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Socially Reconnected or Disconnected? Adolescents' Loneliness and Problematic Social Media Use Following a Smartphone Ban in Dutch Secondary Schools

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Abstract

An increasing number of schools worldwide are implementing smartphone bans, yet there is limited empirical research on their implications for various aspects of youth socio-emotional functioning. The current study examined changes in secondary school students' social and emotional loneliness and problematic social media use (PSMU) following a smartphone ban, and the extent to which these changes depended on students' initial levels of social avoidance and distress (SAD). Our sample included 982 students (M_{age} = 14.1 years, SD = 1.6) from two Dutch secondary schools implementing a full ban (smartphone use was prohibited during all school hours including breaks). Students completed questionnaires about loneliness, PSMU, and SAD before the ban (W1) and three months following the ban (W2). Data were analyzed using difference score and multiple regression analyses. Students used substantially less social media during school breaktimes post-ban compared to pre-ban. Further, we found a small mean-level increase in emotional loneliness from pre-ban to post-ban. While mean levels of social loneliness remained stable, higher baseline levels of SAD predicted increased social loneliness post-ban. There were no changes in PSMU at the mean level nor in relation to students' baseline levels of SAD. Taken together, we did not find that a smartphone ban alleviates secondary school students' loneliness and problematic social media use. On the contrary, such a ban may entail an initial adjustment period and may not be a one-size-fits-all solution for improving students' socio-emotional functioning.

Keywords: smartphone ban; adolescents; secondary schools; loneliness; social media; problematic social media use; social anxiety

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Introduction

There is growing global concern about smartphone use among youth and its potential to interfere with their academic performance, well-being, and social relationships (Abi-Jaoude et al., 2020; Haidt, 2024). In response, numerous countries and international organizations have recommended restricting students' smartphone access in schools (Rahali et al., 2024; UNESCO, 2023). In the Netherlands, the use of phones and other smart devices has

been prohibited in classrooms since January 1, 2024 (Rijksoverheid, 2023). Some schools took this policy a step further by implementing a full smart-device ban, where students are not allowed to use such devices throughout the school day (including breaks) and must leave them at home or in a locker (Pouwels et al., 2024). Despite the increasing prevalence of such bans (Carrión Braakman et al., 2024; UNESCO, 2023), prior research on how aspects of smartphone use, such as social media use (SMU), relate to youth well-being has shown small and inconsistent associations (e.g., Huang, 2017; Meier & Reinecke, 2021; Orben& Przybylski, 2019; Valkenburg et al., 2022). Furthermore, there is limited empirical research on the actual implications of smartphone bans for various aspects of youth functioning.

Some studies have examined how smartphone bans relate to adolescents' academic performance, mental well-being, and cyberbullying, with mixed and nuanced findings (Abrahamsson, 2024; Campbell et al., 2024; Goodyear, Randhawa, et al., 2025). This may partly be due to differences in school policies, namely whether phone use is permitted during recreational time such as breaks (i.e., partial ban or permissive policy) or prohibited throughout the entire school day (i.e., full ban or restrictive policy), as well as how strictly these policies are enforced (Goodyear, Randhawa, et al., 2025; Vanluydt et al., 2026). In this study, we focus on schools implementing a full smartphone ban (i.e., 'at home or in the locker' policy; Pouwels et al., 2024). Recent qualitative research shows that students, parents, and teachers expect a full smartphone ban to have substantial socio-emotional consequences (Pouwels et al., 2024), an aspect often overlooked in existing literature.

During adolescence, peer relationships and belonging become increasingly important (Lam et al., 2014; Tomova et al., 2021). Schools serve as key environments for peer socialization, yet adolescents also interact extensively with peers via social media throughout the day (Anderson et al., 2022; Anderson et al., 2023; Studsrød & Bru, 2011). Social media can be defined as "computer-mediated communication channels that allow users to engage in social interaction with broad and narrow audiences in real time or asynchronously" (Valkenburg et al., 2022), and includes platforms such as Instagram, TikTok, WhatsApp, and Snapchat (Valkenburg et al., 2022).In a recent U.S. survey, the majority of adolescents reported feeling connected to their friends through the use of social media platforms (Faverio et al., 2025), highlighting their relevance for peer relationships.

Many adolescents tend to go online instead of, or even during, in-person interactions, such as school breaks (Yang & Christofferson, 2020). Further, most of their time spent on smartphones during school hours tends to be on social media apps (Burnell et al., 2025). As going online has become embedded in adolescents' daily routines and interactions, smartphone bans that restrict access to social media in school may have implications for their social lives. Although initial studies suggest that smartphone bans may reduce the occurrence of social problems such as (cyber)bullying (Beneito & Vicente-Chirivella, 2022; Böttger & Zierer, 2024), it remains to be investigated whether other social aspects also improve, a gap that this study aims to address.

Social and Emotional Loneliness

A recent pressing concern has been the rise in youth loneliness, a trend often attributed to parallel increases in SMU and decreases in in-person social interaction (Twenge et al., 2019; Twenge et al., 2021). Loneliness can be defined as a subjective negative experience arising from a discrepancy between one's desired and actual social network, either in terms of quantity or quality (Perlman & Peplau, 1982). Adolescent loneliness is associated with adverse short- and long-term mental and physical health outcomes (Hunter et al., 2024), and was found to be higher in countries where adolescents tend to spend more time using smart devices recreationally at school (Twenge, 2026). Further, experience sampling method (ESM) research shows that loneliness is dynamic and can fluctuate based on the social context, including at school (van Roekel et al., 2015). Taken together, a full smartphone ban that prohibits use at school (particularly during recreational times such as breaks) might impact adolescents' levels of loneliness.

An additional consideration is that loneliness is a multidimensional construct (Hunter et al., 2024): A distinction can be made between social and emotional loneliness. Social loneliness refers to the perceived lack of social integration within peer networks, for example feeling excluded or lacking a sense of belonging within a peer group. Emotional loneliness refers to the perceived absence of intimacy and support in a close dyadic friendship, for example lacking a close friend who understands you and is there for you (Hoza et al., 2000; Maes et al., 2022). As these constructs tap into different types of peer relationships, which might fulfill distinct social needs (Maes et al., 2022), further research is warranted to examine the impact of a full smartphone ban on both social and emotional loneliness.

Many students, parents, and teachers expect positive social outcomes from a full smartphone ban, such as an increase in the quantity and quality of in-person interactions (Pouwels et al., 2024). This is in line with research showing that adolescents tend to feel less lonely during in-person interactions than online interactions (Achterhof et al., 2022). Furthermore, students can no longer go online during offline interactions (e.g., school breaktimes) following a full ban. When perceived as interfering with offline interactions, this so-called digital social multitasking has been associated with higher levels of loneliness (Yang & Christofferson, 2020). Thus, on average, full smartphone bans that restrict phone access in school during recreational time (as well as in class) might reduce both social and emotional loneliness by facilitating more in-person interactions without digital interruptions.

The Role of Social Avoidance and Distress

Nevertheless, the impact of the smartphone ban on loneliness may differ across individuals. For adolescents with high social avoidance and distress (SAD), socially integrating at school may be challenging (Sumter et al., 2009). SAD, a subcomponent of social anxiety, refers to distress in social situations, often leading to their avoidance due to fear of judgment or social failure (La Greca & Lopez, 1998). According to the compensatory Internet use theory, individuals with social difficulties (e.g., SAD) may turn to online social platforms to fulfill their social needs (Kardefelt-Winther, 2014). They may obtain social support online that they lack offline (poor-get-richer hypothesis; Pouwels et al., 2022) and therefore seek—or even rely on—the virtual world (e.g., during school breaktimes). Parents, teachers, and students are therefore concerned that students with social difficulties may feel lonelier following the ban (Pouwels et al., 2024). Taken together, although many adolescents may feel less lonely due to more in-person interactions at school following a full smartphone ban, those with higher SAD might instead experience increased social and emotional loneliness.

Problematic Social Media Use

In addition to loneliness, the ban may also impact some adolescents' problematic social media use (PSMU). PSMU involves difficulties in regulating one's own social media use to the extent that one (1) becomes preoccupied with social media, (2) experiences negative affect when access is restricted, and/or (3) exhibits lower daily functioning (Andreassen, 2015; Boer et al., 2020). Most adolescents who use social media a lot do not show PSMU; the prevalence of PSMU was around 7.4% across 29 European countries (Boer et al., 2020). Adolescents who experience social difficulties offline (such as social anxiety) tend to be more susceptible to PSMU, as they may prefer or rely on online interactions (Ali et al., 2021; Casale et al., 2022). Due to the ban, these adolescents may no longer be able to compensate for unmet social needs (e.g., the need for social interaction) by going online during school hours, which may exacerbate their urge to use social media. These concerns have also been raised by students, parents, and teachers regarding the ban (Pouwels et al., 2024). Therefore, adolescents with higher SAD may show increased PSMU following a full smartphone ban.

Current Study

Taken together, this study examined changes in adolescents' social and emotional loneliness following the implementation of a full smartphone ban at school (Aim 1), and the extent to which pre-ban SAD levels predict these changes (Aim 2). Additionally, we examined whether the ban leads to changes in adolescents' PSMU (exploratory research question) and whether pre-ban SAD levels predict this change (Aim 3). We hypothesized that mean-level social and emotional loneliness would decrease from pre- to post-ban (H1). However, adolescents with higher baseline SAD were expected to show increased social and emotional loneliness (H2) and PSMU (H3) from pre- to post-ban. All hypotheses and tested models in this study were preregistered prior to accessing the data (https://edu.nl/dmh7h).

Methods

Design and Sample

We used data from the Nijmegen Smartphone Ban Study (Pouwels et al., 2024), which was a two-wave natural experiment conducted at two Dutch secondary schools (ages 12–18). Both schools introduced a full smartphone

ban in January 2024, in which students were not allowed to use their phones and other smart devices at any point in the school day, even during breaktimes. They had to either leave their phone at home or place it in a locker. Self-reported data were collected before the ban in December 2023 (W1), and around three months following the ban in March/April 2024 (W2).

In the Netherlands, students attend secondary education for 4–6 years depending on the educational level to which they are assigned. Our sample included students from three different levels in the Dutch system: preparatory vocational (MAVO, involves vocational training), intermediate (HAVO, prepares students for universities of applied sciences and applied professions), and pre-university (VWO, prepares students for research universities and academic or highly specialized professions). Participants from school 1 attended grades 1–6 (equivalent to ages 12–18) across preparatory vocational, intermediate, and pre-university education. Participants from school 2 attended grades 1–4 (equivalent to ages 12–16) at preparatory vocational education.

In total, data from 982 students aged 11 to 22 (M = 14.1, SD = 1.6, 42.4% girls, 85.2% Dutch) were analyzed. Of this sample, 90% had complete data at W1, and 39.3% also participated in W2 (see Table 1 for an overview of demographics at both waves).

Table 1. *Pre-Ban (W1) and Post-Ban (W2) Demographics.*

	Wave 1 (N = 982)	Wave 2 (N = 386)
	n (%)	*n* (%)
Gender		
Boy	537 (54.7%)	198 (51.3%)
Girl	416 (42.4%)	177 (45.9%)
Other	7 (0.7%)	3 (0.8%)
I don't know	3 (0.3%)	1 (0.3%)
I don't want to say	19 (1.9%)	7 (1.8%)
Dutch		
Yes	837 (85.2%)	348 (90.2%)
No	145 (14.8%)	38 (9.8%)
Educational level		
MAVO (preparatory vocational)	305 (31.1%)	162 (42.0%)
MAVO/HAVO	103 (10.5%)	24 (6.2%)
HAVO (intermediate)	178 (18.1%)	24 (6.2%)
HAVO/VWO	114 (11.6%)	32 (8.3%)
VWO (pre-university)	282 (28.7%)	144 (37.3%)
Grade		
1 (ages 12–13)	225 (22.9%)	109 (28.3%)
2 (ages 13–14)	182 (18.5%)	100 (25.9%)
3 (ages 14–15)	239 (24.3%)	103 (26.7%)
4 (ages 15–16)	206 (21.0%)	49 (12.7%)
5 (ages 16–17)	99 (10.1%)	20 (5.2%)
6 (ages 17–18)	31 (3.2%)	5 (1.3%)
School		
1	770 (78.4%)	237 (61.3%)
2	212 (21.6%)	149 (38.6%)
Breaktime Social Media Use	(n = 949)	(n = 357)
Never (1)	101 (10.6%)	216 (60.5%)
Rarely (2)	186 (19.6%)	60 (16.8%)
Sometimes (3)	293 (30.9%)	49 (13.7%)
Most of the time (4)	264 (27.8%)	22 (6.2%)
Always (5)	105 (11.1%)	10 (2.8%)

Note. The MAVO track is from grades 1–4 (equivalent to ages 12–16), while the HAVO and VWO tracks are from grades 1–6 (equivalent to ages 12–18). School refers to the percentage of students from the total sample who attended either school 1 or school 2. Breaktime social media use refers to the percentage of students who reported using social media during the lunch break from *never* (1) to *always* (5).

Procedure

As the study was conducted at the schools' request, the schools obtained parental consent. In line with their policy, a passive parental consent procedure was used. The school informed parents about the study, and parents could withdraw their child's participation by contacting the school administration. No parents objected to their child's participation. Children provided informed assent at the beginning of the survey. The study was approved by the Faculty of Social Sciences Ethics Committee at Radboud University (ECSW-2023-129).

At each wave, students received a link to a Qualtrics survey from their teacher (for a complete codebook and procedure of the Nijmegen Smartphone Ban Study, see https://edu.nl/ftn9b). Students completed the survey either in class or in their own time at their teacher's discretion. The survey took approximately 15 minutes to complete, and students could withdraw at any time without consequences. At both waves, the surveys were accessible for two to three weeks. Data were stored anonymously. All participants were included in a raffle for a prize of 25 euros. Eight students per school were randomly selected as winners.

Measures

Social Avoidance and Distress

SAD was measured with the SAD-General subscale of the Social Anxiety Scale for Adolescents Short Form (Nelemans et al., 2017). This subscale consisted of four items rated on a 5-point Likert-type scale (1 = *never* to 5 = *all the time*). The final score was calculated by averaging the item scores. As the Likert-type scales used in this study contain four or less items per construct, we computed McDonald's Omega (ω; McDonald, 1999) to robustly evaluate internal consistencies (Revelle & Zinbarg, 2009). The reliability was excellent at W1 (ω = .91) and W2 (ω = .90).

Social and Emotional Loneliness

A shortened, adapted version of the Peer Network and Dyadic Loneliness Scale (Hoza et al., 2000) was used to measure social and emotional loneliness. Each subscale included three items rated on a 5-point Likert-type scale (1 = *never* to 5 = *all the time*). The original Harter's response format, which can be difficult and time consuming to fill in for some youth (Maes et al., 2022; Wichstraum, 1995), was adapted to a Likert-type scale to make the survey shorter and easier for younger adolescents to complete (in line with Parker et al., 2016; Stevens et al., 2023). Item 3 from social loneliness and all items from emotional loneliness were reverse-coded. Example items are "*I feel excluded from other peers*" (social loneliness) and "*I have a friend who is always there for me*" (reversed; emotional loneliness). An average score was computed per subscale. For social loneliness, the reliability (McDonald, 1999) was near acceptable at W1 (ω = .63) and W2 (ω = .68). For emotional loneliness, the reliability was excellent (ω = .92 at both waves).

Problematic Social Media Use

The Social Media Disorder Scale (van den Eijnden et al., 2016) was used to measure PSMU. This scale consists of nine items with binary answer options *yes* (1) or *no* (0). A sum score of 'yes' responses was computed to indicate the level of PSMU, ranging from 0 to 9. This scale has been validated in a nationally representative Dutch sample of adolescents aged 12–16 (Boer et al., 2022), is widely used in studies on adolescent PSMU, and shows good psychometric properties (Schlossarek et al., 2023). As this scale is dichotomous, we used ordinal alpha based on the tetrachoric correlation matrix to calculate reliability (Gadermann et al., 2019), which was good at W1 (ordinal α = .87) and W2 (ordinal α = .85).

Breaktime Social Media Use

To check whether the ban actually reduced students' SMU, participants reported how often they use social media on their phone, laptop, or smartwatch during the lunch break at both waves, using a 5-point Likert-type scale (1 = *never* to 5 = *always*). In the survey instructions prior to the section in which this question was included,

participants were instructed the following: “When answering the following questions, please think about your experiences using social media (e.g., WhatsApp, TikTok, Instagram, Snapchat, BeReal)".

Statistical Analysis

Data were processed and analyzed in R (R Core Team, 2023), following our preregistration (https://edu.nl/dmh7h). The data, syntax, and codebook relevant to this study are also openly available online (https://edu.nl/xxkr4). A significance threshold of $p < .05$ was used for all tests. Of the full sample, 60.7% had missing data at W2, due to international mobility and the upcoming exam season. To assess potential attrition bias, we conducted attrition analyses (see Appendix A). Participants who were boys, in a lower educational level, in a higher grade, attending school 1, or more emotionally lonely at W1 were less likely to participate at W2, which suggests that data were not missing completely at random. Hence, we included all cases in the main analyses and handled missing data with full-information maximum likelihood (FIML).

We ruled out potential classroom-level effects by computing the intra class correlation coefficient (ICC). As the ICC was well below the commonly used threshold of .10 (Hox et al., 2002), we proceeded without accounting for clustering at the classroom level. We then followed our preregistered plan, though with one deviation. Instead of using paired-samples *t*-tests to evaluate mean-level changes in social and emotional loneliness (Aim 1) and PSMU (exploratory), we estimated mean-level changes in observed scores within a path analysis framework using the *lavaan* R package (Rosseel, 2012), enabling FIML to account for missing data. Specifically, for each outcome, the means, variances, and covariance of the observed scores at both time points were estimated, allowing for the direct calculation of the mean difference parameter (W2−W1). We tested whether the difference score significantly differed from zero. Using FIML allowed participants with data available for at least one of the two waves to be included ($n = 930$ for social and emotional loneliness, $n = 943$ for PSMU).

Second, we examined predictors of change in social loneliness, emotional loneliness, and PSMU with multiple regression analyses using *lavaan* (Rosseel, 2012). In each model, the outcome was the respective observed difference score (W2−W1), with W1 SAD as the main predictor. We controlled for the W1 score of the respective outcome along with W1 gender, grade, educational level, and school. Due to few responses in the gender categories "other", "I don't know”, and "I don't want to say” (see Table 1), these were coded as missing and the remaining responses were dummy coded (*boy* = 0, *girl* = 1). Grade (7–12) was coded from 1 to 6, educational level was coded from 1 (*lowest*) to 5 (*highest*), and school was dummy coded (school 1 = 0 and school 2 = 1). All continuous predictors were standardized to aid interpretation of the intercept. All preregistered regression assumptions were met, except for a mild violation of linearity in the PSMU model, resulting in use of the robust maximum likelihood estimator for that model. We used difference scores as the outcomes as we were interested in the magnitude of change from pre- to post-ban across SAD levels. However, to check the robustness of our findings, we reran our analyses with W2 scores as the outcome variables while controlling for W1 scores.

Results

Descriptive Statistics

Table 2 presents descriptives and Spearman’s rank-order correlations (ρ). All variables showed moderate rank-order stability (ρ = .42 to .59, $p < .001$) except for breaktime social media use (SMU), which showed weak stability (ρ = .19, $p < .001$). SAD correlated positively with social loneliness, emotional loneliness, and PSMU at both waves (ρ = .10 to .39, $p < .05$).W1 breaktime SMU was positively correlated with both W1 social loneliness and PSMU (ρ = .11 to .27, $p < .01$), whereas W2 breaktime SMU was only positively correlated with W2 PSMU (ρ = .15, $p < .01$).The latter correlation suggests that those with higher levels of PSMU at W2 continued to engage in higher breaktime SMU at W2, despite the smartphone ban.

Changes in Breaktime SMU

To examine whether the ban reduced students’ SMU, we conducted a difference score analysis of mean-level change in breaktime SMU using observed scores (W2−W1). Results indicated a large significant decrease in the estimated mean of breaktime SMU from W1 to W2 ($\Delta M = -1.36$, $SE = 0.06$, $z = -21.47$, $p < .001$, Cohen’s $d = -1.22$).

Additionally, the proportion of participants who reported never using social media during breaks was substantially higher at W2 (60.5%) than at W1 (10.6%; see Table 1).

Table 2. *Study Variables: Descriptives and Spearman-Rank Correlations.*

	n	*M* (*SD*)	Range	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) SAD W1	902	2.01 (0.83)	1–5	—								
(2) SAD W2	336	2.11 (0.84)	1–4.5	.58***	—							
(3) Social Loneliness W1	904	1.76 (0.74)	1–5	.39***	.22***	—						
(4) Social Loneliness W2	340	1.76 (0.74)	1–5	.28***	.35***	.42***	—					
(5) Emotional Loneliness W1	904	1.95 (1.03)	1–5	.30***	.20***	.27***	.20***	—				
(6) Emotional Loneliness W2	340	1.99 (1.00)	1–5	.16**	.20***	.19***	.27***	.59***	—			
(7) PSMU W1	926	1.55 (1.78)	0–9	.10**	.11*	.14***	.17**	.01	.02	—		
(8) PSMU W2	348	1.48 (1.75)	0–9	.09	.16**	.17**	.30***	−.03	.03	.50***	—	
(9) Breaktime SMU W1	949	3.09 (1.16)	1–5	−.05	.03	.11**	.08	.00	−.04	.27***	.26***	—
(10) Breaktime SMU W2	357	1.74 (1.08)	1–5	−.05	−.02	.00	.04	−.06	−.01	.04	.15**	.19***

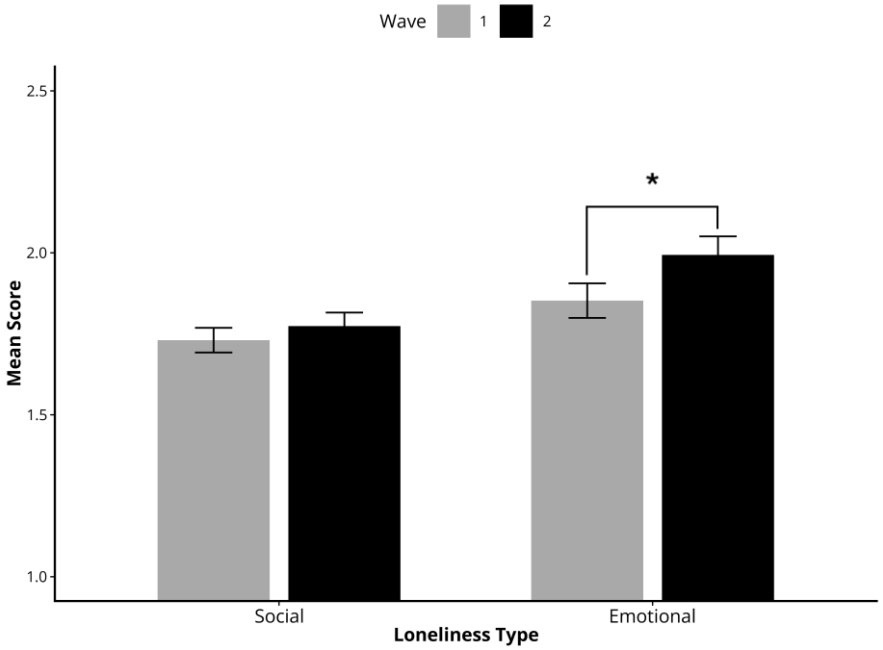
Note. SAD = social avoidance and distress; PSMU = problematic social media use; SMU = social media use. Range refers to the observed minimum and maximum values in the data. *p < .05, **p < .01, ***p < .001.

Primary Analyses

Changes in Loneliness (Aim 1)

The difference in estimated means was not significant for social loneliness (ΔM = 0.02, SE = 0.04, z = 0.50, p = .620) but was significant for emotional loneliness (ΔM = 0.10, SE = 0.05, z = 1.99, p = .046, Cohen's d = 0.09). These findings indicate a small increase in emotional loneliness following the ban, while social loneliness remained stable (Figure 1).

Figure 1. *Mean Levels of Loneliness Pre-Ban (W1) and Post-Ban (W2).*

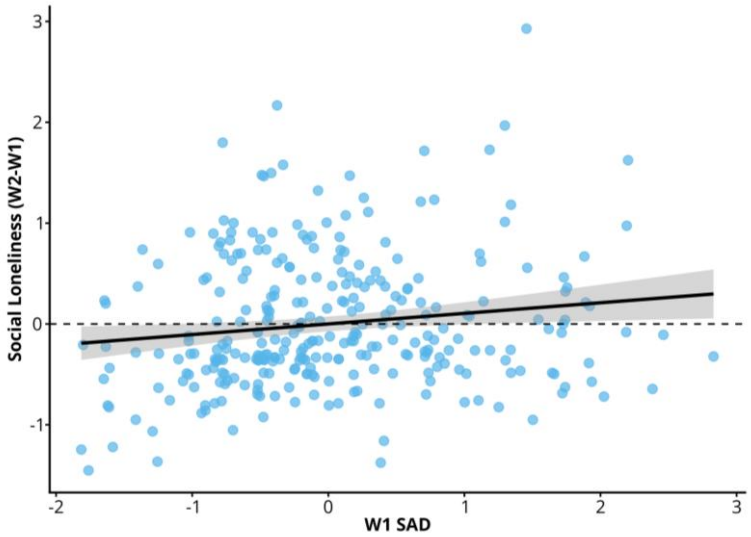


Note. Complete-case data (n = 314) is used to illustrate changes in mean levels of social and emotional loneliness.

SAD and Loneliness (Aim 2)

W1 SAD significantly predicted changes in social loneliness (β = .11, *SE* = 0.04, *p* = .005; see Table 3). To interpret this effect, we calculated the predicted values of social loneliness changes (*y*) at different standardized W1 SAD values. At average SAD (intercept), the predicted change (*y* = 0.07) indicates a non-significant increase in social loneliness (see Table 3). At relatively high SAD (+1*SD*), the larger predicted change (*y* = 0.19) indicates increases in social loneliness. At relatively low SAD (−1*SD*), the predicted change (*y* = −0.04) indicates a slight decrease in social loneliness. Thus, changes in social loneliness depended on W1 SAD levels, with high W1 SAD predicting increases in social loneliness from pre- to post-ban (see Figure 2). Regarding changes in emotional loneliness, W1 SAD was not a significant predictor (see Table 3).

Figure 2. *Residual Plot: W1 SAD and Changes in Social Loneliness.*



Note. Complete-case data (*n* = 304) are used to illustrate the association between the residuals of W1 SAD and changes in social loneliness (W2−W1) after controlling for other variables.

Additionally, some of the demographic variables were significant predictors of changes in loneliness. Being in a lower educational level was associated with increases in social loneliness (β = −.14, *SE* = 0.06, *p* = .023), while being a boy was associated with increases in emotional loneliness from pre- to post-ban (β = −.30, *SE* = 0.10, *p* = .004; see Table 3).

SAD and PSMU (Aim 3)

We first explored whether there was a mean-level change in PSMU from pre- to post-ban. The difference in estimated means (W2−W1) was not significant (Δ*M* = −0.02, *SE* = 0.09, *z* = −0.20, *p* = .843). Further, while W1 SAD did not significantly predict changes in PSMU, some demographic variables were significant predictors of changes in PSMU. Being in a lower educational level (β = −.40, *SE* = 0.14, *p* = .004) and being a girl (β = .48, *SE* = 0.17, *p* = .005) was associated with increases in PSMU from pre- to post-ban (see Table 3).

Sensitivity Analyses

To check the robustness of our findings, we ran four sensitivity analyses. First, we reran our analyses with complete cases only (see Appendix B). Second, we checked for suspicious response patterns and influential cases; while there were no suspicious response patterns, some influential cases were identified that could potentially influence model fit (Fox, 2019). We therefore re-ran regressions excluding influential cases as a robustness check (see Appendix C). Findings of both sets of analyses were largely comparable to the original, except that educational level no longer significantly predicted changes in social loneliness.

The third sensitivity analysis consisted of regressions with W2 social loneliness, emotional loneliness, and PSMU as outcome variables instead of difference scores (W2–W1), while controlling for their respective W1 scores (see Appendix D). Findings were consistent with the original analyses. For the fourth and final sensitivity analysis, we further examined the social loneliness subscale at the item level given its relatively low internal consistency (ω = .63 at T1 and ω = .68 at T2). We excluded item 3 as it correlated less strongly with the other items in the scale

(see Appendix E) and reran the regression analysis concerning social loneliness (Model 1). These findings were also consistent with the original analysis; W1 SAD remained a significant predictor of changes in social loneliness.

Table 3. *Multiple Regression Results (N = 982).*

	β	*SE*	*p*	R^2
Model 1: Social Loneliness				.30
Intercept	.07	.07	.342	
School (school 1 = 0)	−.12	.14	.391	
Grade	.07	.04	.108	
Educational Level	**−.14**	**.06**	**.023**	
Gender (male = 0)	.02	.08	.807	
Social Loneliness W1	**−.47**	**.05**	**<.001**	
SAD W1	**.11**	**.04**	**.005**	
Model 2: Emotional Loneliness				.23
Intercept	**.21**	**.10**	**.028**	
School (school 1 = 0)	.07	.18	.682	
Grade	.00	.06	.999	
Educational Level	-.04	.08	.592	
Gender (male = 0)	**−.30**	**.10**	**.004**	
Emotional Loneliness W1	**−.48**	**.06**	**<.001**	
SAD W1	.02	.05	.766	
Model 3: PSMU				.28
Intercept	−.08	.17	.623	
School (school 1 = 0)	−.33	.31	.296	
Grade	.18	.10	.062	
Educational Level	**−.40**	**.14**	**.004**	
Gender (male = 0)	**.48**	**.17**	**.005**	
PSMU W1	**−.89**	**.09**	**<.001**	
SAD W1	.03	.08	.679	

Note. In each model, the difference score (W2-W1) of the construct is the outcome variable. Significant results ($p < .05$) are shown in bold.

Discussion

In response to growing societal concerns about the negative impact of smartphone use on various aspects of youth functioning, numerous countries are enforcing policies to ban or restrict smartphone use in schools (UNESCO, 2023). However, empirical evidence supporting the effectiveness of such policies is scarce (Rahali et al., 2024).This study is among the first to investigate changes in adolescents' loneliness and problematic social media use (PSMU) at Dutch secondary schools implementing a full smartphone ban (i.e., prohibiting the use of smartphones and other smart devices during all school hours including breaks), and the extent to which pre-ban levels of social avoidance and distress (SAD) predict these changes. Contrary to expectations, we found a small overall increase in emotional loneliness from pre- to post-ban, suggesting that on average, adolescents experienced less intimacy and support in close friendships after the ban was implemented. In line with expectations, higher baseline SAD was associated with increases in social loneliness from pre- to post-ban, suggesting that adolescents with SAD felt even less integrated among their peers after the ban was implemented. We did not find evidence for changes in PSMU either at the overall level or in relation to SAD.

Altogether, our findings suggest that a smartphone ban at school might not reduce adolescents' loneliness and PSMU, at least not in a relatively short time frame (i.e., three to four months after the ban was implemented). Rather, the ban may entail some initial social challenges (i.e., emotional loneliness), and its impact does not seem to be uniform across adolescents; those already experiencing social difficulties (such as SAD) before the ban may be more at risk for social loneliness following the implementation of the ban. This finding aligns with existing research, although limited in scope, from the Netherlands as well as other European countries (e.g., UK and

Norway) showing that there is heterogeneity in the impact of smartphone bans on youth outcomes (Abrahamsson, 2024; Goodyear, James, et al., 2025; Rahali et al., 2024; Vanluydt et al., 2026).

Changes in Breaktime Social Media Use

To first check whether implementing a smartphone ban was effective in reducing students' social media use (SMU) at school overall, we compared pre- and post-ban levels of SMU during lunch breaks, which are relatively unstructured periods for socializing and other recreational activities (Blatchford, 2012). We found a substantial decrease in breaktime SMU; the majority of students reported never engaging in breaktime SMU after the ban was implemented. However, a considerable minority continued to use social media during breaks. Thus, although both schools included in this study intended a 'full' smartphone ban, our findings suggest that students can still find a way to access key smartphone applications, such as social media, for instance through covert smartphone use (e.g., in bathrooms) or via alternative devices. Previous research shows that adolescents often access social media on their laptops (Martin et al., 2018), which are permitted by most schools in the Netherlands. Additionally, there may be differences in how strictly schools, and educators within the same school, enforce a full smartphone ban in practice (Randhawa et al., 2025), leaving room for social media or smartphone use in certain areas or periods in school.

Correlations indicated that those with higher PSMU may particularly engage in breaktime SMU post-ban, supporting the notion that PSMU entails difficulties in disengaging from social media (van den Eijnden et al., 2016). This may also explain why we did not observe a decrease in overall PSMU from pre- to post-ban; those with PSMU may actively seek ways to bypass smartphone restrictions, thereby maintaining problematic use patterns. These initial findings highlight the need to complement broad smartphone policies with targeted support for non-compliant students focused on reducing or managing PSMU, such as trainings aimed at digital literacy and healthy social media engagement (Nagata et al., 2025).

Changes in Social and Emotional Loneliness

School is a key social context (Studsrød & Bru, 2011) and students, parents, and teachers expect not only academic and cognitive implications, but also socio-emotional consequences of smartphone bans (Pouwels et al., 2024), warranting their investigation. We expected overall decreases in social and emotional loneliness from pre- to post-ban (H1), in line with prior findings suggesting that adolescents feel more connected to peers during in-person interactions uninterrupted by smartphone use (Achterhof et al., 2022; Pouwels et al., 2024; Yang & Christofferson, 2020). However, social loneliness (i.e., perceived lack of integration within peer networks) remained stable from pre- to post-ban. Most adolescents might have already felt sufficiently integrated among peers before the ban, indicated by the relatively low mean found in our study. Post-ban, students continued to have opportunities for in-person interaction in school, which may have helped maintain these low levels. Moreover, smartphone use during in-person interactions can entail drawbacks, such as being perceived as distracting or dismissive during the interaction, but also benefits, such as a feeling a sense of connection over a shared activity (Yang et al., 2021). While the benefits may have been more salient before the ban, the drawbacks may be reduced following the ban, resulting in comparable levels of social loneliness.

Contrary to expectations, overall levels of emotional loneliness (i.e., perceived lack of intimacy and support in close dyadic friendships) slightly increased from pre- to post-ban. Social media allows one to stay in touch with close friends asynchronously throughout the day regardless of physical proximity (Nesi et al., 2018), and prior studies have found that SMU enhances friendship closeness for some adolescents (Angelini et al., 2024; Pouwels et al., 2021). Further, the lack of physical cues online could aid self-disclosure compared to in-person settings (Nesi et al., 2018). Following the ban, adolescents—especially those whose close friends are not in immediate proximity (i.e., in the same class or school)—can no longer easily reach out to share their feelings or receive support online during school hours, and self-disclosure may become more difficult. Nevertheless, it remains to be investigated whether elevated emotional loneliness is a transitionary or longer-term effect of the ban. An alternative possibility is that emotional loneliness might decline over time as students become more accustomed to ban and focus more on in-person interactions, as prior research shows that the quality of in-person support tends to be higher than online support (Trepte et al., 2015).

The Role of Baseline Social Avoidance and Distress

We further examined whether changes in social and emotional loneliness depended on pre-ban SAD. Although social loneliness did not change overall, it increased among adolescents with high pre-ban SAD, providing partial support for H2. Adolescents with high SAD may particularly struggle to integrate with peers at school, as they tend to avoid social interactions from fear of judgment or social failure (La Greca & Lopez, 1998). Post-ban, these adolescents may no longer be able to rely on online social platforms during school to fulfill social needs (compensatory Internet use theory; Kardefelt-Winther, 2014) or to obtain social support (poor-get-richer hypothesis; Pouwels et al., 2022). Our findings indicate that adolescents with SAD may require additional support to socially adjust following a smartphone ban. However, further research is required to examine whether effects are long-lasting or reflect an initial adjustment period.

Changes in Problematic Social Media Use

Although high SAD was associated with increased social loneliness, we did not find associations with increased PSMU following implementation of the ban, contrary to H3. We expected that adolescents with SAD might show a heightened preference for, or reliance on, social media post-ban, as they might be more confronted with their lack of social integration and could no longer compensate for unmet social needs by going online during school (Ali et al., 2021; Casale et al., 2022; Pouwels et al., 2024). The finding that SAD is related to increased social loneliness but not PSMU is unexpected, as all three positively correlate with each other. However, as prior research has identified loneliness as an antecedent of PSMU (O'Day & Heimberg, 2021), it is possible that SAD leads to increased social loneliness in the months after implementation of the ban, which in turn contributes to increased PSMU over a longer time period. This is especially likely given that the measure used in this study—the Social Media Disorder Scale (van den Eijnden et al., 2016)—likely captures more severe PSMU symptoms as it was adapted from the DSM 5 criteria for Internet Gaming Disorder.

Limitations and Suggestions for Future Research

This study has a number of limitations. The first broadly pertains to the operationalization and reliability of some key constructs in this study. Regarding breaktime SMU, the response options consisted of subjective frequency expressions (e.g., 'rarely' or 'sometimes'), which may be interpreted differently across participants (Bocklisch et al., 2012). Breaktime SMU was also a global measure of how often social media were used, conflating different platforms and types of use. Research increasingly suggests that adolescents' SMU is not a monolith (Maheux et al., 2025); associations with socio-emotional functioning may differ depending on how adolescents engage with social media. Additionally, the three-item social loneliness measure used in the current study showed relatively low reliability. These limitations should be taken into account when interpreting the study findings concerning breaktime SMU and social loneliness. Further research is warranted using quantifiable and preferably objective SMU measures (e.g., digital trace data; Ohme et al., 2024; Verbeij et al., 2021) with a distinction between types of use (e.g., platforms), as well as established measures of social loneliness with strong psychometric properties, such as the original Peer Network and Dyadic Loneliness Scale (Hoza et al., 2000).

A second limitation pertains to the design of this study; it included only two schools in one region of the Netherlands and did not include a comparison group of schools without a smartphone ban, which limits our conclusions. It is possible that some of the observed changes, such as the association between higher SAD and increases in social loneliness, reflect broader developmental trends rather than being a consequence of the ban (Maes et al., 2019). Future research should compare a representative sample of schools with varying smartphone policies (e.g., Goodyear, Randhawa, et al., 2025) using a longitudinal design, while also comparing the extent to which schools enforce the policy in practice, to determine the extent to which outcomes are conclusively attributable to a full smartphone ban.

A third limitation, also concerning the design of this study, is that we had a single post-ban measurement wave around three months after the ban was implemented. While the initial and shorter-term response to a new policy is important to investigate (e.g., a few months after the ban is implemented), the longer-term effects (e.g., after a year) remain unknown. It is plausible that adolescents experience an initial adjustment period—particularly given their habitual smartphone use throughout the day (Anderson et al., 2023)—but eventually adapt to the new context. It is also plausible that a longer time period is required to see substantial changes in constructs like

loneliness and PSMU following a smartphone ban. Hence, future studies on smartphone bans effects should include follow-up measures over a longer time frame when feasible.

A final limitation is that our findings are based on group-level associations, which may obscure the heterogeneity of individual experiences. The nomothetic design used here focuses on average effects across adolescents, thereby assuming that group-level patterns apply to individuals. However, as individuals can largely differ in their susceptibility to media effects (Valkenburg & Peter, 2013), individuals may be differentially impacted by the ban even within the subgroup of adolescents with high SAD. Future research should therefore adopt person-specific, idiographic approaches to capture this variability, also regarding other relevant youth outcomes such as cognitive functioning and mental health.

Practical Implications

This study does not provide a conclusive answer to whether or not smartphone bans should be implemented. Schools may have different reasons for implementing smartphone bans, such as improving concentration or reducing cyberbullying (Campbell et al., 2024), which are beyond the scope of this study. Nevertheless, if a ban is implemented, there may be some unexpected effects. Firstly, our study shows that achieving complete student compliance with a full smartphone ban may be challenging in practice. In particular, students who already show signs of PSMU may find ways to bypass the ban, such as accessing smartphone apps (e.g., social media) via a laptop. Secondly, students may feel less connected to their close friends and adolescents already experiencing SAD may feel even less socially integrated among peers, at least in the months following the implementation of the ban. Schools should monitor and address these initial social challenges if they decide to implement a smartphone ban, for example by offering tailored support (e.g., interventions for students with SAD and arranging structured social activities during the breaks to stimulate in-person interaction). It is also important to take students' home context into consideration given that smartphone bans are restricted to the school environment. Adolescents tend to continue their usual smartphone and SMU outside of school (Goodyear, Randhawa et al., 2025), which may also explain some of the weak or null findings in this study.

Conclusion

In conclusion, this study contributes to the limited but growing literature (e.g., Goodyear, James, et al., 2025; Rahali et al., 2024) suggesting that implementing a smartphone ban in schools may not serve as a stand-alone, immediate solution for socio-emotional problems in adolescence, specifically regarding loneliness and PSMU. On the contrary, adolescents might feel more socially disconnected rather than reconnected in the months following the implementation of the ban. Though replication is needed with long-term longitudinal studies and comparisons across different smartphone policies, our findings offer initial insight into some of the social challenges a smartphone ban may entail for students, especially those who are socially vulnerable (e.g., those with SAD).

Conflict of Interest

The authors do not have any conflicts of interest to report.

Use of AI Services

The authors declare they have not used any AI services to generate or edit any part of the manuscript or data.

Data Availability Statement

The data and analysis syntax that support the findings of this study are openly available on the Open Science Framework via https://osf.io/3hfnq.

Authors' Contribution

Sanyogita S. Khare: conceptualization, methodology, formal analysis, data curation, writing—original draft, writing—review & editing, visualization. **J. Loes Pouwels:** conceptualization, methodology, investigation, data curation, writing—review & editing, supervision, project administration. **Hanneke Hendriks:** conceptualization, methodology, writing—review & editing, supervision. **Roy Otten:** conceptualization, methodology, writing—review & editing, supervision.

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Appendices

Appendix A

Attrition Analyses

To assess potential attrition bias, we conducted two logistic regression analyses: one including demographics and one including W1 social and emotional loneliness, SAD, PSMU, and breaktime SMU as predictors. The outcome was W2 participation (*no* = 0, *yes* = 1). Results indicated that those who were boys (OR = 1.37;95% CI [1.02, 1.85]), enrolled in a lower educational level (OR =1.87; 95% CI [1.62, 2.16]), in a higher grade (OR = 0.69;95% CI [0.62, 0.77]), in school 1 (OR = 26.79; 95% CI [15.73, 46.88]), or more emotionally lonely at W1 (OR = 0.85;95% CI [0.73, 0.98]) were less likely to participate at W2 (see Table A1).

Table A1. *Attrition Analyses: Logistic Regressions.*

	b	*SE*	*p*
Model 1: Demographics			
Gender (male = 0)	0.32	.15	.039
Educational level	0.62	.07	<.001
Grade	−0.37	.06	<.001
School (school 1 = 0)	3.29	.28	<.001
Model 2: Study Variables			
Social loneliness	−0.04	.11	.723
Emotional loneliness	−0.17	.07	.022
SAD	0.15	.10	.125
PSMU	−0.07	.04	.081
Breaktime SMU	0.09	.06	.151

Appendix B

Complete-Case Analyses

Difference score analyses with complete cases only yielded comparable results. The change from pre- to post-ban in social loneliness and PSMU stayed non-significant, while the change in emotional loneliness stayed significant with a similar difference in estimated means and a smaller *p* value (see Table B1).

Table B1. *Difference Score Analyses With Complete Cases Only.*

	n	Δ*M*	*SE*	*z*	*p*
Social Loneliness	314	0.04	.04	1.02	.306
Emotional Loneliness	314	0.14	.05	2.71	.007
PSMU	331	0.03	.09	0.36	.718

Multiple regression analyses with complete cases only yielded comparable results, except that educational level was no longer a significant predictor of changes in social loneliness (see Table B2).

Table B2*. Multiple Regression Analyses With Complete Cases Only.*

	n	β	*SE*	*p*	R^2
Model 1: Social Loneliness	304				.25
Intercept		.05	.08	.536	
School (school 1 = 0)		−.08	.15	.574	
Grade		.05	.05	.254	
Educational Level		−.12	.06	.064	
Gender (male = 0)		.01	.08	.862	
Social Loneliness W1		**−.47**	**.05**	**< .001**	
SAD W1		**.11**	**.04**	**.013**	
Model 2: Emotional Loneliness	304				.18
Intercept		**.24**	**.10**	**.020**	
School (school 1 = 0)		.02	.19	.931	
Grade		−.02	.06	.721	
Educational Level		−.05	.08	.504	
Gender (male = 0)		**−.30**	**.10**	**.004**	
Emotional Loneliness W1		**−.46**	**.06**	**< .001**	
SAD W1		.01	.05	.883	
Model 3: PSMU	310				.21
Intercept		−.02	.18	.926	
School (school 1 = 0)		−.46	.33	.167	
Grade		.14	.10	.178	
Educational Level		**−.44**	**.14**	**.002**	
Gender (male = 0)		**.45**	**.17**	**.010**	
PSMU W1		**−.85**	**.10**	**< .001**	
SAD W1		.01	.09	.870	

Note. Significant results ($p < .05$) are shown in bold.

Appendix C

Sensitivity Analyses Excluding Influential Cases

We checked for cases with suspicious response patterns using R package *responsePatterns,* which uses auto-correlations of survey data to detect repetitive patterns (Rihacek & Gottfried, 2023). No suspicious response patterns were identified.

To check for influential cases, we inspected generalized Cook's distance plots using R package *influence.SEM* (Pastore & Altoé, 2025). Cases with Cook's distances past the threshold of 4/N that were also clearly substantially larger than others were identified as influential, in line with our preregistration. We reran each regression excluding the identified influential cases. Findings were comparable to the original findings except for educational level no longer significantly predicting changes in social loneliness (see Table C1).

Table C1. *Multiple Regression Analyses Excluding Influential Cases.*

	n	β	*SE*	*p*	R^2
Model 1: Social Loneliness	981				.31
Intercept		.05	.07	.541	
School (school 1 = 0)		−.04	.14	.750	
Grade		.08	.04	.055	
Educational Level		−.11	.06	.067	
Gender (male = 0)		.00	.08	.963	
Social Loneliness W1		**−.47**	**.04**	**<.001**	
SAD W1		**.10**	**.04**	**.012**	
Model 2: Emotional Loneliness	977				.20
Intercept		**.17**	**.09**	**.049**	
School (school 1 = 0)		.14	.16	.376	
Grade		.00	.05	.964	
Educational Level		−.00	.07	.997	
Gender (male = 0)		**−.28**	**.09**	**.002**	
Emotional Loneliness W1		**−.39**	**.05**	**<.001**	
SAD W1		.01	.05	.841	
Model 3: PSMU	978				.27
Intercept		−.04	.16	.803	
School (school 1 = 0)		−.49	.29	.089	
Grade		.14	.09	.127	
Educational Level		**−.42**	**.13**	**.001**	
Gender (male = 0)		**.48**	**.16**	**.002**	
PSMU W1		**−.78**	**.09**	**<.001**	
SAD W1		.02	.08	.768	

Note. Significant results ($p < .05$) are shown in bold.

Appendix D

Sensitivity Analyses With W2 Scores as Outcomes

We reran the regression models with W2 scores of social loneliness, emotional loneliness, and PSMU as outcomes while controlling for their respective W1 scores, instead of their difference scores (W2−W1) as outcomes (see Table D1). Findings were consistent with the original analyses; small deviations included the R^2 of the social loneliness model being slightly lower and the R^2 of the emotional loneliness and PSMU models being slightly higher. Further, the control variable grade became a significant predictor of W2 PSMU. Nevertheless, all effects of interest were replicated.

Table D1. *Multiple Regression Analyses With W2 Scores as Outcomes.*

	β	*SE*	*p*	R^2
Model 1: Social Loneliness				.26
School (school 1 = 0)	−.13	.14	.357	
Grade	.07	.04	.119	
Educational Level	**−.15**	**.06**	**.016**	
Gender (male = 0)	.02	.07	.813	
Social Loneliness W1	**.27**	**.04**	**<.001**	
SAD W1	**.11**	**.04**	**.004**	
Model 2: Emotional Loneliness				.36
School (school 1 = 0)	.07	.18	.695	
Grade	.01	.06	.855	
Educational Level	−.06	.08	.428	
Gender (male = 0)	**−.26**	**.10**	**.007**	
Emotional Loneliness W1	**.55**	**.06**	**<.001**	
SAD W1	.02	.05	.699	
Model 3: PSMU				.34
School (school 1 = 0)	−.38	.31	.218	
Grade	**.19**	**.10**	**.044**	
Educational Level	**−.43**	**.14**	**.002**	
Gender (male = 0)	**.46**	**.17**	**.005**	
PSMU W1	**.89**	**.09**	**<.001**	
SAD W1	.03	.08	.693	

Note. Significant results ($p < .05$) are shown in bold.

Appendix E

Sensitivity Analysis Excluding Item 3 From the Social Loneliness Scale

Given the relatively low internal consistency of social loneliness (ω = .63 at T1 and ω = .68 at T2), we examined this subscale further at the item level. Item 3 (reverse-coded) correlated less strongly with items 1 and 2 at both waves (see Table E1). This item may have been interpreted more generally as it does not specify "peers", or the positive phrasing in contrast to the other items may have affected interpretation. We therefore reran the social loneliness regression analysis after excluding item 3 (i.e., only items 1 and 2 were averaged to calculate the final social loneliness mean scores). W1 SAD remained a significant predictor of changes in social loneliness (see Table E2), suggesting that the inclusion of item 3 in the main analysis did not influence the main finding.

Table E1. *Correlations Between Social Loneliness Items.*

W1	Item 1	Item 2	Item 3
Item 1 ("I feel excluded from other peers")	—		
Item 2 ("I want other peers to let me join in more often")	.55***	—	
Item 3 ("I feel like I belong to a group")	.31***	.21***	—
W2	Item 1	Item 2	Item 3
Item 1 ("I feel excluded from other peers")	—		
Item 2 ("I want other peers to let me join in more often")	.58***	—	
Item 3 ("I feel like I belong to a group")	.29***	.15**	—

Note .**p < .01, ***p < .001.

Table E2. *Social Loneliness Regression Analysis Excluding Item 3.*

	β	*SE*	*p*	R^2
Model 1: Social Loneliness				.28
School (school 1 = 0)	**−.35**	**.16**	**.025**	
Grade	−.00	.05	.987	
Educational Level	**−.19**	**.07**	**.006**	
Gender (male = 0)	.10	.09	.259	
Social Loneliness W1	**−.49**	**.05**	**<.001**	
SAD W1	**.15**	**.04**	**.001**	

*Note.*Significant results (p < .05) are shown in bold.

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