Exploring the Relationship between Smartphone-Based Social Media Time and State Self-Esteem in University Students: An Experience Sampling Study

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Abstract

Background: Although previous studies have investigated the association between social media use and self-esteem, there is limited research concerning daily fluctuations in self-esteem in relation to time spent on social media. This study aimed to investigate the association between daily smartphone screen-time on social media and state self-esteem over time in university students. Further, gender was included as a potential moderating effect in this relationship.

Methods: Experience Sampling Methodology was used to assess the association between smartphone-based time spent on social media and state self-esteem among university students over 15 consecutive days (N = 38, M_{Age} = 22.9, 57.9% women, 100 % German). State self-esteem was measured using a set of 5 items adapted from the Rosenberg Self-Esteem Scale, while social media use was evaluated with 2 formulated questions addressing both duration of social media usage and social media platforms used. For visualisation, the Estimated Marginal Means were retrieved. To analyse the data, Linear Mixed Models were conducted alongside a moderation analysis.

Results: Smartphone screen-time on social media and state self-esteem in university students were not associated over time. Additionally, no significant influence of gender in this association was found (p = .333).

Conclusion: The study's findings highlighted the importance of considering diverse features and activities offered by social media platforms in relation to fluctuations in self-esteem. Further, individual differences and susceptibilities might play an important role when investigating the relationship between smartphone screen-time on social media and state self-esteem.

Keywords: Experience Sampling Method, ESM, state self-esteem, time spent on social media, screen-time, university students

Exploring the Relationship between Smartphone Screen-Time on Social Media and State Self-Esteem Moderated by Gender in University Students: An Experience Sampling Study

With the global number of social media users reaching 4.76 billion in 2022, the use of social media has become increasingly popular due to its opportunity to communicate and interact effortlessly with other individuals (Statista, 2022). One population group that has been identified to be one of the most active and frequent users of social media is university students. To illustrate, in 2021, students spent on average three to four hours on social media platforms (Haddad et al., 2021). Due to the growing popularity and prevalence of social media use, researchers increasingly devoted their attention to the potential influences of social media on students' mental health. In recent years, a small body of research linked the time spent on social media platforms to lowered self-esteem (Cingel et al., 2022). Further, previous literature has found gender to be an influential variable in the time spent on social media, as well as in self-esteem (Dzandu et al., 2016). Existing literature investigating this relationship remains scarce and is mostly limited to cross-sectional study designs. Therefore, the current study used Experience Sampling Methodology (ESM) to explore the relationship between daily time spent on social media *(measured as smartphone screen-time on social media)* and state self-esteem over time. Additionally, gender was explored as a potential moderator in this relationship.

Social Media Use

Social Media can be described as online platforms that allow users to exchange knowledge, as well as to connect and communicate with others through a diverse range of features. Since the first social media platform was launched, the number of social media platforms and the prevalence of social media use has increased significantly (Berryman et al., 2017). The exponential growth of social media networks has attracted billions of individuals who are active on these platforms regularly. To illustrate, almost half of the world's population is active on social media platforms daily (Statista, 2022). Nowadays, a few of the most prominent social media platforms include Instagram, Snapchat, and Facebook (Berryman et al., 2017).

The extensive adoption of smartphones in today's digital landscape coupled with the increased popularity of social media use in the last decades has led to a significant increase in the frequency of social media usage (Saiphoo et al., 2020). Particularly college students and young adults seek to benefit from this dynamic, allowing them to sustain ongoing connections

with friends and family, engage in content consumption, or pursue entertainment (Berryman et al., 2017). Accordingly, a study conducted by the American Psychological Association (2017) revealed that 90% of young adults check their social media account at least once daily, with 43 % of them engaging in this activity multiple times throughout the day. This behaviour was further intensified during the COVID-19 pandemic when face-to-face interactions had to be drastically reduced, resulting in a higher reliance on social media platforms to communicate with peers (Haddad et al., 2021). Thus, students' screen-time on social media has increased significantly during and after the pandemic, resulting in a total of 3-4 hours of social media usage per day in 2022. Undoubtedly, social media has emerged as an essential part in the lives of numerous young individuals, including university students.

The popularity and prevalence of social media among students have led to a growing body of research examining its impact on individuals' mental health. Previous literature has yielded mixed findings, proposing that the connection between social media usage and mental health remains multifaceted. On the one hand, social media use has the potential to enhance social bonds and promote interpersonal relationships that lead to an enhanced sense of mental well-being (Marttila et al., 2021). On the other hand, the use of social media can be associated with negative mental health outcomes, including depressive symptoms and suicidal ideation (Hunt et al., 2018). Considering how prevailing social media use has become in many people's daily routines, an expanding body of research has identified the frequency of using social media platforms as a crucial aspect in the relationship between social media use and psychological well-being. Correspondingly, a positive relationship between higher frequencies of social media use and depressive symptoms was discovered (Huang, 2017). Furthermore, increased frequencies of social media use have been repeatedly linked to decreased well-being, insomnia, anxiety, and self-esteem (Hunt et al., 2018; Banjanin et al., 2015)

Self-Esteem

In recent years, one fundamental aspect of psychological well-being that has gathered attention in relation to social media use, is self-esteem (Cingel et al., 2022; Vogel et al., 2015; Faelens et al., 2021). Self-esteem refers to an individual's reflection of their qualities, capabilities, and abilities. It entails their beliefs, emotions, and thoughts about themselves and plays a vital role in shaping their self-image (Robson, 1988). Research suggested that people who have higher self-esteem showed increased happiness, life satisfaction and are less likely to suffer from anxiety and stress (Dogan et al., 2013; Nguyen et al., 2019). Furthermore, a positive correlation between higher self-esteem and academic performance in students was

revealed (Baumeister et al., 2003).

In previous literature, self-esteem is predominantly seen as a core aspect of an individual's personality that remains relatively stable across various situations and contexts (Robson, 1988). However, more recent research has demonstrated that self-esteem can also be susceptible to immediate experiences and changes in the external environment, such as the transition into a romantic relationship or experiencing a change in employment circumstances (De Ruiter et al., 2017). This phenomenon is commonly referred to as state self-esteem. Fluctuations in self-esteem have not only been observed in real-life, but also in the realm of online environments, such as social media. Whereas numerous studies have studied the association between social media use and trait self-esteem, it was emphasised to specifically consider fluctuations of self-esteem when investigating the relationship between social media use and self-esteem (Faelens et al., 2021; Cingel et al., 2022).

Social Media Use and Self-Esteem

Overall, the relationship between both constructs remains complex and conflicting outcomes in this study field persist. One the one side, studies suggested that social media usage can increase feelings of self-esteem among users by providing opportunities for social connection and validation from others (Vogel et al., 2015, Cingel et al., 2022). On the other side, it has been demonstrated that specifically the time spent on social media is related to lower self-esteem. Accordingly, previous literature found that an increased screen-time on social media is linked to lowered levels of self-esteem in adolescents (Twenge & Farley, 2021; Valkenburg et al., 2021). Further, a recent study utilising eye-tracking technology has discovered that adolescents who spent more time watching content on social media postings experienced lowered feelings of self-esteem (Triệu et al., 2021). In light of this, individuals who use multiple social media platforms regularly are more prone to experience lowered self-esteem compared to those who are using only one social media platform (Bennett et al., 2020). Contrarily, other studies have found no link or only small correlations between increased usage of social media platforms and self-esteem (Donnelly & Kuss, 2016; Hunt et al., 2018).

Further, it is interesting to note that several studies have identified a two-way association between social media use and self-esteem. People may use social media to enhance their self-esteem or escape from negative self-esteem feelings (Andreassen et al., 2017; Hong et al., 2014). It was found that individuals who have lower trait self-esteem tend to spend more time on social media networks, or even use it in a problematic manner, compared to those with higher self-esteem (Andreassen et al., 2017).

Previous literature primarily relied on one-time measurements and cross-sectional research designs when examining the relationship between self-esteem and social media usage. Consequently, self-esteem in the context of social media was assessed at one specific point in time, therefore, failed to consider fluctuations in self-esteem despite being previously determined as important aspect in the context of social media use (Faelens et al., 2021; Cingel et al., 2022). Further, prior research predominantly focused on one or two specific social media platforms; however, it was found that individuals commonly engage in more than one social media platform on a daily basis (Berryman et al., 2017).

As the association between social media use and self-esteem has been established as a complex dynamic, it is crucial to consider potential variables that influence the strength of the relationship between both constructs. Accordingly, previous literature repeatedly proposed that social media usage and self-esteem differs between women and men (Atske, 2022; Bleidorn et al., 2016).

Gender Differences

In general, women demonstrated to be more active and frequent users of social media compared to men (Atske, 2022), as well as possess lower trait self-esteem than men (Bleidorn et al., 2016). In a study investigating social media usage among students, it was found that women use social media more frequently compared to men (Dzandu et al., 2016). From another perspective, it was found that men and women also differed in the motives and intention to use social media (Krasnova et al., 2017; Ali et al., 2021). Consequently, it was found that whereas women have a stronger tendency to use social media for fostering social relationships and receiving social information, men tend to use social media mostly for entertainment purposes (Ali et al., 2021). In light of this, Yau & Reich (2018) revealed that adolescent girls devoted more time in carefully managing their online image compared to boys. Furthermore, although established literature is scarce, some studies have already investigated gender as a potential influence in the relationship between social media use and self-esteem. Accordingly, Twenge & Farley (2021) argued that women demonstrated notably lower levels of self-esteem in association with increased social media use compared to men.

Combining these findings, it appeared that there are differences between gender in terms of frequency, as well as the general use of social media. However, it remains unknown whether gender has an impact on the relationship between time spent on social media and fluctuations of state self-esteem over time.

Experience Sampling Method

For the present study, Experience Sampling Method (ESM) was chosen as the most

suitable method. ESM allows for assessments of people's experiences and states in real-world settings over time. In relation to the current study, employing ESM enables the examination of temporal associations between time spent on social media and state self-esteem, which has not received much attention in recent literature (Myin-Germeys & Kuppens, 2022). By repeatedly collecting data on participants' time spent on social media and state self-esteem over time, between-person and within-person variability can be explored. Secondly, it effectively reduces recall bias by collecting data as experiences occur, thereby minimising reliance on participants' memory (Myin-Germeys & Kuppens, 2022). In the present study, ESM is applied through a diary-like approach to account for daily fluctuations in state self-esteem in the context of time spent on social media.

The Aim of the Present Study

As existing literature provided conflicting results and focused mainly on cross-sectional study designs, a notable research gap concerning state self-esteem in association with time spent on social media in association became notable. Further, previous literature has predominantly focused on adolescents as a target group in this relationship, however, understanding university students as a target population holds significant importance due to the rising prevalence and popularity of social media use among them.

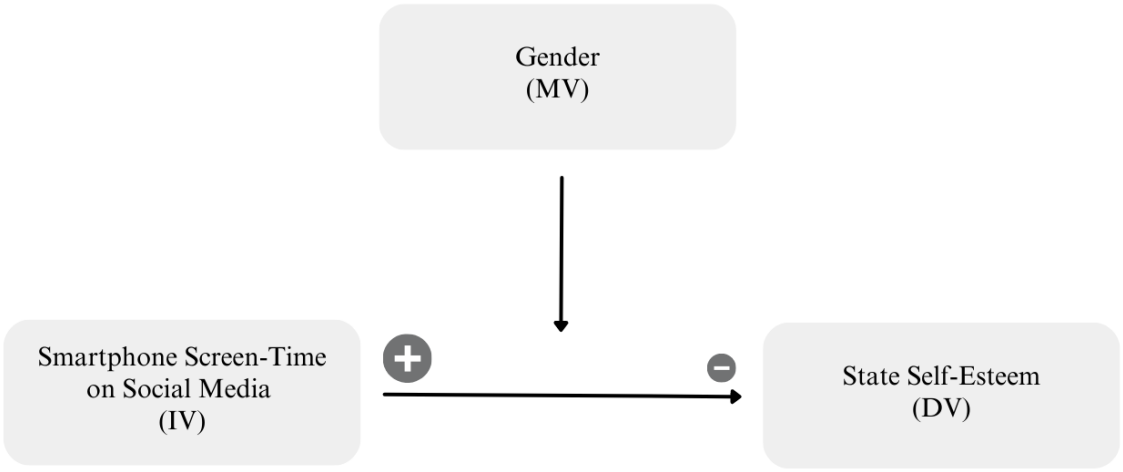
Therefore, this study aimed to investigate the relationship between time spent on social media and state self-esteem in university students. Further, gender is included as a potential moderator in this relationship. Thus, the following research questions were formulated:

> Research Question 1 (RQ1): *How are daily smartphone screen-time on social media and state self-esteem associated over time in university students?*
>
> Research Question 2 (RQ2): *Is the association between smartphone screen-time on social media and state self-esteem in university students moderated by gender?*

This study is exploratory in nature. However, in line with previous research, it can be hypothesised that higher amounts of time spent on social media is linked to decreased levels of state self-esteem on a between-person and within-person level in university students (Twenge & Farley, 2021). Further, it is anticipated that this relationship is more pronounced among women compared to men. An overview of the hypothesised model in the present study can be seen in Figure 1.

Figure 1

Hypothesised Model of the Current Study



Methods

Study Design

The present study was a component of a broader project that examined general smartphone-based screen-time in association with other constructs. Therefore, additional questionnaires were included; however, they are irrelevant within the scope of the present study and hence, were not addressed. The Ethical Committee of the faculty Behavioural, Management and Social Sciences (BMS) of the University of Twente provided ethical approval on March 29, 2023 (Request number: 230422) prior to commencing participant recruitment. For setting up the study and collecting data, the platform Ethica Data was used. Participants answered the questionnaires on the Ethica mobile application on their smartphones. Before the actual data collection took place, a pilot study over the course of 4 days. Afterwards, only a few adjustments were made.

Participants

To recruit participants, snowball sampling and convenience sampling was applied. Accordingly, the study was shared with the researchers' social network and distributed on social media platforms (e.g., WhatsApp, Instagram). Students at the University of Twente were able to enroll in the study through the SONA system of the University of Twente and consequently, received 1.75 credits as a reimbursement for their participation. No compensation was given to participants who did not use the SONA system to enroll and

participate in the study.

Respondents had to be at least 18 years old, being enrolled at a university (of applied sciences) and possess sufficient English proficiency to comprehend the content and questionnaires of the study to be eligible to participate in the study. Moreover, participants must own a smartphone that is used daily and must be willing to install the Ethica mobile application on their own smartphone.

A total of 50 individuals participated in the study. However, 12 participants had to be excluded as they did not provide informed consent or failed to complete at least 50% of the measurements. The final sample was composed of 38 German participants aged between 18 and 33 years (M = 22.9) and had a slightly higher proportion of women (N = 22, 57.9 %) compared to men (N = 16, 42.1 %). Additionally, participants' overall compliance rate in this sample was 85.7 % (N = 38).

Materials

Demographic Questionnaire

The demographic questionnaire included questions about participants' age, gender, and nationality. Further, they were inquired to specify whether they are currently enrolled in a university (of applied sciences) and whether they possess a smartphone that they use daily.

Daily Repeated Measurements

Morning Questionnaire: Social Media Use

Participants were asked two questions concerning their social media use. The first question asked participants to select from a list of pre-determined options to indicate the social media platforms they visited the previous day (Appendix B, Survey B2). Participants were given the option to select multiple choices from the following selection: "Facebook", "Instagram", "Snapchat", "TikTok", "YouTube", "Twitter", "Pinterest", "Tumblr", and "None". The second question required participants to indicate the total amount of time they spent on social media platforms in minutes for the previous day. For this, the Visual Analogue Scale (VAS) with response options ranging from 0 to 600 minutes was used.

Evening Questionnaire: State Self-Esteem

To assess participants' daily state self-esteem, five items of the RSE were used and reformulated to adapt them to daily measurements. Accordingly, the term "Today" was added before the items. This method was adapted from a study by Nezlek & Plesko (2001), who reworded items of the RSE to ensure suitability for ESM studies. Further, the chosen items were included based on its highest factor loadings, as well as subjective assessment of the

degree of fit for daily measurement. Examples of items are: *"Today, I felt that I am a person of worth, at least on an equal plane with others."*, or*: "Today, I felt satisfied with myself"* (Appendix B, Survey B3). Participants answered these questions on a Likert Scale ranging from 1 (Strongly Agree) to 4 (Strongly Disagree). Three items were stated positively and thus required reversed coding. Total scores ranging from 5 to 12 represent low self-esteem, while scores from 13 to 16 indicate moderate self-esteem, and scores between 17 to 20 signify high self-esteem. The Cronbach's alpha in the present study showed excellent reliability ($\alpha = .94$).

Procedure

Consistent with the recommendations of van Berkel et al. (2017), a two-week study duration for ESM studies yielded in good compliance rates. Therefore, the present study used a 16-day data collection period from April 10, 2023, until April 25, 2023. Participants who enrolled in this study were sent an E-Mail with a brief introduction, a study registration code as well as specific instructions on what to do before and during the study. This included an explanation on how to download the Ethica mobile application on their smartphones and how to set up an Ethica account using their E-mail address and a self-chosen password. Additionally, participants were instructed on how to find the "Screen-Time" function on their smartphones to answer the morning questionnaire about their time spent on social media platforms (see Appendix C for the complete E-Mail).

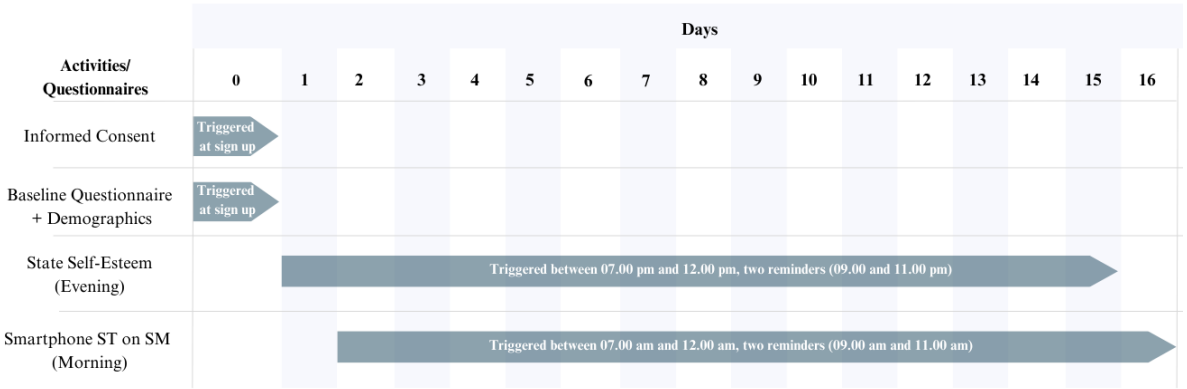
To access the study in the Ethica app, participants were required to enter the study registration code. After registration, an information sheet including the study's objective, methods, and duration were presented to the participants, which remained accessible to them throughout the entire duration of the study. Afterwards, participants were asked to provide active informed consent and to answer the demographic questionnaire (see Appendix A for informed consent). Overall, it took participants approximately 20 minutes to answer. If participants did not agree on the informed consent, indicated that they do not own a smartphone that they use daily, or were not enrolled in a University (of applied sciences), they were immediately provided with a message stating that they are not eligible to participate in the study.

To reduce the burden on participants, only two questionnaires per day were administered to participants (van Berkel et al., 2017). Accordingly, one morning questionnaire was sent out to measure participants' smartphone screen-time on social media for the previous day, while one evening questionnaire was sent out to measure participants' state self-esteem. Each questionnaire took respondents approximately 1-2 minutes to complete. This study adopted a fixed sampling strategy, resulting in more predictable measurements and

subsequently, higher compliance rates (Myin-Germeys & Kuppens, 2022). Hence, both questionnaires were scheduled at specific time points and were accessible for participants from 07.00 until 12.00, including two additional reminders at 09.00, and 11.00 in the morning and evening respectively. On the first day, participants received only one evening questionnaire measuring their state self-esteem. On the last day of the study, participants received a last morning questionnaire to specify their social media use for the previous day. Subsequently, participants were sent an in-app message expressing gratitude for their involvement in the study. In Figure 2, an overview of the study's timetable can be seen.

Figure 2

Overview of the study's schedule



Data Analysis

The results were analysed using the statistical program RStudio (version 2023.3.1.446). The separate datasets were exported from Ethica as a CSV file and merged to one single dataset. The dataset was cleaned, which involved excluding participants who answered less than 50% or disagreed on informed consent. A "Day" variable was created to align the retrospective assessment of smartphone screen-time on social media with state self-esteem to the same day. Text-based data was recoded into numeric and dichotomous scores. Lastly, smartphone screen-time on social media was converted from minutes into hours to facilitate interpretation of the association between smartphone screen-time on social media and state self-esteem.

After the data cleaning process, a descriptive analysis of the demographics, including gender, age, nationality, state self-esteem, and smartphone screen-time on social media was performed. Afterwards, the overall frequencies of the visited social media platforms, as well as its gender differences were calculated. Further, compliance rates for the questionnaires were computed. To account for internal consistency of state self-esteem, Cronbach's alpha

was calculated. To visualise the associations between state self-esteem and smartphone screen-time on social media across participants and over time, estimated marginal means (EMMs) were used. Accordingly, the time point variable "*Day*" served as the independent factor and either *smartphone screen-time on social media* or *state self-esteem* was treated as the dependent variable. Within-person fluctuations were examined by visually displaying individual data. The selection of suitable individuals was based on their compliance rate of 100%, their scores, and their gender.

For testing the associations under investigation, two-level linear mixed models (LMMs) with a first-order autoregressive covariance structure were used. LMMs can handle randomly missing data, which is common in ESM studies, and account for the hierarchical structure of the data (level 1) nested within participants (level 2). Additionally, the first-order autoregressive covariance structure is included to account for the underlying correlation of repeated observations (Myin-Germeys & Kuppens, 2022). For the first research question, smartphone screen-time on social media was set as the fixed covariate, and state self-esteem as the outcome variable. The variables Day and Name were both included as random effects. For the second research question, smartphone screen-time on social media, gender, as well as the interaction effect of both variables were included as independent variables. State self-esteem was treated as the dependent variable. Again, both *Name* and *Day* were treated as random effects. The statistical significance of regression estimates was determined using a threshold of $p < .05$.

Results

Descriptive Statistics

In Table 1, characteristics of participants' statistics of all relevant variables can be found. Accordingly, students in this sample spent on average 103.5 minutes (SD = 69.4) per day on their smartphone on social media platforms. Further, participants in this study had averagely moderate state self-esteem during the study period (M = 13.71, SD = 3.05). Further, Instagram (36%), Snapchat (22%), and YouTube (20%) were the most used social media platforms (Figure 3).

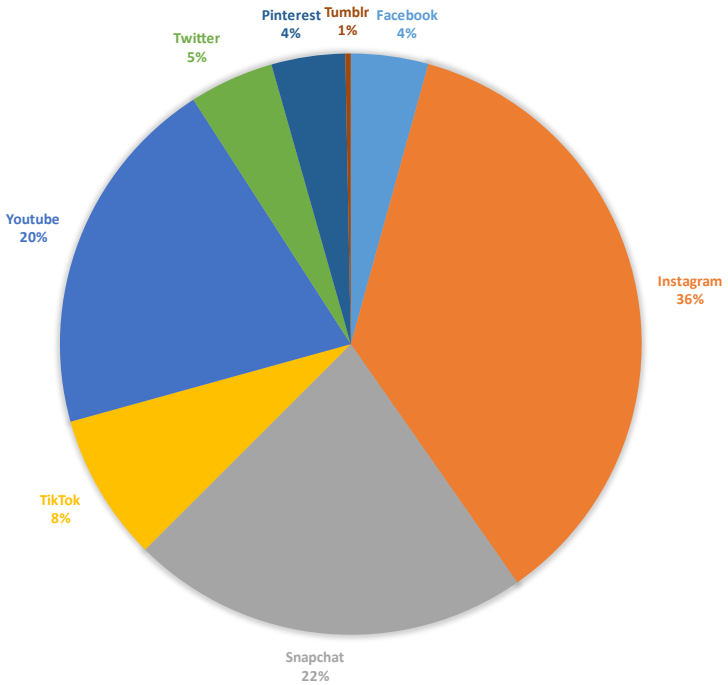
Table 1

Overview of Descriptive Statistics of Smartphone Screen-Time on Social Media and State Self-Esteem

Variable		Total	Women	Men
Smartphone Screen-Time on Social media in minutes	*M*	103.5	110.0	94.55
	SD	69.43	71.45	67.82
State Self-Esteem	*M*	13.71	13.00	14.69
	SD	3.05	2.69	3.32

Figure 3

Frequencies of Most Used Social Media Platforms over 15 days

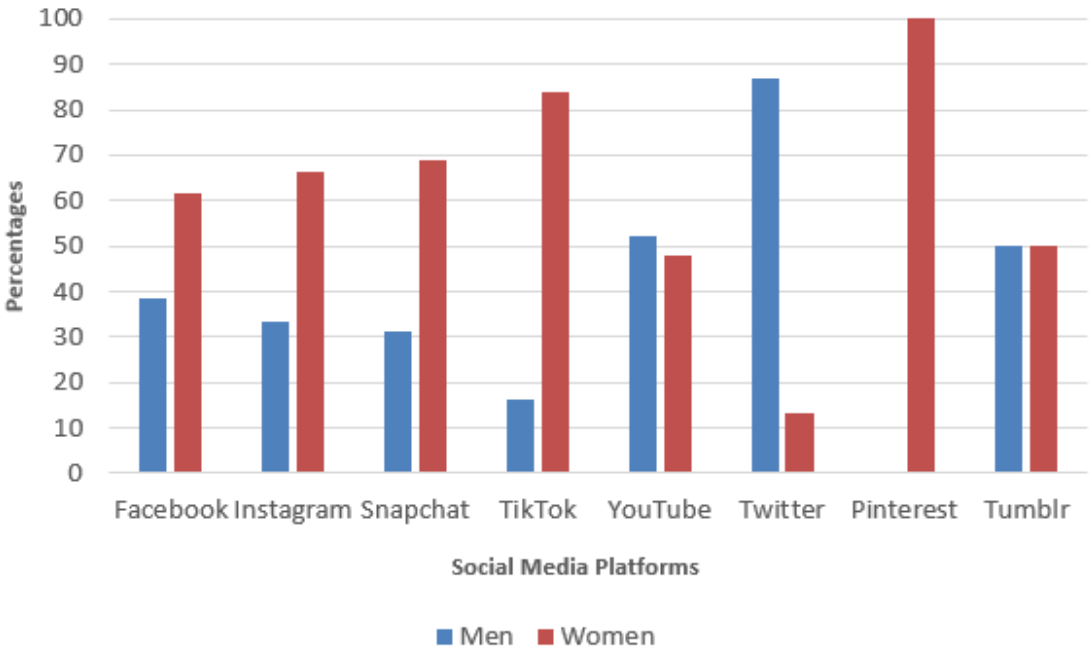


Concerning gender differences in this sample, women spent on average slightly more time on social media and scored slightly lower on state self-esteem compared to men (see Table 1). Additionally, in this particular sample, it was observed that women had a higher frequency of visits to social media platforms such as Instagram, Facebook, Snapchat, and

TikTok, while men tended to utilise YouTube and Twitter more frequently during the study period (Figure 4).

Figure 4

Frequencies of used Social Media Platforms divided by Gender (in Percentages)

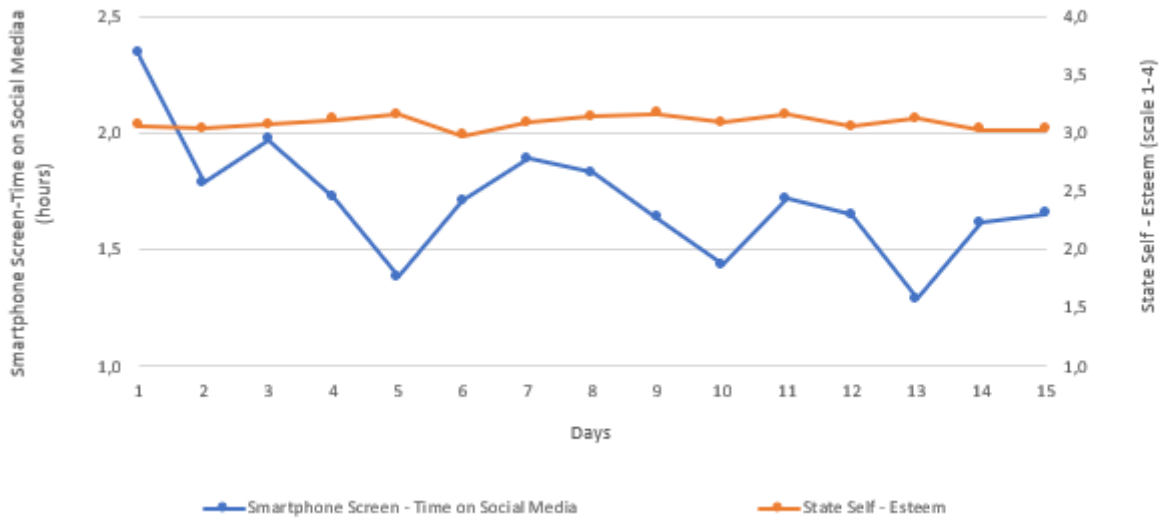


Association between Daily Smartphone Screen-Time on Social Media and State Self-Esteem

The results of the LMM indicated no significant association in the relationship between daily smartphone screen-time on social media and state self-esteem (b = 0.002, SE = 0.003, 95% CI [-0.01, 0.02]). From the results, it became clear that the effect of smartphone screen-time on social media on state self-esteem is almost non-existent. The certainty of this estimate is supported by the narrow confidence interval. Further, the visualised EMMs for smartphone screen-time on social media and state self-esteem over time can be seen in Figure 5. Accordingly, state self-esteem showed almost no temporal fluctuation within this sample over a time period of 15 days. In relation to that, screen-time on social media demonstrated considerable, but not excessive variations. Overall, no significant association between both variables over time were observed.

Figure 5

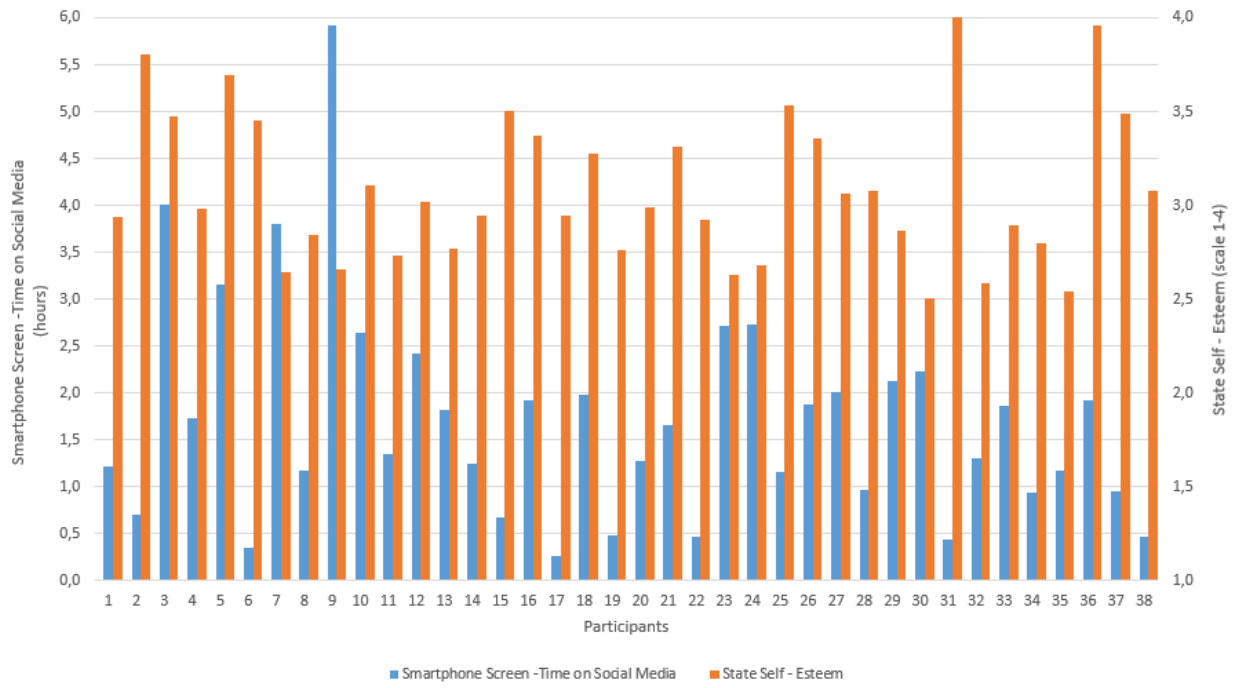
EMMs of Smartphone Screen Time on Social Media and State Self-Esteem over Time



In Figure 6, the EMMs of smartphone screen-time on social media and state self-esteem between participants were visualised. Accordingly, greater variability in both variables compared to the minimal changes over time, can be observed. However, no clear association between both smartphone screen-time on social media and state self-esteem became evident. For instance, whereas participant 38 showed comparable higher levels of state self-esteem and very low amount of smartphone screen-time on social media, participant 3 scored slightly higher on state self-esteem and spent comparable more time on social media. Moreover, participants 18, 33 and 36 spent on average approximately 1.9 hours on social media, but experienced different levels of state self-esteem with scores of 3.3, 2.9 and 3,96 respectively.

Figure 6

EMMs of Smartphone Screen Time on Social Media and State Self-Esteem per Participant



Within-Person Analysis: Individual observations

To gain a better understanding on within-person fluctuations, a more detailed examination was conducted on individual data. Subsequently, one female and one male participant were selected for further individual examination to consider their differences. To guarantee anonymity, pseudonyms were assigned to both individuals. The individual data of participant "Lennart" (male) and "Celia" (female) can be seen in Figure 7.

Participant "Lennart" (Male)

Lennart's time spent on social media varied greatly from day to day, ranging from 1.52 to 5.05 hours. Lennart visited Instagram, Snapchat, and YouTube daily. He exhibited noticeable daily fluctuations in state self-esteem. On Day 2 and 6, he reported a state self-esteem of 1.8, whereas on Day 5 and 9, he scored the highest possible score of 4. Overall, between both variables, no consistent pattern of variation in respect to one another emerged.

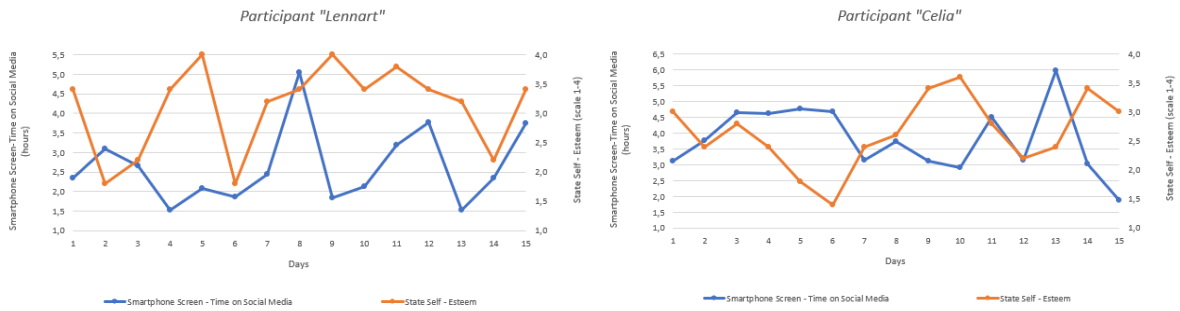
Participant "Celia" (Female)

Overall, the amount of time Celia spent on social media platforms varied considerable between 1.8 hours and nearly 6 hours. Instagram, Snapchat, and Twitter were used daily, closely followed by Pinterest with a usage of 11 out of 15 days. Further, she demonstrated notably fluctuations in state self-esteem over time. Overall, no clear pattern between smartphone screen-time on social media and state self-esteem within participant "Celia" over time became evident. For instance, between Day 3 and Day 6, her state self-esteem score

gradually decreased and reached the lowest score on Day 6, while her smartphone screen-time on social media remained relatively stable during that time.

Figure 7

The Individual Data for Participants "Lennart" and "Celia"



The Moderating Effect of Gender

The outcomes of the LMM testing the interaction effect of gender in the association between smartphone screen-time on social media and state self-esteem are insignificant (b = 0.32, SE = 0.34, p = .33; Table 2]. Consequently, the second hypothesis can be rejected.

Table 2

Results of Moderating Analysis of Gender

					95% Confidence Interval (CI)	
Parameter	*B*	*SE*	*t*	*p*	*Lower bound*	*Upper Bound*
Intercept	14	0.54	25.90	>.001	12.94	15.06
Smartphone Screen-Time on Social Media (hours)	-0.25	0.22	-1.12	.261	-0.68	0.18
Gender	0.89	0.75	1.12	.233	-0.58	2.37
Interaction term	0.32	0.34	0.97	.332	-0.34	0.99

Discussion

The present study aimed to investigate the relationship between time spent on social media (*measured as smartphone screen-time on social media*) and state self-esteem by employing experience sampling methodology. It was examined whether the amount of time spent on social media predicted fluctuations in university students' self-esteem. Additionally, it was tested whether gender affected the strength in this relationship.

The Association between Smartphone Screen-Time on Social Media and State Self-Esteem over Time

This research did not find evidence for an association between smartphone screen-time on social media and state self-esteem in university students over time. This finding contradicts but also align with previous findings. Whereas Cingel et al. (2022) did not find a significant association between overall time spent on social media and state self-esteem, Vogel et al. (2015) identified a significant influence of time spent on specific social media platforms, such as Instagram or Facebook, on self-esteem fluctuations. The difference in the findings might be attributed to the fact that distinct social media platforms vary in its content, features, and nature, which may contribute differently to self-esteem variability. For instance, Vogel et al. (2015) argued that users found that specifically the image-based nature of Instagram or Facebook fostered social comparison, as users encountered idealised and favourably represented content shared by others. This led to perceived inferiority and decreased self-esteem levels (Vogel et al., 2015). Conclusively, investigating social media usage solely under the aspect of time spent and general social media platforms in relation to state self-esteem seemed to overlook the variety of features and activities users can engage in. Further, social comparison might act as a potential mediator in this relationship.

Further, state self-esteem of university students within this sample appeared to remain relatively consistent over time in association with time spent on social media. This outcome contradicts with a study conducted by Faelens et al. (2020), who found a significant negative relationship between daily time spent on Facebook and state self-esteem. The divergence in findings could be attributed to methodological differences. Accordingly, Faelens et al. (2020) employed ESM and assessed state self-esteem and social media use 6 times per day over a period of 14 days and found a significant association between both variables. Hence, it might be that measuring state self-esteem once a day may not fully capture specific factors that contribute to dynamic changes in self-esteem related to smartphone screen-time on social media. This is in line with Vogel et al. (2015), who suggested that state self-esteem is a complex and dynamic construct that is susceptible to change in immediate response to

specific activities or received feedback provided in a social media environment. For instance, it was found that changes in self-esteem was more dependent on peer evaluations received through “likes” in social media environments (Marengo et al., 2021). Accordingly, the effects of social media use on self-esteem may be more short-lived depending on received feedback or encountered content within social media platforms.

Moreover, the individual observations on a within-person level did also not find an association between both variables, but rather demonstrated a unique pattern of smartphone screen-time on social media and state self-esteem. Noteworthy, given the fact that state self-esteem fluctuated considerably over time within-person, it can be implied that other factors beyond smartphone screen-time on social media might influence changes in self-esteem. This is consistent with the findings of Blackwell et al. (2017) research, who found that levels of self-esteem are dependent on individuals’ general well-being. Hence, instability of positive and negative affect predicted higher self-esteem variability. Additionally, stable personality trait such as conscientiousness and extraversion played an influential role in the variability of self-esteem (Blackwell et al., 2017). Conclusively, individual differences might play an important role in the investigation of the relationship between time spent on social media and state self-esteem and therefore, should be accounted for.

Further, the results of the present study indicated that university students in this sample spent on average 1.72 hours per day on social media platforms, which is considerably lower compared to previous research and statistics (Haddad et al., 2021; Statista, 2022). Firstly, these results suggest that students in this sample might not engage in excessive social media consumption, which can be seen as positive news. Secondly, the relatively high standard deviation of 1.16 hours suggested that participants in this sample varied considerably in the amount of time spent on social media platforms. Accordingly, the findings of the present study in contradiction to previous studies might be explained by distinct operationalisations and conceptualisations of social media use in relation to self-esteem fluctuations. In line with previous findings (Cingel et al., 2022; Berryman et al., 2017), different motivations and intentions of social media might influence state self-esteem distinctively. Considering this, specifically problematic social media use has been found to be an indicator in decreases in self-esteem levels. Problematic social media use can be defined as the preoccupation with social media affairs, visiting social media platforms for escaping negative feelings, in addition to excessive amounts of times spent in social media networks (Shannon et al., 2022). Consequently, it can be suggested to consider motivations and intentions for increased social media use in the associations between time spent on social

media and state self-esteem.

The Moderating Effect of Gender

In general, no moderating effect of gender in the relationship under investigation was found. This contradicts with previous studies (Saiphoo et al., 2020; Ma, 2022), who found a significant moderating role of gender in the relationship between social media usage and self-esteem. First of all, it seemed plausible that gender did not function as a moderating variable in the relationship under examination given the absence of a main significant relationship between the two variables in the first place. One potential explanation for these differences in findings may lie in the discrepant engagement in social media platforms, rather than the amount of time spent on social media per se. Accordingly, Ma (2022) found that women differed in the motivation of social media use, thus aiming to foster social relationships, and receiving social information, which ultimately increased their self-esteem levels. Men, on the other side, primarily used social media platforms for entertainment purposes. This gives rise to the presumption that the differences in social media usage purposes, rather than gender per se, play an important role in the association between time spent on social media and self-esteem.

Strengths and Limitations

The present study demonstrated several strengths. In general, to date, this study is the first study employing ESM in the investigation the relationship between smartphone screen-time on social media and state self-esteem in university students. Accordingly, it allowed for evaluating fluctuations in both variables and its association with each other due to repeated measurements over time. This provided the opportunity to explore within-person associations of self-esteem and social media time on the individual level, which has received limited attention in prior research. Additionally, the findings of the present study contributed to the existing body of research examining the potential influence of gender in the relationship. Further, the high compliance rate of 85% in this study might be attributed to fact that the study only administered 2 measurements per day, which reduced the burden on participants. Consequently, the study successfully minimised missing data and potential deviations in the constructs that could have undermined the validity of the findings. This can be interpreted as a clear strength and evidence that the study design and its procedure were likely comprehensible in this sample.

Despite several strengths, this study also exhibited some weaknesses. Firstly, although participants were encouraged to use smartphones' integral screen-time measurement tool to accurately measure their smartphone screen-time on social media, there is no warranty that all

participants complied with this instruction. Consequently, participants could have potentially estimated their screen-time inaccurately due to recall bias (Myen-Germeys & Kuppens, 2022). Secondly, participants were asked about their state self-esteem only once in the evening for the specific day. This might have resulted in individuals lacking "experiential cues" (Connor & Lehmann, 2002), and thus, their answers were prone to biases such as answering based on personality-related beliefs, resulting in potentially distorting results (Conner & Lehmnann, 2002).

Furthermore, measuring state self-esteem with 5 items taken and adapted from Rosenberg Self-Esteem scale, which originally evaluated trait self-esteem, may not fully capture the dynamic nature of state self-esteem. Although high reliability was established, state and trait self-esteem are two different constructs. Therefore, it is important to acknowledge state self-esteem and trait self-esteem as two distinct constructs, which should be emphasised in the assessment and measurement of state self-esteem in the future.

Moreover, another limitation can be attributed to the way social media was captured within this study. Accordingly, social media use was solely investigated under the aspect of time spent on social media, and general social media platforms used. However, it has been shown that individuals differ in their motivations and intentions for using social media, which contributed differently to fluctuations in self-esteem (Valkenburg et al., 2021). Additionally, social media platforms appeared to differ in their nature, which might evoke different underlying mechanisms that influence levels of self-esteem distinctively.

Future Implications

For future research, it can be advised to assess self-esteem in relation to screen-time on social media closer in time. Therefore, assessing both constructs in relation to one another multiple times a day would not only minimise potential cognitive biases, but also evaluate social media use and the time spent on social media usage in a more detailed nature. In relation to that, an objective measurement tool for screen-time should be included to be able to measure these data accurately and more objectively. Nonetheless, to keep participants' burden as low as possible, it is advised to examine the association between both constructs over a period of one complete week instead of two (Myin-Germeys & Kuppens, 2022).

In addition to that, including additional items that measure distinct types of activities, as well as types of content when using social media might lead to a better understanding of the complex and multifaceted nature of social media use in relation to state self-esteem. For instance, Valkenburg et al. (2021) asked participants whether they have actively interacted on social media through sending messages or engaged more passively through viewing posts or

stories of others. Consequently, asking about different experiences made in social media might contribute to a better understanding of its influences on state self-esteem. Further, focusing on certain social media platforms, such Instagram, could help in differentiating the complex relationship between time spent on such platforms and state self-esteem. This method would allow for a more thorough investigation of the unique characteristics and features that Instagram offers, potentially revealing insights on the specific factors and underlying mechanism provoked within such platforms. Additionally, to assess state self-esteem appropriately, it is of high importance to develop and establish an individual scale tailored for state self-esteem. Accordingly, it can be ensured that the measurements and included items are more responsive to fluctuations in self-esteem.

Conclusion

Although no significant relationship was found in the association between both variables as well as in the moderating analysis of gender as a potential influence in this relationship, valuable insights could be derived from this study. Accordingly, this study's findings emphasised that investigating social media usage solely based on time spent on social media and general platforms used may overlook the variety of features and activities users can engage in. Further, it highlighted the importance of considering methodological differences in assessing state self-esteem, as well as time spent on social media using ESM. Examining social media use in association with state self-esteem more closely in real-time, as well as consider distinct types of engagement on social media, might result into a more nuanced understanding of this relationship. Conclusively, the outcomes of this study added value to the complex and multifaceted nature of the relationship between time spent on social media and state self-esteem. By taking the provided recommendations into account, a more discriminated and detailed understanding of the variability in both constructs can be achieved.

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Appendix A

Informed Consent Form

Dear participant,

We appreciate your participation in our study on smartphone screen-time and well-being! Please read the following information thoroughly.

Purpose of the Research

This study aims to investigate the relationship between daily screen-time on smartphones and mental health-related constructs. By taking part in this study, you will help us contribute to the scientific knowledge of daily screen-time on smartphones and social media, as well as its relationship to positive and negative affect and self-esteem.
You are eligible to participate in this study if you are at least 18 years old, proficient in English, enrolled at a university or university of applied sciences, and use your smartphone daily.

Procedure

This research will take place over the course of 15 days beginning on April 10th, 2023. Once you've signed up for our study, you'll get an email with further instructions on how to participate in our study, including information on how to download the needed application 'Ethica' on your smartphone with the respective Study ID that will allow you to access our study within Ethica. After you successfully entered our study in Ethica, you will be presented with the informed consent. After you agreed to participate in our study, you will be asked to fill out demographic data, and to complete three different baseline questionnaires about self-esteem, creativity, and positive and negative affect. It will take roughly 15-20 minutes to complete this questionnaire, and you will only have to answer it once. On April 10th, 2023, in the evening, you will receive your first daily questionnaire via the Ethica App. From April 11th until April 24th, you will receive two brief questionnaires daily via the Ethica App. The first one you will receive in the morning about your smartphone screen time for the previous day. In the evening, you will receive two brief questionnaires about self-esteem, and negative and positive affect, that will take approximately two minutes to complete. On the last day, 25th of April, 2023, you will receive your final questionnaire in the morning to indicate your smartphone screen-time for the previous day. After that, the study is over. It is important to fill out as many questionnaires as possible to ensure the success of the project. Continue

answering the following questions even if you miss one. Please make sure that the notifications on your device for Ethica are turned on.

Risks and Benefits

There are no anticipated risks associated with participating in this study. One possible effect is an increased awareness of your smartphone usage, self-esteem, and negative and positive affect. For this reason, please consider your participation in this study carefully if you are sensitive to these topics. Moreover, if applicable, as a psychology or communication science student of the University of Twente, you are eligible to collect SONA credits as compensation. Finally, your participation helps us to investigate the relationship between smartphone screen time and well-being in university students.

Confidentiality

Your responses will be kept confidential, and your personal information will be anonymized. We will not share your data with any third party or publish it outside of this study. If you wish to receive the research results, you can contact the researchers.

Right to Withdraw

You do not have to participate in this study if you do not wish to do so. Moreover, you may stop participating in our study at any time without having to give a reason. Even after the study has been completed, it is possible to withdraw. On request, the personal data given during the study will be destroyed and will not be used for further analysis.

The Ethics Committee of the University of Twente has approved this study. If you have any questions or concerns, please feel free to contact the researchers at any time, whether before, during, or after your participation.

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I hereby declare that I have fully read and understood the text above and I am willing to participate in this study. By ticking ‘Yes’, I actively consent to participate in this study and the processing of my data.

- Yes, I agree.
- No, I do not agree.

Appendix B

Survey B1

Baseline Questionnaire

1. How old are you (in years)?

2. What is your gender?

A. Female

B. Male

C. Other

D. Prefer not to say

3. Are you currently enrolled in a University or University of Applied Science (HBO, Hochschule)?

A. Yes

B. No

4. Do you own a smartphone that you use daily?

A. Yes

B. No

5. What is your nationality?

A. German

B. Dutch

C. Other (Please indicate)

Survey B2

Daily Smartphone Screen-Time on Social Media

1. Please indicate which social media platforms you have used yesterday on your smartphone. Note that it is possible to select more than one option.

- Facebook
- Instagram

- Snapchat
- TikTok
- YouTube
- Twitter
- Pinterest
- Tumblr
- None

2. Please indicate the total time you spent on social media platforms yesterday in minutes.

VAS (0-600 minutes)

Survey B3

State Self-Esteem

1. Today, I felt that I am a person of worth, at least on an equal plane with others**. ***

2. Today, I took a positive attitude toward myself. *

3. Today, I felt useless.

4. Today, I felt satisfied with myself. *

5. Today, I felt I did not have much to be proud of.

* Items with reversed coding

Appendix C

C1

Email for Participants Who Were Recruited via Convenience Sampling

Dear Participant,

We are pleased to welcome you to our study on smartphone screen time and well-being!

In this email, we would like to introduce you to our study and its experience sampling method. We want to make sure that you understand the whole procedure and feel comfortable during your participation.

The purpose of the study is to investigate students' smartphone screen time and usage in association to their well-being in their day-to-day lives. By asking a few questions about your smartphone usage and screen-time, and well-being at two different times of the day, we want to gain insight into student's behaviour and feelings on a daily basis. For that, you are required to download the smartphone application "Ethica" (See specific instructions below).

For this study you need to fulfil the following characteristics to participate:

- Be above 18 years old
- Be enrolled in a university or university of applied science
- Be fluent in English
- Own a smartphone and use it on a daily basis

Here's what you need to do before and during the study:

Step 1: Download the application "Ethica" from your AppStore or Playstore. Create an account (register as a participant) and log in. It is important that you enable notifications from Ethica. To access this study, fill in the following **Registration Code: 3226**.

Step 2: Once you have registered and accessed the study, you need to fill out the first activity that will be immediately available to you. This activity consists of the **informed consent form** (if you do not give your consent, you cannot participate in this study), **demographic data** (age, gender, nationality), and **three baseline questionnaires**. This will take roughly 15-20 minutes to finish. It is important that you finish these as soon as you have entered the study in Ethica.

Step 3: On the **10th of April 2023**, the first daily assessment will start in the evening at 07.00 pm. You will have time until 12 am to finish this survey. From **April 11th to April 24th**, you will receive two daily questionnaires.
You will receive the first one at 07.00 am in the morning and you'll have time to finish it by 12.00 in the noon.
You will receive the second one at 07.00 pm in the evening and you'll have time to finish it by 12.00 am. Each questionnaire will take approx. 1-2 minutes to complete. We also help you to remember filling out the questionnaire by sending notifications.

Step 4: On the **25th of April 2023**, you will receive your last questionnaire at 7.00 am in the morning. After that, you are done with the study.

Some Important Information for you:

- For the success of our study, we need you to respond to as many assessments as possible. In the case that you missed one assessment, please make sure to continue with the following questionnaires.
- In our study, you will be asked about your smartphone screen-time. For that, please check your screen time on your smartphone.

For **Android:**
Go to **Settings > Digital Wellbeing & parental controls > Dashboard** and check the time under **Screen time**.

For **iOS:** simply go to **Settings** > **Screen time**.

If your smartphone does not have this feature, please make an estimation about your screen-time.

We thank you in advance for your participation and time that you will invest in our study. We hope the study is interesting or even beneficial to you as well and that you are enjoying the assessments!

For further questions, feel free to contact the researchers:

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Email for Participants Who Were Recruited via SONA

Hey!

You recently signed up to take part in the study: "Smartphone Screen Time and Well-Being" on SONA.
Here is some important information about the study.

First, the study will start on the **10th of April**. However, there are some small steps you need **to do before the study starts:**

Step 1: Download the application "Ethica" from your AppStore or Playstore. Create an account (register as a participant) and log in. It is important that you **enable notifications** from Ethica.To access this study, fill in the following **Registration Code: 3226**.

Step 2: Once you have registered and accessed the study, you need to fill out the first activity that will be immediately available to you. This activity consists of the **informed consent form** (if you do not give your consent, you cannot participate in this study), **demographic data** (age, gender, nationality), and **three baseline questionnaires**. This will take roughly 15-20 minutes to finish. It is important that you finish these as soon as you have entered the study in Ethica (You need to fill these out **before 07.00 pm on 10th April 2023!**)

Step 3: On the **10th of April 2023**, the first daily assessment will start in the evening at 07.00 pm. You will have time until 12 am to finish this survey. From **April 11th to April 24th**, you will receive two daily questionnaires.
You will receive the first one at 07.00 am in the morning and you'll have time to finish it by 12.00 in the noon.
You will receive the second one at 07.00 pm in the evening and you'll have time to finish it by 12.00 am. Each questionnaire will take approx. 1-2 minutes to complete. We also help you to remember filling out the questionnaire by sending notifications.

Step 4: On the **25th of April 2023**, you will receive your last questionnaire at 7.00 am in the morning. After that, you are done with the study.

Some Important Information for you:

- For the success of our study, we need you to respond to as many assessments as possible. In the case that you missed one assessment, please make sure to continue with the following questionnaires.
- In our study, you will be asked about your smartphone screen-time. For that, please check your screen time on your smartphone.

For **Android:**
Go to **Settings > Digital Wellbeing & parental controls > Dashboard** and check the time under **Screen time**.

For **iOS:** simply go to **Settings** > **Screen time**.

If your smartphone does not have this feature, please make an estimation about your screen-time.

For the success of our study, we need you to respond to as many assessments as possible. In the case that you missed one assessment, please make sure to continue with the following questionnaires.

We thank you in advance for your participation and time that you will invest in our study. We hope the study is interesting or even beneficial to you and that you are enjoying the assessments!

For further questions, feel free to contact the researchers:

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