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Journal of Children and Media

ISSN: 1748-2798 (Print) 1748-2801 (Online) Journal homepage: www.tandfonline.com/journals/rchm20

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To cite this article: Sophie Mayen, Anne Reinhardt & Claudia Wilhelm (2025) Revealing the interplay between digital media use and affective well-being across developmental stages: Results of an experience sampling study with Austrian adolescents, Journal of Children and Media, 19:3, 598-618, DOI: 10.1080/17482798.2024.2443662

To link to this article: https://doi.org/10.1080/17482798.2024.2443662

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JOURNAL OF CHILDREN AND MEDIA
2025, VOL. 19, NO. 3, 598–618
https://doi.org/10.1080/17482798.2024.2443662

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Revealing the interplay between digital media use and affective well-being across developmental stages: Results of an experience sampling study with Austrian adolescents

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ABSTRACT

The debate about the impact of digital media use on youths' well-being is polarized. We provide a comprehensive examination of the relationship between digital media use and adolescents' affective well-being, investigating both within-person and between-person associations. We also examined how age and gender moderate these relationships, considering developmental stages. Using the Experience Sampling Method (ESM), we collected 3,087 responses from 343 Austrian students between September and November 2022, covering social media use, gaming, web browsing, video streaming, and audio streaming. Multilevel linear regression analyses revealed nuanced associations: Within-person associations appeared positive for social media use, gaming, and video streaming, whereas social media use was negatively related to affective well-being at the between-person level, suggesting aggregated displacement effects. The positive association of gaming with affective well-being was confined to the within-person level, yet video streaming showed a consistently positive link at both levels. The complex associations further varied by age and gender, indicating developmental variability. This study highlights the importance of considering development in media use and effects research and calls attention to how short-term influences may interplay with individual traits, fostering long-term differences.

IMPACT SUMMARY

Prior state of knowledge: Research has largely focused on the effects of social media and gaming through cross-sectional studies. Comprehensive analyses of various digital media activities across developmental stages using in-situ methodologies are limited.

Novel contributions: This study examines multiple digital media activities, analyzes within- and between-person associations, and integrates developmental perspectives. It highlights the variability in adolescents' responses, advancing the understanding of how media use impacts well-being across developmental stages.

Practical implications: Findings provide insights for parents, educators, and healthcare providers by integrating developmental factors.

ARTICLE HISTORY
Received 26 April 2024
Revised 10 December 2024
Accepted 13 December 2024

KEYWORDS
Digital media use; adolescents; well-being; experience sampling; developmental stages; multilevel modeling

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/17482798.2024.2443662

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We predict how short-term patterns of digital media use may influence long-term well-being, enabling developmentally appropriate interventions for adolescents.

Adolescents today increasingly engage with a vast array of digital media that serve a multitude of functions and fulfill several needs (Feierabend et al., 2022). Digital media are conceptualized as a broad category of new media forms and activities (Nesi et al., 2022), including the Internet (e.g., websites, online forums), communication applications and platforms (e.g., social media, messaging apps), and electronic games. However, the integration of digital media into almost every aspect of adolescents' lives has sparked a polarized debate about its impact on adolescents' well-being (Nesi et al., 2022).

This study focuses on affective well-being, which refers to a person's current level of happiness (Tov, 2018). Affective well-being has robust convergent validity, as it correlates with emotional states and the absence of negative emotions (Beyens et al., 2020). In the context of media effects studies and youth, affective well-being is particularly relevant due to its immediacy and responsiveness to external stimuli. By capturing the transient effects of media exposure on young individuals, we gain critical insights into their immediate mood and emotional experiences (Rutledge et al., 2014).

Notably, studies on the effects of digital media use on adolescents' well-being yielded fragmented and inconclusive results. The displacement hypothesis (Kraut et al., 1998) suggests that the time spent on digital media displaces time that would otherwise be spent on offline activities essential for well-being, explaining the potential negative effects of media use. For instance, excessive media engagement can reduce time spent on vital off-screen activities (e.g., Twenge et al., 2019, 2020), negatively affect self-esteem (Mei et al., 2016), detract from sleep (Hale et al., 2019), displace physical activity (Tremblay et al., 2011; Vilhelmson et al., 2017), and decrease school performance (Van Den Eijnden et al., 2018). Conversely, the stimulation hypothesis proposes that digital media use can foster various aspects of youth well-being, particularly when involving social interaction (e.g., Dienlin et al., 2017; Hygen et al., 2024; Marciano et al., 2022; Orben et al., 2019). The inconsistent evidence can be explained by the Differential Susceptibility to Media Effects Model (DSMM; Valkenburg & Peter, 2013), which posits that media effects on individuals are not uniform but vary based on individual differences, such as developmental stages and social contexts.

While prior research has provided valuable insights on this topic, it often lacks a comprehensive integration of both the digital media landscape (e.g., focusing solely on specific media activities, such as social media use) and recipients' characteristics (e.g., overlooking the moderating role of developmental needs). Our study addresses this gap by investigating associations across various media activities within adolescents' digital repertoires (Geers, 2020; Scheibe & Zimmer, 2022) and also analyzing how adolescents' developmental stages (reflected in age and gender; Perry & Pauletti, 2011) influence the relationship between media use and the affective well-being of youths. To do this, we will utilize large-scale in-situ data. This analytical procedure enhances our understanding of how variations in short-term usage (within-effects, e.g., across hours or days) influence affective well-being,

which then is observable as differences between individuals (between-effects; Neubauer et al., 2023). In this context, understanding within-person associations is important, as they provide invaluable insights into the dynamic and temporal nature of media effects, including shifts in affective well-being that may be missed by between-person analyses (Blahošová et al., 2024).

Building upon these observations, we conducted an Experience Sampling Method (ESM) study to examine the relationships between the most prominent adolescent digital media activities (Rideout & Robb, 2019) – including Internet use (e.g., surfing the web), social media use (e.g., TikTok, Instagram), gaming (e.g., online games), video streaming (e.g., YouTube, Netflix), and audio streaming (e.g., Spotify, podcasts) – and affective well-being. By considering the moderating role of youths' developmental stages, this study seeks to disentangle the effects of digital media use within a digitally immersed generation.

State of research & research interest

Studies have resulted in mixed and unclear effects regarding the impact of digital media use on well-being. In the following, we briefly summarize the research state regarding five prevalent media activities in order to gain a more comprehensive understanding of this topic.

Social media

The ubiquitous access to social media has led to a significant body of research examining the impacts on well-being. Social media encompasses computer-mediated channels enabling social interaction (active and passive), self-presentation, and content sharing with diverse audiences (Carr & Hayes, 2015), in real-time or asynchronously (Bayer et al., 2020). Findings from meta-analyses, systematic and narrative reviews, and large-scale cross-sectional studies present mixed evidence (e.g., Appel et al., 2020; Orben, 2020; Orben & Przybylski, 2019, Valkenburg, 2022; Orben et al., 2019). In support of the displacement hypothesis, longitudinal research revealed a small-to-moderate negative between-person effect of social media use on mental health aspects (i.e., depression and anxiety; Coyne et al., 2020). However, at the within-person level, these adverse effects disappeared, with individuals exceeding or falling below their average social media usage, showing neither an increase nor a decrease in depression or anxiety. Overall, the findings remain modest and predominantly negative (Orben & Przybylski, 2019). An exception was found in studies during the COVID-19 pandemic, with social-oriented online activities mitigating the adverse effects of lockdowns on social isolation and loneliness (Hygen et al., 2024; Marciano et al., 2023). Since this study took place in the post-covid phase with no lockdowns or social restrictions whatsoever, we hypothesize:

H1: Social media use is negatively associated with adolescents' affective well-being.

Gaming

Digital gaming (e.g., computer, web, portable, or console games), integral to adolescents' leisure and social activities (Feierabend et al., 2022), presents heterogeneous effects. Meta-analytic and longitudinal evidence indicates that gaming, particularly when involving problematic gaming behavior (i.e., behavioral patterns characterized by consistent and repeated engagement with games, resulting in significant distress), tends to have a small but negative effect on adolescent health outcomes, including life satisfaction, anxiety, and depression (Ferguson, 2015; Lobel et al., 2017; Männikkö et al., 2020; Wright & Wachs, 2022). However, more recent studies showed that gaming positively influenced adolescents' well-being during the COVID-19 lockdown (Barr & Copeland-Stewart, 2022). Moreover, no negative effects of gaming emerged for youth engaging in moderate gaming durations (Bohnert & Gracia, 2023). Based on these mixed findings, we ask:

RQ1: How is gaming associated with adolescents' affective well-being?

Web browsing

Web browsing ranks among the most popular media activities among adolescents, regardless of the device or channel (Feierabend et al., 2022), including activities such as information searching on Google, surfing the Internet, and reading news online. Despite its popularity, the impact of web browsing on well-being has received less research attention compared to social media and gaming. A longitudinal analysis by Schemer et al. (2021) found no significant association between the frequency of web browsing and well-being. However, some studies have raised concerns about the risks associated with problematic web use – characterized by, for instance, excessive use and a loss of control (Pan et al., 2024) – and internet addiction (Park et al., 2014), both of which may negatively impact adolescents' physical and psychological development, including overall well-being (Pan et al., 2024). Therefore, the second research question is:

RQ2: How is web browsing associated with adolescents' affective well-being?

Video streaming

Video streaming comprises watching online videos (e.g., on YouTube) and using streaming devices, such as Netflix (Rideout & Robb, 2019). Despite the popularity of these platforms, research on the relationship between youths' video streaming behavior and affective well-being remains scarce. This gap is surprising given YouTube's widespread use among U.S. teens (Anderson et al., 2023) and Netflix's similar popularity (Rideout & Robb, 2019). Existing research primarily focuses on binge-watching as a potentially pathologic behavior, showing mixed results: It can be a source of pleasure and reward, yet also an excessive behavior linked to negative outcomes and mental health risks (e.g., depression and anxiety; for a systematic review, see Flayelle et al., 2020). In contrast, other studies report

positive effects, such as increased mindfulness and enjoyment, which may promote well-being (Anghelcev et al., 2021; Taylor et al., 2021). Moreover, adolescents frequently engage in watching videos that teach them how to create, construct, or perform tasks they are keen on (Pires et al., 2022; Rideout & Robb, 2019). Such engagement can support their capacity to deal with environmental challenges while fostering a sense of autonomy and competence, which is likely to have a positive impact on well-being (e.g., Ryan & Deci, 2017). Therefore, we ask:

RQ3: How is video streaming associated with adolescents' affective well-being?

Audio streaming

Finally, the impact of audio streaming (e.g., listening to music or podcasts) on adolescents' well-being, though receiving relatively minor research attention, is noteworthy. Systematic and meta-analytic research assessing the effectiveness of music interventions from a clinical-therapeutic perspective shows significant stress reduction benefits (De Witte et al., 2020). Garrido et al. (2022) explored music listening as an emotion-regulation strategy among adolescents. The authors found that youths turn to music to manage their emotions, but the success of these strategies depends on several factors, including the listener's initial mood, music characteristics, and cognitive capacities. However, at the same time, studies have shown that music can exacerbate moods, both negative and positive, and that girls are particularly susceptible to downward spirals in their negative moods (Ter Bogt et al., 2021).

Given the relatively understudied relationship, we propose the following research question:

RQ4: How is audio streaming associated with adolescents' affective well-being?

Accounting for developmental stages

The heterogeneous research landscape suggests that adolescents' individual developmental trajectories shape their responses to media (Orben et al., 2022; Oswald et al., 2020). The DSMM (Valkenburg & Peter, 2013) identifies three types of susceptibility to media effects: Dispositional, developmental, and social. Developmental susceptibility, in particular, examines how cognitive, emotional, and social development – especially during puberty – affects media's impact on adolescents.

While age is a useful proxy for identifying developmental stages (Remschmidt, 1994), these are not strictly age-bound and can vary (e.g., by sex; Perrin et al., 2009). For instance, girls have been shown to face more severe adverse social and emotional impacts from excessive internet use (Orben et al., 2019; Victorin et al., 2020), which underscores the importance of considering the gender-specific timing of developmental stages. Orben et al. (2022) highlight "windows of sensitivity to social media use," which correspond with gender- and age-specific developmental milestones, such as the onset of puberty. Hence, we examine how digital media use is associated with adolescents' affective well-being

across age stages and gender. We ask:

RQ5: How do age and gender moderate the effects of digital media use on adolescents' affective well-being?

Method

Sampling and procedure

Prior to data collection, we registered the project on OSF (https://osf.io/hej54?view_only=204d84a6314f414495f403eaf968fddd)[1] and received approval from the ethics committee of the University of Vienna (#00776). Study participants were recruited from nine schools in two urban cities in Austria, representing different types of schools (middle school, secondary school). Eligible students had to be at least 11 years old. The data collection took place from September to November 2022. The study was initiated by an online baseline survey, followed by a one-week ESM study. The ESM collects data in real-time in the participants' natural environments, typically using a personal smartphone or similar device (van Berkel & Kostakos, 2021). Although it relies on self-reports of digital media use, its in-situ nature helps mitigate the biases associated with self-reporting, potentially increasing the accuracy of measuring digital media use among youth (see, also Masur, 2019).

Before data collection, we collected informed consent, with students aged 14 or above providing it themselves and parents providing it for their children when they were under 14 years old. During the ESM study, participants received prompts via text message on their smartphones, providing them with a link to the questionnaire. The 15-minute baseline survey was conducted on Monday (5 p.m.) and measured all relevant sociodemographic and socioeconomic variables. Afterward, participants received three prompts each on two consecutive working days (Tue and Wed) and one weekend day (Sat). The ESM survey, which lasted approximately three minutes, asked about their time use and experiences during the last hour. The prompts were scheduled for 2 p.m., 4.30 p.m., and 7 p.m. on school days and at 11 a.m., 2 p.m., and 5 p.m. on the weekend. In sum, each participant received nine prompts to answer the ESM questionnaire. The participating adolescents were compensated with €5.

Sample

Responding to the baseline survey on the first day of the study was a prerequisite for participants to be included in the final study sample. The study sample ($N_{ESM} = 3{,}537$) represents the total amount of answered ESM surveys (time points), considering that each participant was invited to answer nine ESM surveys in total (excluding the baseline survey). During the data cleansing process, participants who answered less than three ESM surveys were excluded to ensure sufficient within-person variability (for a similar approach, see Sun et al., 2021). Thus, the study's final sample includes 343 eligible adolescents with $N_{ESM} = 3{,}087$ completed surveys.

On average, participants were 14.43 years old ($SD = 1.79$; range = 11–20; Median = 14), with 55.7% ($N = 191$) of the participants identifying as female. In terms of educational level, 77.8% of students were attending high school, while 22.2% were in middle school. Additionally, 42.3% of the participants ($N = 145$) indicated that German is their mother tongue, which is consistent with the ethnic distribution in the respective school districts.

Measures

ESM survey

Affective well-being. We measured participants' affective well-being with one item ("How did you feel during the last hour?," 1 = very bad, 5 = excellent; Beyens et al., 2020; $M = 3.73$, $SD = 1.12$).

Time spent with digital media. We assessed digital media use for the last hour using five items (web browsing, video streaming, gaming, audio streaming, and social media use). Participants selected from the following values in 15-minute intervals: 1 ("not at all"), 2 ("under 15 minutes"), 3 ("under 30 minutes"), 4 ("under 45 minutes"), and 5 ("above 45 minutes;" $M_{web} = 1.53$, $SD_{web} = 0.92$; $M_{video} = 1.79$, $SD_{video} = 1.27$; $M_{gaming} = 1.48$, $SD_{gaming} = 1.08$; $M_{audio} = 1.62$, $SD_{audio} = 1.13$; $M_{social\ media} = 2.00$, $SD_{social\ media} = 1.32$).

Baseline survey

Sociodemographic factors. We assessed participants' age, gender, school type, and their first language (1 = German, 0 = other languages). Additionally, as a proxy for their socioeconomic background (Heppt et al., 2022), participants were asked to indicate the number of books in their household using a five-point Likert scale (1 = no/very few books, 5 = enough books to fill three whole bookshelves; $M = 3.18$, $SD = 1.43$).

Analytical strategy

After data pre-processing,[2] we conducted multilevel linear regression using the lme4 package (version 4.1.2; Bates et al., 2023) in R statistical software (version 2023.06.0 + 421). A two-level model with random intercept (i.e., participants' ID) was utilized for this analysis (Bell et al., 2019), chosen to accommodate correlations within clusters (participants) and over time (repeated measures; Monsalves et al., 2020). This analytical strategy allowed us to distinguish within-person variability (e.g., daily changes) from between-person differences (e.g., individual characteristics). For the direct effects of digital media use on affective well-being, grand-mean centering was applied for all level-2 control variables (i.e., sociodemographic factors), whereas level-1 variables (i.e., time spent on digital media activities) were treated both between-person and within-person centered (Yaremych et al., 2021).

We moreover calculated a second model accounting for the three-way interaction effects of age (continuous), gender (female vs. male), and time spent on digital media, controlling for school type, socioeconomic background, and first language. The R-script is available on OSF at https://osf.io/f9rz5/?view_only=7468e0f2b1f44af392a877bbbe04b166.

Table 1. Pooled regression coefficients for level-1 (within-person and between-person centered) and level-2 predictors.

				95% CI	
Effect	*B*	*SE*	t-value	*LL*	*UL*
Intercept	3.481***	.043	81.578	3.397	3.565
Level-1 predictors **(wpc)**					
Social media use	.083**	.024	3.482	.036	.130
Gaming	.098***	.025	3.921	.049	.148
Web browsing	.018	.029	0.624	−.039	.074
Video streaming	.073***	.020	3.590	.033	.114
Audio streaming	.043	.023	1.856	−.002	.088
Level-1 predictors **(bpc)**					
Social media use	−.194***	.066	−2.946	−.323	−.065
Gaming	.080	.087	.916	−.091	.252
Web browsing	.023	.109	.215	−.190	.237
Video streaming	.189*	.084	2.246	.024	.354
Audio streaming	−.158	.088	−1.808	−.330	.013
Level-2 predictors **(bpc)**					
Age	−.078***	.027	−2.908	−.131	−.026
Gender	.023	.099	.235	−.170	.217
School type	.090	.127	.707	−.160	.340
First language	−.040	.102	−.390	−.240	.160
Socioeconomic status	−.015	.037	−.410	−.087	.057

All level-1 predictors are within-person centered ("wpc") and between-person centered ("bpc"). Level-2 predictors (covariates) are between-person centered. Gender: 1 = female, 0 = male. First language: 1 = German, 0 = other languages. *B* = Unstandardized Coefficient; *SE* = Standard Error; 95% CI = Confidence Interval; *LL* = lower limit; *UL* = upper limit. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 2. Significant interaction effects of time spent with digital media activities in the last hour, age, and gender on affective well-being.

	Interaction effects on affective well-being	
Activity	*Boys*	*Girls*
Social media use **(wpc)**	Positive association among younger boys → association decreases with age	Positive association strengthens with age
Gaming **(bpc)**	Negative association remains constant across all ages	Association becomes increasingly negative with age
Video streaming **(wpc)**	Positive association among younger boys → association decreases with age	No association among younger girls → positive association strengthens with age
Audio streaming **(wpc)**	Positive association among younger boys → association decreases with age	Association becomes increasingly negative with age

"wpc" = within-person centered. "bpc" = between-person centered.

Results

Effects of digital media use on affective well-being (H1, RQ1–4)

Table 1 summarizes the results of the multilevel regression model. We hypothesized that social media use is negatively associated with adolescents' affective well-being **(H1)**. This hypothesis was only supported on the between-person level: Adolescents who, on average, spent more time on social media showed poorer affective well-being compared to adolescents with less social media time ($b = -0.194$, $SE = 0.066$, $p < .001$). On the within-person level, a contrasting pattern emerged: Participants reported more positive affective well-being when they indicated higher levels of social media use in

the previous hour compared to periods of less social media use ($b = 0.083$, $SE = 0.024$, $p < .01$.) In contrast, the relationship between gaming and adolescents' affective well-being (**RQ1**) was positive only at the within-person level ($b = 0.098$, $SE = 0.025$, $p < .001$).

RQ2 was set to examine the impact of web browsing on adolescents' affective well-being. The relationship was statistically significant, neither on the within-level ($b = 0.018$, $SE = 0.029$, $p = 0.624$) nor the between-level ($b = 0.023$, $SE = 0.109$, $p = 0.215$).

Next, we investigated the link between video streaming and adolescents' affective well-being (**RQ3**). The results showed a positive association both within individuals ($b = 0.073$, $SE = 0.020$, $p < .001$) and between individuals ($b = 0.189$, $SE = 0.084$, $p < .05$), suggesting that higher affective well-being is linked to spending the previous hour streaming videos and that frequent streamers tend to report higher affective well-being.

Lastly, we examined the relationship between audio streaming and adolescents' affective well-being (**RQ4**). However, this relationship did not reach statistical significance at either the within-person level ($b = 0.043$, $SE = 0.023$, $p = 0.064$) or the between-person level ($b = -0.158$, $SE = 0.088$, $p = 0.141$).

Moderating effects of age and gender

We also examined the three-way interaction between age, gender, and digital media use to account for heterogeneity across developmental stages (**RQ5**). In this section, we will only report the significant effects due to reasons of clarity and readability. Table 2 provides an overview of these interaction effects. A complete overview of all interaction

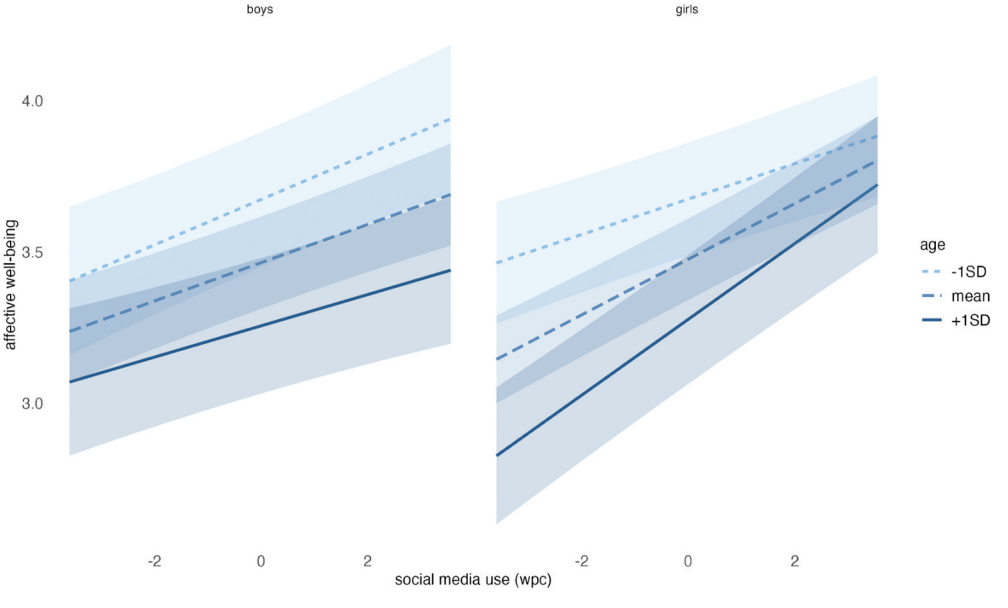

Figure 1. Interaction between social media use, age, and gender on affective well-being. Note. "wpc" = within-person centered.

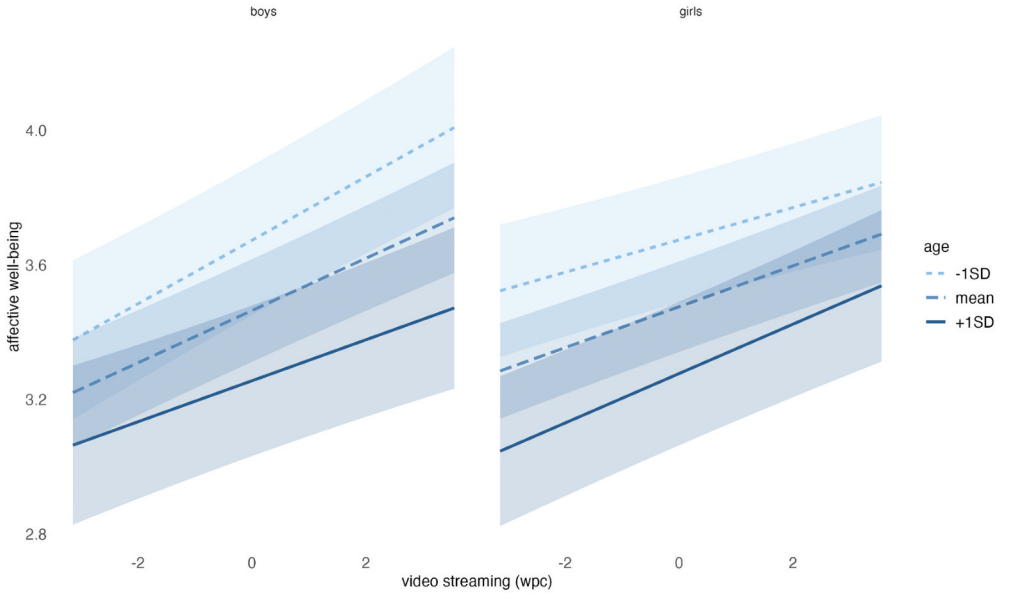

Figure 2. Interaction between video streaming, age, and gender on affective well-being.
Note. "wpc" = within-person centered.

effects can be found in Supplemental Appendix A on OSF (https://osf.io/f9rz5/?view_only=7468e0f2b1f44af392a877bbbe04b166).

Our analyses indicated that the within-person relationship between social media use and affective well-being varied by age and gender ($b = 0.025$, $SE = 0.007$, $p < .001$, 95% CI = 0.012, 0.039; Figure 1). Specifically, as boys age, the positive association between social media use and well-being diminishes. In contrast, for girls, the positive association between social media use and affective well-being strengthens as they age.

Moreover, our analysis demonstrated a significant three-way interaction effect for video streaming at the within-person level ($b = 0.016$, $SE = 0.006$, $p < .05$, 95% CI = 0.004, 0.029; Figure 2). For younger boys, video streaming is linked to higher well-being, but this positive relationship weakens with age. The opposite pattern emerges for girls: The positive association becomes increasingly pronounced as they progress through adolescence.

Likewise, the relationship between audio streaming and affective well-being varied significantly by age and gender at the within-person level ($b = 0.026$, $SE = 0.007$, $p < .01$, 95% CI = 0.011, 0.040; Figure 3). Therefore, audio streaming was particularly related to higher well-being in younger boys. In contrast, the time spent on audio streaming showed no significant association with girls' affective well-being.

Finally, our analysis revealed a significant negative association between gaming (between-person) and affective well-being, moderated by age and gender ($b = -0.283$, $SE = 0.133$, $p < .01$, 95% CI = −0.535, −0.032; Figure 4). No significant relationship was observed in boys. However, among girls, gaming was associated with higher well-being in younger ages, whereas it was linked to lower well-being as girls aged. Notably, this interaction effect became nonsignificant when outliers in terms of age were excluded,

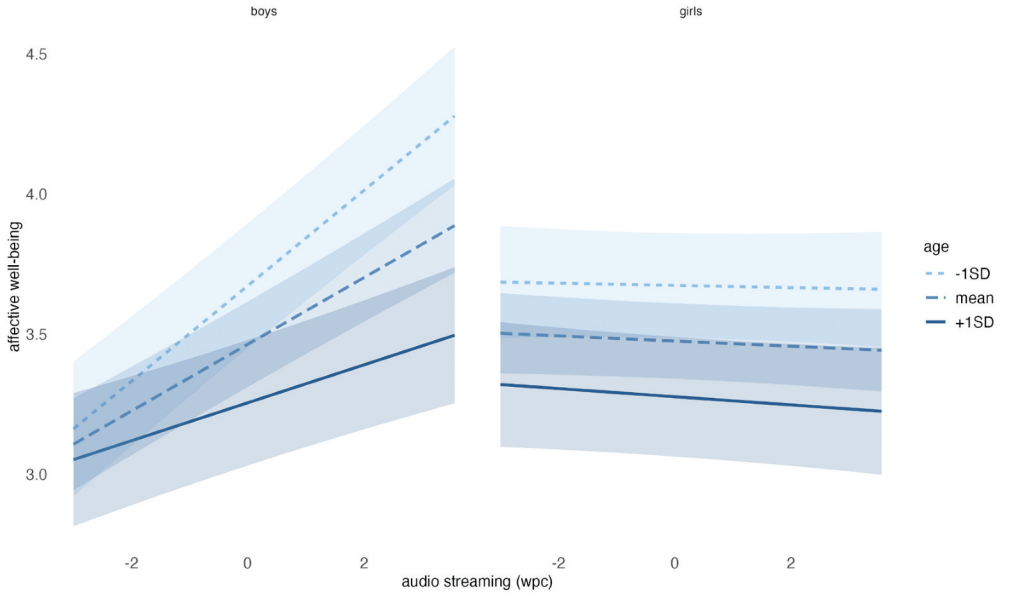

Figure 3. Interaction between audio streaming, age, and gender on affective well-being. *Note*. "wpc" = within-person centered.

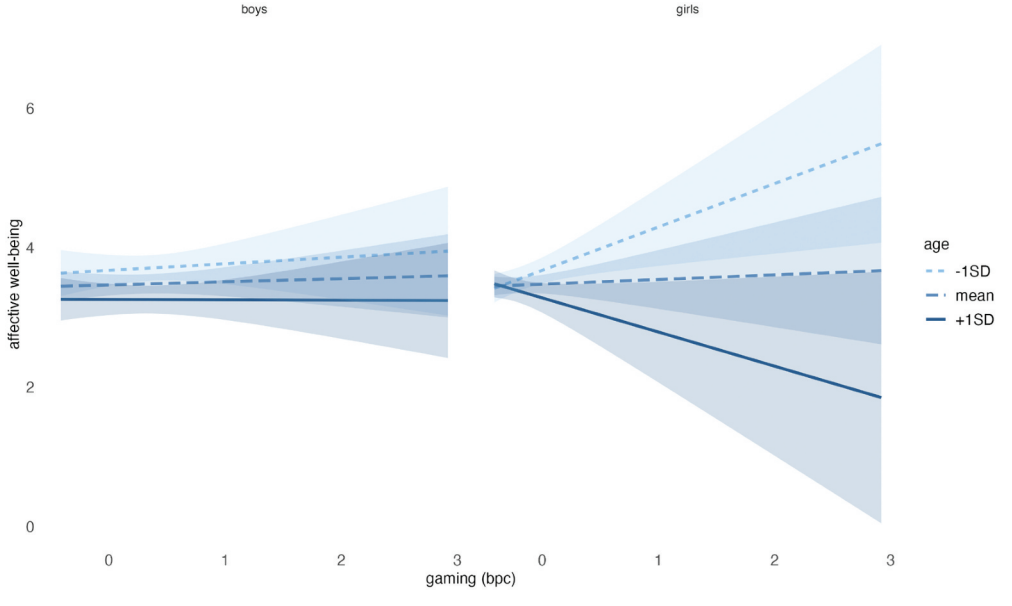

Figure 4. Interaction between gaming, age, and gender on affective well-being. *Note*. "bpc" = between-person centered.

indicating that this result may not be robust across all age groups in our sample, as it may be influenced by a small number of participants at specific ages.

Exploratory analyses of grouped media activities

In addition to the primary analyses, we performed exploratory analyses in response to reviewer feedback. Specifically, we grouped individual digital media activities based on shared design characteristics: (1) Primarily visual content (social media, gaming, video streaming) and (2) mixed media content (Internet use, audio streaming).

Exploring these subgroupings aimed to enhance the understanding of what precisely drives differences in media use and affective well-being across developmental stages. Key findings indicate that visual media use continues to show positive associations with well-being at the within-person level, whereas mixed media use exhibits a smaller effect. Full regression and interaction analysis results, as well as interaction visualizations, can be found in Supplemental Appendix B on OSF.

Discussion

This study thoroughly examines the associations between adolescents' digital media use and their affective well-being. Utilizing an ESM approach, we analyzed both within-person and between-person effects, thus opening up new perspectives into the ongoing discourse on digital media's influence on youth.

The findings reveal a specifically nuanced pattern in how social media use relates to adolescents' affective well-being. On the one hand, more time spent using social media relates to higher levels of affective well-being of individuals at the within-person level, suggesting that social media use potentially benefits youths' affective well-being (for similar findings, see Beyens et al., 2020; Weinstein, 2017). On the other hand, consistent, high social media use is associated with diminished affective well-being at the between-person level. This contrasting pattern aligns with previous findings (e.g., Twenge et al., 2020) and highlights a paradoxical aspect of social media use: While occasional use may improve affective well-being in the short term, sustained high levels of engagement appear detrimental over time. This observed dichotomy indicates a potential "sweet spot" for social media use, where moderate engagement is associated with improved well-being, whereas excessive use is linked to negative outcomes (see also Przybylski & Weinstein, 2017). However, individual thresholds (or "sweet spots") for beneficial levels of social media use are likely to vary between adolescents, influenced by factors such as psychological vulnerability, developmental stage, and socioeconomic background (as outlined in the DSMM; Valkenburg & Peter, 2013).

Previous research has linked excessive and pathological gaming to adverse health and well-being outcomes (Gentile, 2009; Wright & Wachs, 2022). In our study, gaming was associated with higher affective well-being, albeit only at the momentary (within-person) level. While this momentary association reflects the pattern observed for social media use, we observed no shift towards a negative between-person influence, potentially due to the absence of pathological gamers in our sample. The positive within-person relationship may stem from gaming's capacity for immediate cognitive stimulation and socialization opportunities, which can help alleviate stress and anxiety (e.g., Barr & Copeland-Stewart,

2022). We cannot confirm the long-term benefits of well-being, but the lack of a positive between-person association in this study suggests that the situational benefits of gaming may be short-lived.

Moreover, the results revealed a consistently positive association between video streaming and well-being on both within-person and between-person levels, likely due to stress relief, enjoyment, and perceived autonomy (Granow et al., 2018). According to the Self-Determination Theory (SDT; Ryan & Deci, 2017), activities fulfilling basic psychological needs (i.e., autonomy, competence, and relatedness) contribute to well-being. In this context, streaming "how-to" videos on YouTube, for instance, likely supports adolescents' fundamental need for autonomy and competence, thereby stimulating well-being. Unlike social media, video streaming may inherit fewer potential online risks, such as cyberbullying or sexting, linked to negative well-being (Paschke & Thomasius, 2024).

When examining the individual activities, we found no significant relationship between the time spent on Internet use or audio streaming and affective well-being. It is likely that adolescents primarily engage with this medium for reasons of information, regardless of its impact on aspects of affective well-being. However, it should be noted that we can only speculate about possible usage patterns for our sample, as this category covers a broad range of activities. The grouped analyses included in the Supplemental material (see Appendix B) provide additional insights: While the individual relationships for audio streaming and Internet use were non-significant on both within-person and between-person levels, grouping audio streaming and Internet use into a "mixed media" category revealed a significant positive within-person association. As activities within the "mixed media" category are potentially less immersive, they may leave adolescents less susceptible to long-term displacement effects associated with reduced well-being. On the other hand, the significant positive within-person associations of the individual digital media activities (i.e., social media use, gaming, and video streaming) persisted when combining these effects into the "visual media" category. Therefore, we argue that follow-up well-being research should consider how specific media design features and other shared elements (e.g., the amount of algorithmically derived content and adolescents' perception thereof) shape adolescents' experiences and well-being outcomes.

The findings of this study provide additional insights when accounting for the moderating roles of age and gender. First, our interaction analysis aligns with findings by Orben et al. (2022), who identified heightened sensitivity to media effects among girls aged 11–13. Despite this, the data suggest that as girls mature, their affective well-being may increasingly benefit from elevated levels of social media use, whereas girls aged 13 and younger may lack the developmental readiness to experience such positive effects due to ongoing cognitive and emotional growth. However, while development may partially explain this pattern for both boys and girls, the appearance-focused nature of social media, including heavy use of filters and image processing, may particularly affect younger girls, fostering unrealistic comparisons (Kleemans et al., 2018). Future research should thus examine how these content-related factors interact with developmental stages.

Second, for gaming, we observed consistent positive associations with affective well-being for boys across all ages whereas girls' positive association was apparent for younger girls exclusively, with older girls showing a strong negative relationship. While we can, again, only speculate about the specific gaming content, the findings suggest that female

gamers may have unfavorable experiences. This could include, for instance, exposure to stereotypical male aggression and hypersexualized content (Lopez-Fernandez et al., 2019), and/or potential internal conflicts arising from the male-oriented design of many games, which may clash with their personal values (Hartmann & Klimmt, 2006).

Third, higher levels of video streaming strengthened the positive association with affective well-being in younger boys, but not in older boys. In contrast, girls showed a relatively stable positive association that slightly increased with age. One possible explanation is that, as adolescents mature, video streaming may lead to internal goal conflicts (Granow et al., 2018). Alternatively, girls may select different content, which could account for the observed differences. However, further research is needed to explore these possibilities.

Fourth, boys' relationship patterns for audio streaming and affective well-being mirrors that observed with video streaming. Younger boys, demonstrating a stronger positive association with audio streaming, may find greater comfort or enjoyment in audio streaming as a form of escapism or emotional expression, while older boys may shift towards strategies to manage their emotions. Prior research on gender differences in emotion processing and affect regulation showed that males tend to experience elevated anxiety and neuroticism when using music as a way to release or express negative emotions compared to females (Carlson et al., 2015). Among girls, no age-based link was observed; however, a slight negative interaction emerged, indicating a minor decline in affective well-being as audio streaming levels increase with age.

Hence, the observed age and gender differences in this study may be partly explained by recent longitudinal research on adolescent emotion regulation: As emotional reactivity heightens from early to middle adolescence, the use of functional strategies (e.g., cognitive appraisal) declines while dysfunctional ones (e.g., suppression) remain stable (Rueth et al., 2023) – a shift that potentially contributes to the age-related differences in digital media's association with well-being that we monitored. Rueth et al. (2023) noted significant gender differences only at baseline; as development continued, no gender differences were observed, and no significant age-by-gender interactions were found. Our findings, however, revealed such gender-specific patterns across diverse digital activities, in which boys consistently exhibit decreased positive associations with age, while girls show a reversed trend (i.e., increasingly positive relationship with age). Henceforth, this study emphasized the need to research how such gender differences in emotion regulation interact with other developmental factors. Referring to Orben et al. (2022) observations, we propose that future research exploring the factors shaping potential "windows of developmental sensitivity" to media use effects should consider aspects such as the onset of puberty, cognitive development, shifts in social identity, and changes in emotional regulation during adolescence, among others, to deepen our understanding of the interplay between digital media use and affective well-being.

This study has some limitations. First, although relying on in-situ data that are less affected by memory and social biases, the potential influence of social desirability bias and the inherent constraints of self-reported data on the study's results must be recognized. Second, while this study captures both within-person variations and between-person differences, the data are insufficient to support causal inferences. Thus, for some associations, the direction of influence may be reversed, with affective well-being potentially driving patterns of digital media use rather than media use

directly impacting affective well-being. However, the findings can be used as a starting point for future experimental studies. Third, our results can only reveal insights into the associations between the observed level-1 and level-2 variables and adolescents' affective well-being. Hence, other variables related to well-being, such as factors concerning adolescents' mental health, are not considered. Fourth, although our experience sampling study was designed to balance participant burden and data collection needs, the limited number of surveys per participant may constrain the detection of smaller cross-level interaction effects, which should be considered when interpreting the results (see as well Arend & Schäfer, 2019). Fifth, we used age and gender as proxies for developmental stages, which, however, may overlook other relevant indicators that could provide a more nuanced understanding of developmental differences, such as cognitive and emotional development. Finally, while our study design is remarkable for considering a wide variety of media activities, we cannot make any claims about the specific content of the media used and their possible influence on well-being.

Conclusion

This study examined the relationship between digital media use and adolescents' affective well-being, moving beyond simplistic narratives of harm or benefit. Key findings are as follows: (1) Social media use shows a dual nature, likely prompting immediate lifts in affective well-being yet potentially tied to long-term risks for heavy users; (2) video streaming is consistently associated with higher levels of affective well-being among adolescents, highlighting its positive potential; (3) the associations vary across digital media activities and developmental stages.

The results of this study indicate displacement effects for social media use at the aggregated, between-person level while also signaling situational stimulation of affective well-being for particularly immersive digital media activities (i.e., social media use, gaming, and video streaming). These mixed associations may be interpreted through the DSMM (Valkenburg & Peter, 2013), suggesting that dispositional susceptibilities, family and peer influence, and sociocultural context likely affect the relationship between digital media use and adolescent well-being. In addition, these factors appear to interact with adolescents' developmental stages, shaping their responsiveness to media effects. In-situ analyses covering longer periods hold promise for uncovering these underlying mechanisms through a developmental framework. On the whole, the findings of this study, coupled with guidance for future directions, inform parents and educators in developing targeted interventions to support the health and well-being of adolescents as they navigate their digital environments.

Notes

1. To ensure transparency, we highlight that the pre-registration was updated post-data collection in response to peer-review feedback and recent literature. A detailed document outlining these deviations is available on OSF (https://osf.io/f9rz5/?view_only=7468e0f2b1f44af392a877bbbe04b166).

2. Due to missing data exceeding the 5% threshold (Jakobsen et al., 2017), we excluded participants with fewer than three ESM responses and applied multiple imputation using the 2-level predictive mean matching method via the "mice" R package (Buuren & Groothuis-Oudshoorn, 2011; Enders, 2023). Ten imputed datasets were generated and analyzed, and the estimates were pooled according to Rubin's Rules (Rubin, 1987) to obtain final estimates for the imputed variables.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Austrian Science Fund (FWF) under grant number [P34431-G].

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References

Anderson, M., Faverio, M., & Gottfried, J. (2023). *Teens, social media and technology 2023*. Pew Research Center.

Anghelcev, G., Sar, S., Martin, J. D., & Moultrie, J. L. (2021). Binge-watching serial video content: Exploring the subjective phenomenology of the binge-watching experience. *Mass Communication & Society*, *24*(1), 130–154. https://doi.org/10.1080/15205436.2020.1811346

Appel, M., Marker, C., & Gnambs, T. (2020). Are social media ruining our lives? A review of meta-analytic evidence. *Review of General Psychology*, *24*(1), 60–74. https://doi.org/10.1177/1089268019880891

Arend, M. G., & Schäfer, T. (2019). Statistical power in two-level models: A tutorial based on Monte Carlo simulation. *Psychological Methods*, *24*(1), 1–19. https://doi.org/10.1037/met0000195

Barr, M., & Copeland-Stewart, A. (2022). Playing video games during the COVID-19 pandemic and effects on players' well-being. *Games and Culture*, *17*(1), 122–139. https://doi.org/10.1177/15554120211017036

Bates, D., Maechler, M., Bolker, B., Walker, S., Christensen, R. H. B., Singmann, H., Dai, B., Scheipl, F., Grothedieck, G., Green, P., Fox, J., Bauer, A., & Krivitsky, P. N. (2023). *Lme4: Linear mixed-effects models using "Eigen" and S4 (Version 1.1-32) [R]*. https://cran.r-project.org/web/packages/lme4/index.html

Bayer, J. B., Triệu, P., & Ellison, N. B. (2020). Social media elements, ecologies, and effects. *Annual Review of Psychology*, *71*(1), 471–497. https://doi.org/10.1146/annurev-psych-010419-050944

Bell, A., Fairbrother, M., & Jones, K. (2019). Fixed and random effects models: Making an informed choice. *Quality & Quantity*, *53*(2), 1051–1074. https://doi.org/10.1007/s11135-018-0802-x

Beyens, I., Pouwels, J. L., van Driel, I. I., Keijsers, L., & Valkenburg, P. M. (2020). The effect of social media on well-being differs from adolescent to adolescent. *Scientific Reports*, *10*(1), 10763. https://doi.org/10.1038/s41598-020-67727-7

Blahošová, J., Tancoš, M., Cho, Y. W., Šmahel, D., Elavsky, S., Chow, S.-M., & Lebedíková, M. (2024). Examining the reciprocal relationship between social media use and perceived social support among adolescents: A smartphone ecological momentary assessment study. *Media Psychology*, 1–32. https://doi.org/10.1080/15213269.2024.2310834

Bohnert, M., & Gracia, P. (2023). Digital use and socioeconomic inequalities in adolescent well-being: Longitudinal evidence on socioemotional and educational outcomes. *Journal of Adolescence*, *95*(6), 1179–1194. https://doi.org/10.1002/jad.12193

Buuren, S. V., & Groothuis-Oudshoorn, K. (2011). Mice: Multivariate imputation by chained equations in *R*. *Journal of Statistical Software*, *45*(3). https://doi.org/10.18637/jss.v045.i03

Carlson, E., Saarikallio, S., Toiviainen, P., Bogert, B., Kliuchko, M., & Brattico, E. (2015). Maladaptive and adaptive emotion regulation through music: A behavioral and neuroimaging study of males and females. *Frontiers in Human Neuroscience*, *9*, 9. https://doi.org/10.3389/fnhum.2015.00466

Carr, C. T., & Hayes, R. A. (2015). Social media: Defining, developing, and divining. *Atlantic Journal of Communication*, *23*(1), 46–65. https://doi.org/10.1080/15456870.2015.972282

Coyne, S. M., Rogers, A. A., Zurcher, J. D., Stockdale, L., & Booth, M. (2020). Does time spent using social media impact mental health?: An eight year longitudinal study. *Computers in Human Behavior*, *104*, 106160. https://doi.org/10.1016/j.chb.2019.106160

De Witte, M., Spruit, A., Van Hooren, S., Moonen, X., & Stams, G.-J. (2020). Effects of music interventions on stress-related outcomes: A systematic review and two meta-analyses. *Health Psychology Review*, *14*(2), 294–324. https://doi.org/10.1080/17437199.2019.1627897

Dienlin, T., Masur, P. K., & Trepte, S. (2017). Reinforcement or displacement? The reciprocity of FTF, IM, and SNS communication and their effects on loneliness and life satisfaction. *Journal of Computer-Mediated Communication*, *22*(2), 71–87. https://doi.org/10.1111/jcc4.12183

Enders, C. K. (2023). Missing data: An update on the state of the art. *Psychological Methods*. https://doi.org/10.1037/met0000563

Feierabend, S., Rathgeb, T., Kheredmand, H., & Glöckler, S. (2022). *JIM-Studie 2022. Jugend, Information, Medien [JIM study 2022: Youth, information, media]*. Medienpädagogischer Forschungs- verbund Südwest. https://www.mpfs.de/fileadmin/files/Studien/JIM/2022/JIM_2022_Web_final.pdf

Ferguson, C. J. (2015). Do angry birds make for angry children? A meta-analysis of video game influences on children's and adolescents' aggression, mental health, prosocial behavior, and

academic performance. *Perspectives on Psychological Science*, *10*(5), 646–666. https://doi.org/10.1177/1745691615592234

Flayelle, M., Maurage, P., DiLorenzo, K. R., Vögele, C., Gainsbury, S. M., & Billieux, J. (2020). Binge-Watching: What do we know so far? A first systematic review of the evidence. *Current Addiction Reports*, *7*(1), 44–60. https://doi.org/10.1007/s40429-020-00299-8

Garrido, S., Du Toit, M., & Meade, T. (2022). Music listening and emotion regulation: Young people's perspectives on strategies, outcomes, and intervening factors. *Psychomusicology: Music, Mind, and Brain*, *32*(1–2), 7–14. https://doi.org/10.1037/pmu0000285

Geers, S. (2020). News consumption across media platforms and content. *Public Opinion Quarterly*, *84*(S1), 332–354. https://doi.org/10.1093/poq/nfaa010

Gentile, D. (2009). Pathological video-game use among youth ages 8 to 18: A national study. *Psychological Science*, *20*(5), 594–602. https://doi.org/10.1111/j.1467-9280.2009.02340.x

Granow, V. C., Reinecke, L., & Ziegele, M. (2018). Binge-watching and psychological well-being: Media use between lack of control and perceived autonomy. *Communication Research Reports*, *35*(5), 392–401. https://doi.org/10.1080/08824096.2018.1525347

Hale, L., Li, X., Hartstein, L. E., & LeBourgeois, M. K. (2019). Media use and sleep in teenagers: What do we know? *Current Sleep Medicine Reports*, *5*(3), 128–134. https://doi.org/10.1007/s40675-019-00146-x

Hartmann, T., & Klimmt, C. (2006). Gender and computer games: Exploring females' dislikes. *Journal of Computer-Mediated Communication*, *11*(4), 910–931. https://doi.org/10.1111/j.1083-6101.2006.00301.x

Heppt, B., Olczyk, M., & Volodina, A. (2022). Number of books at home as an indicator of socio-economic status: Examining its extensions and their incremental validity for academic achievement. *Social Psychology of Education*, *25*(4), 903–928. https://doi.org/10.1007/s11218-022-09704-8

Hygen, B. W., Skalicka, V., Coplan, R. J., Von Soest, T., Fredriksen, E., & Bekkhus, M. (2024). Norwegian adolescents in the initial stages of COVID-19 restrictions: Links between interactions, digital media use, loneliness, and mental health problems. *Journal of Media Psychology*, *36*(5), 317–329. https://doi.org/10.1027/1864-1105/a000401

Jakobsen, J. C., Gluud, C., Wetterslev, J., & Winkel, P. (2017). When and how should multiple imputation be used for handling missing data in randomised clinical trials - a practical guide with flowcharts. *BMC Medical Research Methodology*, *17*(1), 162. https://doi.org/10.1186/s12874-017-0442-1

Kleemans, M., Daalmans, S., Carbaat, I., & Anschütz, D. (2018). Picture perfect: The direct effect of manipulated Instagram photos on body image in adolescent girls. *Media Psychology*, *21*(1), 93–110. https://doi.org/10.1080/15213269.2016.1257392

Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukophadhyay, T., & Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being? *The American Psychologist*, *53*(9), 1017–1031. https://doi.org/10.1037/0003-066X.53.9.1017

Lobel, A., Engels, R. C. M. E., Stone, L. L., Burk, W. J., & Granic, I. (2017). Video gaming and children's psychosocial wellbeing: A longitudinal study. *Journal of Youth & Adolescence*, *46*(4), 884–897. https://doi.org/10.1007/s10964-017-0646-z

Lopez-Fernandez, O., Williams, A. J., Griffiths, M. D., & Kuss, D. J. (2019). Female gaming, gaming addiction, and the role of women within gaming culture: A narrative literature review. *Frontiers in Psychiatry*, *10*, 454. https://doi.org/10.3389/fpsyt.2019.00454

Männikkö, N., Ruotsalainen, H., Miettunen, J., Pontes, H. M., & Kääriäinen, M. (2020). Problematic gaming behaviour and health-related outcomes: A systematic review and meta-analysis. *Journal of Health Psychology*, *25*(1), 67–81. https://doi.org/10.1177/1359105317740414

Marciano, L., Albanese, E., Viswanath, K., & Camerini, A.-L. (2023). The protective role of social-oriented digital media use in children's and adolescents' life satisfaction during the covid-19 pandemic: A latent growth curve model. *European Journal of Health Communication*, *4*(1), 1–27. https://doi.org/10.47368/ejhc.2023.101

Marciano, L., Schulz, P. J., & Camerini, A.-L. (2022). How do depression, duration of internet use and social connection in adolescence influence each other over time? An extension of the RI-CLPM

including contextual factors. *Computers in Human Behavior*, *136*, 107390. https://doi.org/10.1016/j.chb.2022.107390

Masur, P. K. (2019). *Capturing situational dynamics: Strength and pitfalls of the experience sampling method* [Preprint]. Open Science Framework. https://doi.org/10.31219/osf.io/vx5ha

Mei, S., Yau, Y. H. C., Chai, J., Guo, J., & Potenza, M. N. (2016). Problematic internet use, well-being, self-esteem and self-control: Data from a high-school survey in China. *Addictive Behaviors*, *61*, 74–79. https://doi.org/10.1016/j.addbeh.2016.05.009

Monsalves, M. J., Bangdiwala, A. S., Thabane, A., & Bangdiwala, S. I. (2020). LEVEL (Logical explanations & visualizations of estimates in linear mixed models): Recommendations for reporting multilevel data and analyses. *BMC Medical Research Methodology*, *20*(1), 3. https://doi.org/10.1186/s12874-019-0876-8

Nesi, J., Prinstein, M. J., & Telzer, E. H. (Eds.). (2022). *Handbook of adolescent digital media use and mental health*. Cambridge University Press; Cambridge Core. https://doi.org/10.1017/9781108976237

Neubauer, A. B., Brose, A., & Schmiedek, F. (2023). How within-person effects shape between-person differences: A multilevel structural equation modeling perspective. *Psychological Methods*, *28*(5), 1069–1086. https://doi.org/10.1037/met0000481

Orben, A. (2020). Teenagers, screens and social media: A narrative review of reviews and key studies. *Social Psychiatry & Psychiatric Epidemiology*, *55*(4), 407–414. https://doi.org/10.1007/s00127-019-01825-4

Orben, A., Dienlin, T., & Przybylski, A. K. (2019). Social media's enduring effect on adolescent life satisfaction. *Proceedings of the National Academy of Sciences*, *116*(21), 10226–10228. https://doi.org/10.1073/pnas.1902058116

Orben, A., & Przybylski, A. K. (2019). Screens, teens, and psychological well-being: Evidence from three time-use-diary studies. *Psychological Science*, *30*(5), 682–696. https://doi.org/10.1177/0956797619830329

Orben, A., Przybylski, A. K., Blakemore, S.-J., & Kievit, R. A. (2022). Windows of developmental sensitivity to social media. *Nature Communications*, *13*(1), 1649. https://doi.org/10.1038/s41467-022-29296-3

Oswald, T. K., Rumbold, A. R., Kedzior, S. G. E., Moore, V. M., & Slobodskaya, H. R. (2020). Psychological impacts of "screen time" and "green time" for children and adolescents: A systematic scoping review. *PLOS ONE*, *15*(9), e0237725. https://doi.org/10.1371/journal.pone.0237725

Pan, Y., Teng, Z., Gu, M., Chen, C., & Shek, D. (2024). Editorial: Internet use and psychological well-being among children and adolescents. *Frontiers in Psychiatry*, *14*, 1349082. https://doi.org/10.3389/fpsyt.2023.1349082

Park, S., Kang, M., & Kim, E. (2014). Social relationship on problematic Internet use (PIU) among adolescents in South Korea: A moderated mediation model of self-esteem and self-control. *Computers in Human Behavior*, *38*, 349–357. https://doi.org/10.1016/j.chb.2014.06.005

Paschke, K., & Thomasius, R. (2024). Digitale Mediennutzung und psychische Gesundheit bei Adoleszenten - eine narrative Übersicht. *Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz*, *67*(4), 456–464. https://doi.org/10.1007/s00103-024-03848-y

Perrin, J. S., Leonard, G., Perron, M., Pike, G. B., Pitiot, A., Richer, L., Veillette, S., Pausova, Z., & Paus, T. (2009). Sex differences in the growth of white matter during adolescence. *Neuroimage*, *45*(4), 1055–1066. https://doi.org/10.1016/j.neuroimage.2009.01.023

Perry, D. G., & Pauletti, R. E. (2011). Gender and adolescent development. *Journal of Research on Adolescence*, *21*(1), 61–74. https://doi.org/10.1111/j.1532-7795.2010.00715.x

Pires, F., Masanet, M.-J., Tomasena, J. M., & Scolari, C. A. (2022). Learning with YouTube: Beyond formal and informal through new actors, strategies and affordances. *Convergence: The International Journal of Research into New Media Technologies*, *28*(3), 838–853. https://doi.org/10.1177/13548565211020545

Przybylski, A. K., & Weinstein, N. (2017). A large-scale test of the Goldilocks hypothesis: Quantifying the relations between digital-screen use and the mental well-being of adolescents. *Psychological Science*, *28*(2), 204–215. https://doi.org/10.1177/0956797616678438

Remschmidt, H. (1994). Psychosocial milestones in normal puberty and adolescence. *Hormone Research*, *41*(2), 19–29. https://doi.org/10.1159/000183955

Rideout, V. J., & Robb, M. B. (2019). *The common sense census: Media use by tweens and teens*. Common Sense Media. https://www.commonsensemedia.org/sites/default/files/research/report/2019-census-8-to-18-full-report-updated.pdf

Rubin, D. B. (Ed.). (1987). *Multiple imputation for nonresponse in surveys*. John Wiley & Sons, Inc. https://doi.org/10.1002/9780470316696

Rueth, J.-E., Kerkhoff, D., & Lohaus, A. (2023). Latent growth curve analyses of emotional awareness and emotion regulation in early and middle adolescence. *International Journal of Behavioral Development*, *47*(4), 294–305. https://doi.org/10.1177/01650254231168695

Rutledge, R. B., Skandali, N., Dayan, P., & Dolan, R. J. (2014). A computational and neural model of momentary subjective well-being. *Proceedings of the National Academy of Sciences*, *111*(33), 12252–12257. https://doi.org/10.1073/pnas.1407535111

Ryan, R. M., & Deci, E. L. (Eds.). (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press. https://doi.org/10.1521/978.14625/28806

Scheibe, K., & Zimmer, F. (2022). *Asylees' ICT and digital media usage*. De Gruyter Saur.

Schemer, C., Masur, P. K., Geiß, S., Müller, P., & Schäfer, S. (2021). The impact of internet and social media use on well-being: A longitudinal analysis of adolescents across nine years. *Journal of Computer-Mediated Communication*, *26*(1), 1–21. https://doi.org/10.1093/jcmc/zmaa014

Sun, J., Rhemtulla, M., & Vazire, S. (2021). Eavesdropping on missing data: What are university students doing when they Miss experience sampling reports?. *Personality & Social Psychology Bulletin*, *47*(11), 1535–1549. https://doi.org/10.1177/0146167220964639

Taylor, G., Alpert, J., Waddell, T. F., & Bylund, C. L. (2021). Streaming mindfulness: Well-being and mindfulness among subscribers to a video streaming service. *Internet Interventions*, *25*, 100419. https://doi.org/10.1016/j.invent.2021.100419

Ter Bogt, T., Canale, N., Lenzi, M., Vieno, A., & van den Eijnden, R. (2021). Sad music depresses sad adolescents: A listener's profile. *Psychology of Music*, *49*(2), 257–272. https://doi.org/10.1177/0305735619849622

Tov, W. (2018). Well-being concepts and components. In E. Diener, S. Oishi, & L. Tay (Eds.), *Handbook of well-being*. DEF Publishers. https://doi.org/10.31234/osf.io/nobascholar

Tremblay, M. S., LeBlanc, A. G., Kho, M. E., Saunders, T. J., Larouche, R., Colley, R. C., Goldfield, G., & Gorber, S. (2011). Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *The International Journal of Behavioral Nutrition and Physical Activity*, *8*(1), 98. https://doi.org/10.1186/1479-5868-8-98

Twenge, J. M., Haidt, J., Joiner, T. E., & Campbell, W. K. (2020). Underestimating digital media harm. *Nature Human Behaviour*, *4*(4), 346–348. https://doi.org/10.1038/s41562-020-0839-4

Twenge, J. M., Martin, G. N., & Spitzberg, B. H. (2019). Trends in U.S. Adolescents' media use, 1976-2016. The rise of digital media, the decline of TV, and the (near) demise of print. *Psychology of Popular Media Culture*, *8*(4), 329–345. https://doi.org/10.1037/ppm0000203

Valkenburg, P. M., Meier, A., & Beyens, I. (2022). Social media use and its impact on adolescent mental health: An umbrella review of the evidence. Current Opinion in Psychology, 44, 58–68. https://doi.org/10.1016/j.copsyc.2021.08.017

Valkenburg, P. M., & Peter, J. (2013). The differential susceptibility to media effects model: Differential susceptibility to media effects model. *Journal of Communication*, *63*(2), 221–243. https://doi.org/10.1111/jcom.12024

van Berkel, N., & Kostakos, V. (2021). Recommendations for conducting longitudinal experience sampling studies. In E. Karapanos, J. Gerken, J. Kjeldskov, & M. B. Skov (Eds.), *Advances in longitudinal HCI research* (pp. 59–78). Springer International Publishing. https://doi.org/10.1007/978-3-030-67322-2_4

Van Den Eijnden, R., Koning, I., Doornwaard, S., Van Gurp, F., & Ter Bogt, T. (2018). The impact of heavy and disordered use of games and social media on adolescents' psychological, social, and school functioning. *Journal of Behavioral Addictions*, *7*(3), 697–706. https://doi.org/10.1556/2006.7.2018.65

Victorin, Å., Åsberg Johnels, J., Bob, E., Kantzer, A., Gillberg, C., & Fernell, E. (2020). Significant gender differences according to the problematic and risky internet use screening scale among 15-year-olds in Sweden. *Acta Pædiatrica*, *109*(9), 1891–1892. https://doi.org/10.1111/apa.15240

Vilhelmson, B., Thulin, E., & Elldér, E. (2017). Where does time spent on the Internet come from? Tracing the influence of information and communications technology use on daily activities. *Information Communication & Society*, *20*(2), 250–263. https://doi.org/10.1080/1369118X.2016.1164741

Weinstein, E. (2017). Adolescents' differential responses to social media browsing: Exploring causes and consequences for intervention. *Computers in Human Behavior*, *76*, 396–405. https://doi.org/10.1016/j.chb.2017.07.038

Wright, M. F., & Wachs, S. (2022). Problematic online gaming, subjective health complaints, and depression among adolescent gamers from the United States: The role of console-gaming aggression. *Journal of Children and Media*, *16*(3), 451–460. https://doi.org/10.1080/17482798.2022.2036211

Yaremych, H. E., Preacher, K. J., & Hedeker, D. (2021). Centering categorical predictors in multilevel models: Best practices and interpretation. *Psychological Methods*. https://doi.org/10.1037/met0000434