captured with the Positive and Negative Affect Schedule (Watson et al., 1988). Participants had to describe their feelings at this moment using a five-point rating scale (1 = *not at all*; 5 = *extremely*). Levels of perceived loneliness were measured using the University of California, Los Angeles loneliness scale (Russell, 1996). On a four-point rating scale (1 = *never*; 4 = *often*, Cronbach's $\alpha = 0.95$, $M = 2.25$, $SD = 0.61$), participants indicated how often each of the 20 items (e.g., *How often do you feel left out?*) is descriptive of them. We administered Rosenberg's Self-Esteem Scale (Rosenberg, 1965) to measure trait self-esteem consisting of 10 items (e.g., *I take a positive attitude toward myself.*; Cronbach's $\alpha = 0.92$, $M = 2.77$, $SD = 0.63$) answered on a four-point Likert scale (1 = *strongly agree*; 4 = *strongly disagree*).

For our experimental manipulation, we randomly assigned participants to either EG or CG. In the first step, we asked participants how many pictures they usually post on their Instagram profile per week. 82% of participants reported usually posting less than one picture. The rest indicated usually posting $M = 2.9$ pictures per week ($SD = 2.0$). Upon the end of T1, we reminded participants about their previously specified number of usual postings and presented the instruction according to their respective condition. Participants in the EG were instructed to post more pictures on Instagram during the study than the specified number. In contrast, participants in the CG were instructed to continue using Instagram as they usually would.

Participants filled out six short daily questionnaires on the days in-between T1 and T2. These daily questionnaires included items about the number of posted pictures and stories since the completion of the last questionnaire and an item about their current level of perceived social connectedness (*At the moment, I feel connected and in touch with my friends*; five-point Likert-scale: 1 = *strongly disagree*; 5 = *strongly agree*; averaged across all daily questionnaires: $M = 3.43$, $SD = 0.89$).² Participants were reminded about their instructions for the course of the study at the end of each daily questionnaire.

The study ended with the T2 questionnaire one week after the completion of T1. Besides the same outcome measures as at T1 (i.e., life satisfaction, positive/negative affect, self-esteem, and loneliness), T2 included a scale measuring participants' perception of self-affirmation throughout the study (Napper et al., 2009). The scale consists of five items, slightly adapted for our study (e.g., *The eight days of this study made me aware of things I value about myself.*; Cronbach's $\alpha = 0.91$, $M = 3.41$, $SD = 0.86$) and answered on a five-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*).

As a manipulation check, we asked participants at T1 and T2 to upload anonymized screenshots of the upper part of their Instagram profile, displaying the total number of posts added to the profile to this date. Following the call for more objective and reliable methods to capture SNS usage (Kross et al., 2021), we used the difference between these numbers at

T1 and T2 to verify that participants in the EG followed the given instruction (i.e., posted more pictures than usual).

Dropout analyses

Initially, $N = 403$ participants completed T1 and were added to the panel list of the study. Of those, $N = 391$ participants completed T2. Ten participants were removed due to failed attention checks in both T1 and T2 or for completing T2 more than 8 days after the completion of T1, leading to a final sample of $N = 381$ participants (dropout from T1 to T2 = 5.5%).

For the full sample, dropouts did not statistically differ from the remaining participants in any of the collected demographics, the outcomes at baseline, and their usual posting frequency. More importantly, there was no systematic difference with respect to dropouts' baseline outcome measures between EG and CG, and hence, the data did not show any signs of selective attrition bias.³

Results

Manipulation check and compliance

To ensure the manipulation's success, we assessed the number of pictures posted during the study based on the uploaded screenshots from participants' Instagram profiles. For cases where screenshots were missing or clearly faulty (4% of the sample), the self-reported number of pictures posted during the study was used instead. The full sample posted $M = 1.83$ ($SD = 2.95$) pictures during the study, thereby $M_{\text{difference}} = 1.31$ pictures more than usual ($SD_{\text{difference}} = 2.55$). Participants in the EG ($N = 183$) showed a strong increase ($d = 0.76$) in their posting frequency and posted $M_{\text{difference}} = 2.19$ pictures more than usual ($M_{\text{baseline}} = 0.42$, $SD_{\text{baseline}} = 1.21$) during the study ($SD_{\text{difference}} = 2.87$, $t[182] = 10.31$, $p < .001$). Participants in the CG ($N = 198$) also registered a small increase ($d = 0.26$) and posted $M_{\text{difference}} = 0.49$ pictures more than usual ($M_{\text{baseline}} = 0.62$, $SD_{\text{baseline}} = 1.56$) during the study ($SD_{\text{difference}} = 1.88$, $t[197] = 3.71$, $p < .001$). EG and CG significantly differed in their posting frequency increase (Welch t test, $t[309.5] = 6.76$, $p < .001$), indicating a successful manipulation.

In the EG, 31% of participants did not comply with the given instruction (i.e., posting the same number or fewer pictures than usual). A similar share in the CG (34%) showed non-compliance (i.e., posting more or fewer pictures during the study compared to their usual frequency). We opted for more conservative testing and followed an intention-to-treat approach (Sagarin et al., 2014). That is, for the analyses, no participants were excluded from the final sample, and all participants were kept in their originally assigned condition, regardless of their compliance with the given instruction. Therefore, the EG included both participants that increased their usual posting frequency or did not show a change in their usual posting frequency (or posted even less). The CG included both participants that did not change their usual frequency or did so (i.e., posting more or less than usual). Essentially, this ensures that randomization is maintained and allows to fathom unbiased effect estimates (Sagarin et al., 2014).

Effect of active Instagram use

Linear regression models were calculated to analyze the effects of active SNS use. Each respective well-being outcome at T2 was regressed on its level at T1 and condition (dummy coded: 0 = CG; 1 = EG), which corresponds to an analysis of covariance (ANCOVA) and is the recommended approach to analyze data from a randomized pretest/post-test control group design (e.g., van Breukelen, 2006). A different methodological approach — but with less power — is to test for differences in average change between the conditions (CHANGE, van Breukelen, 2013). The two approaches can sometimes yield different results (Lord's paradox, van Breukelen, 2006). For all outcomes, we additionally tested for the effect of the manipulation following the CHANGE approach. The results were consistent with the ANCOVA approach. Hence, only the ANCOVA is reported. To avoid alpha-error inflation, Bonferroni correction for multiple testing (Wright, 1992) was applied for the central statistical tests (i.e., the statistical testing of the regression coefficient for condition in each model). Therefore, the p -values of these coefficients were adjusted (p_{adjusted}) by multiplying them by the number of tests performed ($n = 5$).

For life satisfaction, the results of the conducted analyses did not suggest a significant effect ($\alpha = 0.05$) of condition ($\beta = 0.03$, $t[378] = 0.63$, $p_{\text{adjusted}} > .99$, $\text{partial } \eta^2 = 0.001$). While participants in the EG showed a significant increase in life satisfaction from T1 to T2 ($M_{\text{difference}} = 0.17$, $t[182] = 3.44$, $p < .001$, $d = 0.25$), a similar change emerged in the CG ($M_{\text{Difference}} = 0.13$, $t[197] = 2.57$, $p = .005$, $d = 0.18$).

Analyzing the effect of condition on participants' positive affect, results indicated a positive effect of condition ($\beta = 0.23$, $t[378] = 2.99$, $p_{\text{adjusted}} = .015$, $\text{partial } \eta^2 = 0.023$). The EG noted a significant increase in positive affect from T1 to T2 ($M_{\text{difference}} = 0.18$, $t[182] = 3.88$, $p < .001$, $d = 0.29$), while the CG did not ($M_{\text{difference}} = 0.00$, $t[197] = -0.05$, $p = .522$, $d = 0.00$) (see Figure 3).

In contrast, for negative affect, results did not hint at an effect of condition ($\beta = 0.08$, $t[378] = 0.88$, $p_{\text{adjusted}} > .99$, $\text{partial } \eta^2 = 0.002$). While the EG noted a slight but insignificant decrease in negative affect ($M_{\text{difference}} = -0.05$, $t[182] = -1.33$, $p = .092$, $d = 0.10$), the CG showed a significant decrease in negative affect ($M_{\text{difference}} = -0.09$, $t[197] = -2.15$, $p = .017$, $d = 0.15$).

Insignificant results were found for the risk or resilience factors to well-being (see Table 1). The analyses indicated null findings for the effect of condition on self-esteem ($\beta = 0.01$, $t[378] = 0.19$, $p_{\text{adjusted}} > .99$, $\text{partial } \eta^2 < 0.001$) and on loneliness ($\beta = -0.04$, $t[377] = -0.76$, $p_{\text{adjusted}} > .99$, $\text{partial } \eta^2$

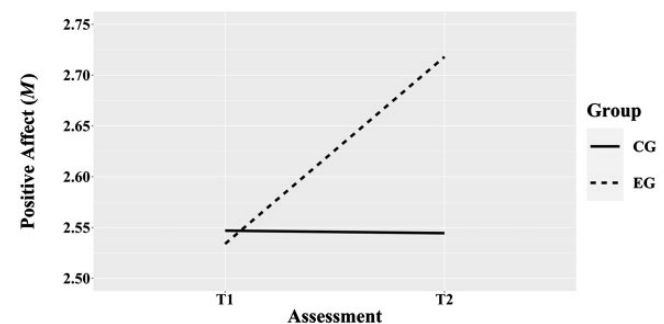


Figure 3. Change in positive affect between T1 and T2 in EG and CG.

Table 1. Means and SDs of each outcome for EG and CG on each assessment

Outcome	EG (N = 183)		CG (N = 198)		Effect of condition ^a
	T1 M (SD)	T2 M (SD)	T1 M (SD)	T2 M (SD)	
Life satisfaction	4.36 (1.42)	4.53 (1.41)	4.31 (1.38)	4.45 (1.41)	$\beta = 0.03, p_{adjusted} > .99$
Positive affect	2.53 (0.78)	2.72 (0.80)	2.55 (0.78)	2.54 (0.79)	$\beta = 0.23, p_{adjusted} = .015^*$
Negative affect	1.48 (0.62)	1.43 (0.59)	1.48 (0.62)	1.39 (0.57)	$\beta = 0.08, p_{adjusted} > .99$
Self-esteem	2.76 (0.61)	2.82 (0.60)	2.77 (0.64)	2.82 (0.64)	$\beta = 0.01, p_{adjusted} > .99$
Loneliness	2.24 (0.61)	2.19 (0.60)	2.27 (0.60)	2.25 (0.61)	$\beta = -0.04, p_{adjusted} > .99$
Self-affirmation		3.36 (0.88)		3.46 (0.84)	$t(371.97) = -1.15, p = .874$
Social connectedness	3.45 (0.92)		3.42 (0.87)		$t(372.76) = 0.29, p = .385$

Note. Values for social connectedness represent average levels of social connectedness over all daily assessments in-between T1 and T2.

* $p < .05$.

a Beta-coefficient of condition in the respective outcome's linear regression model within the intention-to-treat analysis.

= 0.002). Both groups noted an increase in self-esteem (EG: $M_{difference} = 0.06, t[182] = 2.06, p = .021, d = 0.15$; CG: $M_{difference} = 0.05, t[197] = 1.76, p = .040, d = 0.12$). The EG showed a slight decrease in loneliness ($M_{difference} = -0.04, t[182] = -1.89, p = .030, d = 0.14$), while it did not change significantly ($M_{difference} = -0.03, t[196] = -1.49, p = .069, d = 0.11$) in the CG.

Next, we tested if the treatment affected outcomes assumed to mediate the relationship between active SNS use and well-being: self-affirmation and social connectedness. A one-sided Welch t test revealed that participants in the EG did not show higher levels of perceived self-affirmation at T2 compared to the CG ($M_{EG} = 3.36; M_{CG} = 3.46, t[371.97] = -1.15, p = .874$). Also, contrary to our hypotheses, compared to the CG, participants in the EG did not exhibit higher levels of social connectedness, as averaged over the six daily assessments in-between T1 and T2 ($M_{EG} = 3.45; M_{CG} = 3.42, t[372.76] = 0.29, p = .385$).

Finally, to ensure the robustness of the findings, we performed per-protocol ($N = 256$) analyses and recalculated the analyses with compliant participants only ($N_{EG} = 126; N_{CG} = 130$). Therefore, in the EG, participants were excluded if they were posting an equal amount or fewer pictures than usual during the study. In the CG, participants were excluded if their change in post-frequency was $\neq 0$ (i.e., posting more or less than usual during the study). However, we retained the initial randomization into EG and CG. The results resembled those gathered in the intention-to-treat analyses, yielding no effect of condition on the considered well-being outcomes. Also, the effect on participants' positive affect was not significant at the 5%-level, potentially due to the reduced sample size ($\beta = 0.14, t[253] = 1.92, p_{adjusted} = .281$).

Summary and discussion

The results of the RCT — in most cases — did not support the ASUH. Life satisfaction, self-esteem, loneliness, negative affect, and the assumed mediating factors of self-affirmation and social connectedness seem to remain unaffected by posting pictures on one's Instagram account. In contrast, the only outcome for which we observed a small (Cohen, 1988) significant effect was positive affect. Positive affect marks the affective component of subjective well-being (Diener, 1984). At least for this outcome, our results align with the ASUH. An increase in photo posting activity on Instagram led to a significant increase in positive affect, while it did not change perceptions of negative affect. This indicates that active use

can slightly sway users' positive affect even after just one week, thereby complementing research already suggesting a similar short-term effect (Bayer et al., 2018).

Interestingly, our results do not suggest a similar effect on negative affect. This could indicate that active use might specifically target positive affect while leaving its seeming opposite (i.e., negative affect) unaffected. A similar pattern has been observed in other SNS and well-being studies (Meier et al., 2020) and is consistent with the call for a differentiated view of well-being — including conceptualizing it not necessarily as the reverse of ill-being (Meier & Reinecke, 2021; Valkenburg et al., 2022b).

The null findings for the other outcomes contrast with some previous studies (e.g., große Deters & Mehl, 2012; Matook et al., 2015; Wenninger et al., 2014). For life satisfaction, some studies reported a positive association with active SNS use (e.g., Dienlin et al., 2017; Lee et al., 2011; Wenninger et al., 2014; Wu et al., 2021). However, these were mostly correlative, while an experimental study also yielded null findings (Verduyn et al., 2015). It might be that some reported effects either reflected a reversed relationship (i.e., life satisfaction positively impacts active SNS usage patterns) or were caused by differences in the applied active SNS use operationalization. Moreover, contextual factors such as the valence of the content (Locatelli et al., 2012) and the platform (Teo & Lee, 2016) might determine how active use affects life satisfaction.

For loneliness, our null finding contrasts with some cross-sectional research that detected a link between active SNS use and loneliness (Aydm et al., 2013; Lin et al., 2020; Matook et al., 2015; Yang, 2016). Interestingly, the findings from a study with a similar design like ours (große Deters & Mehl, 2012) showed that an increase in Facebook status updates reduced perceived loneliness after one week in US students, which was further mediated by social connectedness. Notably, a conceptual replication of the study with German participants likewise failed to detect a substantial effect (große Deters et al., 2014). The disparity between the findings of our study and the studies above could indicate cultural and platform differences in the effects of active use. In contrast to Facebook, communication on Instagram is mainly picture-based and may be less effective in causing loneliness alterations. Also, our findings align with some other research failing to detect an association between active SNS use and loneliness (Burke et al., 2010; Dienlin et al., 2017; Verduyn et al., 2015). Importantly, current work increasingly stresses the importance of other contextual factors determining how active

use can impact loneliness. Besides users' age (Teo & Lee, 2016), the amount of content also seems to influence the active use and loneliness relationship, with findings indicating even adverse effects of rampant posting activities (Hunt et al., 2021; Wang et al., 2018).

For self-esteem, several past studies stress the importance of reciprocation by others, for instance, through likes and comments, for active use to exert a positive effect on self-esteem (e.g., Marengo et al., 2021; Valkenburg, 2017). Likewise, a positive effect was shown in previous studies in cases where users reflected upon the legacies of active use as in the viewing or editing of their profile (Gentile et al., 2012; Toma, 2013; Toma & Hancock, 2013), presumably by enabling self-esteem-benefitting self-reflective processes (Krause et al., 2021). However, like other findings (e.g., Steinsbekk et al., 2021; Wang et al., 2017), our results indicate that merely posting pictures seems insufficient to sway self-esteem and perceived social connectedness — deeming this often-assumed mediating mechanism less likely. Similarly, our results do not hint at active use's potential to stimulate self-affirmation and it might need some further processing for self-esteem effects to emerge.

In summary, our results mainly do not support the claim of the ASUH that active SNS use positively contributes to well-being. While we could detect an effect of active use on positive affect, the other considered well-being outcomes did not change significantly by increasing participants' Instagram photo posting frequency.

Our findings support the increasingly critical view on the ASUH (e.g., Valkenburg et al., 2022b) with much-needed causal evidence from a strong research design. Our results challenge active SNS use as the beneficial counterpart to harmful passive usage. This view shaped research for a long time and was often promoted by platform providers themselves (Docherty, 2020). Instead, our study mainly indicates null findings and therefore does not support active use being a significant determinant of users' well-being.

At this point, we would also like to draw attention to the importance of reporting null findings for research in general (e.g., Ferguson & Heene, 2012), but especially regarding the ongoing debate on the active/passive use dichotomy (e.g., Meier & Krause, 2022). Besides the already voiced points of critique concerning the ASUH (Valkenburg, 2022; Valkenburg et al., 2022b), we believe it is crucial to also note the possibility that existing meta-analyses (e.g., Liu et al., 2019) could have overestimated effects due to unpublished null findings (Ferguson & Heene, 2012; Rosenthal, 1979). Therefore, we deliberately decided to report effects for all outcomes considered to encourage a critical but nuanced view of the ASUH and potentially assist future meta-analyses in clarifying the overall relationship between active SNS use and well-being.

Limitations

Our study operationalized active use as the frequency of posting pictures on one's Instagram account. This ensured that any detected effects could be traced to this activity alone. This approach, relying on a well-defined and quantifiable *public* active use action (Valkenburg et al., 2022b), helped overcome the obstacles of other ill-defined active use operationalizations (Trifiro & Gerson, 2019). Nevertheless, it limits the generalizability of our findings as they do not cover the full spectrum of actions (e.g., Burke et al., 2010; Verduyn et al., 2017).

Especially, more *private* or *interactive* forms of active use (e.g., chatting; Valkenburg et al., 2022b) seem conceptually different from public active use. These have been, in some instances, shown to be more consistently and positively linked with well-being outcomes (e.g., Yang et al., 2021).

Likewise, we did not consider the posts' content or tonality. However, a recent extension of the active/passive dichotomy advises accounting for the content's tone of communication and how targeted it is toward one's audience. The *extended active - passive model* assumes that warm and targeted content contributes most to well-being (Verduyn et al., 2022). The extended model further aligns with recurring claims to incorporate contextual factors into our understanding of active use's potential, including focusing on the depth and authenticity of the shared content (Yang et al., 2021). Ultimately, this could explain why our study, without focusing on a specific type of communication, mostly failed to reveal effects.

We further opted for a relatively short time frame of one week. This could explain why we found an effect on a more fluctuating construct, such as positive affect. In contrast, more stable aspects of well-being, such as self-esteem, life satisfaction, or perceptions of loneliness (Eid & Diener, 2004; Mund et al., 2020) might have been too inert to be impacted by the applied manipulation in this short period. However, we note that previous experimental studies manipulating SNS use have been able to detect effects on these constructs for a similar period (e.g., große Deters & Mehl, 2012) or even shorter time frames (e.g., Gonzales & Hancock, 2011; Vogel et al., 2014). Notably, most participants reported posting pictures on Instagram only rarely. Thus, they could have found a sudden increase in such unusual activity off-putting or would have needed longer acclimatization before effects could have unfolded. Nevertheless, the results of our study hint at an increase in positive affective states and thus provide evidence for a mood-enhancing impact of active Instagram use. Given the centrality of positive affect in subjective well-being (Diener, 1984), it could well be that, in the long run, the positive effect of active SNS use also spills over to other dimensions of well-being. Therefore, we call for future research to examine varying time frames to further distinguish immediate, medium, and long-term effects of active SNS use.

An additional limitation concerns the increment in posting frequency in the EG. While the change in posting frequency in the EG during the study was large (i.e., 2.2 pictures more) — especially considering the group's relatively low usual frequency of posting Instagram pictures (i.e., 0.4 pictures) — it might have still been too marginal to cause well-being changes. We explicitly opted for individualized instructions based on each participant's usual posting frequency instead of instructing them to post a fixed number of pictures during the study. This brought several benefits: First, it ensured that all participants in the EG, regardless of how many pictures they usually post, would increase their posting frequency. Second, this approach created similar barriers for all participants to increase their posting frequency. For instance, instructing participants to post five more pictures than usual could have been a drastic change for a person that usually posts nothing compared to someone that posts several pictures daily. Finally, by letting participants freely decide how many pictures they feel comfortable posting more, we captured behavior in participants' natural range and hence, increased the study's external validity. Moreover, not forcing participants into an unnatural and potentially burdensome SNS activity

(i.e., posting too many pictures) reduced the dropout risk. Nonetheless, this individualized instruction might have caused a change in posting frequency during the study, not powerful enough to cause sufficiently big effects on well-being. Future studies could investigate the optimal dose for active use to promote well-being.

Lastly, we would like to highlight some unique characteristics of our recruited sample. The sample included a relatively high share of females and had a fairly high mean age ($M_{age} = 32.5$). Although the ASUH does not suggest any gender- or age-specific effects, future studies must show how the findings generalize to more gender-balanced populations, other cultures, and younger users.

Conclusion

The study contributes to the ongoing debate on the ASUH. The results yielded a positive effect of active SNS use on positive affect but no significant effects on any other well-being measure. This underlines the need to move beyond the long-lasting dichotomizing view on SNS activities and calls for further refinements of the active/passive dichotomy to fully understand the effects of SNSs on users' well-being. The extended active-passive model (Verduyn et al., 2022) could constitute a viable starting point. At the very least, encouraging users to increase the number of pictures posted on their Instagram account — as considered in our study — does not seem to be the promising solution that researchers and platform providers have long hoped for to unlock Instagram's potential to enhance well-being.

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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Conflicts of interest: None declared.

Notes

1. A first run of the study was conducted in August 2020. However, in that first run, in which participants were not monetarily incentivized for their participation, we encountered a systematic dropout from T1 to T2 in the EG. The analyses showed that dropped-out participants in the EG significantly differed in their level of negative affect at T1, indicating that participants with higher levels of negative affect were more likely to drop out in this group. Due to this selective attrition bias, the study's results did not allow for valid conclusions. Therefore, we re-ran the study and took measures in the current study to prevent the reoccurrence of systematic dropout (e.g., Zhou & Fishbach, 2016). First, we used a monetary incentive. Secondly, we applied a stratified randomization procedure based on participants' baseline negative affect. Participants below or above a cut-off score of 1.5 were separately randomized into EG or CG. In case of encountering a systematic dropout once again, we then could still test our hypotheses with the data of participants in the low-negative affect stratum in which — based on the results of the initial study — the risk of systematic dropout seemed less likely.

- In addition, the daily questionnaires included short measures for self-esteem, mood, and loneliness for exploratory multilevel analyses that turned out to be highly underpowered to be used for further analyses.
- Therefore, data of participants in the low and high affect stratum were combined for the analyses (see footnote 1).

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