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The Goldilocks dilemma: gendered patterns of social media usage and adolescent life satisfaction across OECD countries

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Abstract

Purpose The escalating prevalence of social media usage (SMU) among adolescents coincides with a concerning decline in their life satisfaction globally. While public and scientific discourse vigorously debates the impact of SMU on well-being, existing research offers mixed evidence, often lacking in gender-specific analyses, control for key confounders, and clarity on the functional form of this relationship. This study addresses these gaps by examining the association between SMU time and adolescent life satisfaction in a large international context.

Methods Utilizing data from the 2022 Programme for International Student Assessment (PISA), our analytical sample comprised 159,185 15-year-old students across 24 OECD countries. Life satisfaction was measured on a 0–10 scale, and daily SMU was categorized into five groups (no usage, less than 1 h, 1–3 h, 3–5 h, over 5 h). We employed ordinary least squares (OLS) regression models, controlling for socioeconomic status (SES) and bullying experiences as confounders. Models were estimated separately for boys and girls, and a combined model included gender interaction effects to test for gender differences. We conducted both pooled analyses with country-fixed effects and separate country-specific analyses; all models were weighted to account for complex sampling

Results Our pooled analyses reveal an inverted J-shaped relationship between SMU time and life satisfaction. Consistent with the digital Goldilocks hypothesis, adolescents with moderate SMU (1–3 h daily) reported the highest life satisfaction. Importantly, controlling for SES and bullying experiences significantly altered these associations. For boys, the relationship between SMU and life satisfaction became statistically non-significant after confounder control. For girls, however, the inverted J-shaped association persisted, albeit with reduced magnitudes. Girls with no SMU and those with over 5 h of daily usage reported the lowest life satisfaction, with differences of up to 0.32 scale points compared to moderate users. However, country-specific analyses reveal considerable heterogeneity, indicating that this inverted J-shaped pattern is not universal. Consequently, pooled estimates should be interpreted with caution as they mask significant variation across national contexts.

Conclusion This study demonstrates a gendered and highly context-dependent association between SMU and adolescent well-being, underscoring the critical

importance of controlling for confounders. The most robust finding across diverse national contexts is the negative association between excessive use (over 5 h daily) and life satisfaction, particularly for girls. These findings highlight the necessity of gender-specific considerations in research and interventions aiming to promote adolescent life satisfaction in the digital age, particularly addressing the vulnerability of girls to excessive social media engagement.

Keywords Adolescent, Well-being, Life satisfaction, Social media usage, Gender differences, PISA 2022

Introduction

The prevalence and utilization of social media among adolescents have shown a steady increase. On average, social media usage (SMU) accounts for several hours per day (Bobzien et al., 2025; Bertoni et al., 2025; OECD, 2025). This rapid proliferation and shift in usage patterns have raised concerns within both the scientific community and the general public regarding the potential negative influences of SMU (Beyens et al., 2020; Odgers, 2024; Orben & Blakemore, 2023). Concurrently, there has been an observable decline in adolescent life satisfaction and an increase in mental health issues in recent years, placing us in a period of comparatively low life satisfaction among this demographic (Cosma et al., 2022; Keyes & Platt, 2024; Mader et al., 2025; Marquez et al., 2024; Neugebauer et al., 2023; Rudolf & Bethmann, 2023). Consequently, there are vigorous discussions in both public discourse (e.g., debates surrounding smartphone bans in schools or the reception of the Netflix series "Adolescent") and academic circles concerning the relationship between SMU and well-being, particularly among children and adolescents (Fumagalli et al., 2024; Odgers et al., 2020; Twenge & Campbell, 2018; Twenge et al., 2019).

Various theoretical frameworks attempt to explain the relationship between SMU and life satisfaction. One prominent perspective is the *displacement hypothesis* (Neuman, 1988). This hypothesis posits that the detrimental aspects of technology use, such as social media [e.g., bedtime usage, cyberbullying (Best et al., 2014; Carson et al., 2016; Gentile et al., 2017)], increase proportionally with usage time, thereby leading to decreased life satisfaction. It is further argued that increased SMU reduces the time available for other activities known to positively impact life satisfaction, such as engaging in sports, spending offline time with friends and family, or reading (Gentile et al., 2017; Loban et al., 2024). Conversely, some arguments suggest that specific aspects of SMU can yield positive effects (Marciano & Viswanath, 2023). For instance, the *digital Goldilocks hypothesis* (Przybylski & Weinstein, 2017) proposes a inverted J-shaped relationship between SMU and life satisfaction. This perspective suggests that moderate SMU is not harmful. However, very low usage could be detrimental, potentially leading to deprivation of peer interaction and missing out on important information.

The critical importance of this topic has led to an "explosion of research" (Kross et al., 2021). Evidence supporting the displacement hypothesis (Neuman, 1988) indicates that individuals with the lowest social media use often report the highest life satisfaction (Twenge et al., 2019). Conversely, support for the digital Goldilocks hypothesis (Przybylski & Weinstein, 2017) suggests that both very low and very high SMU time are associated with the lowest well-being (Brannigan et al., 2023; Wheatley & Buglass, 2019). While a multitude of studies and reviews exist on this topic, the overall evidence

regarding the influence of SMU on well-being remains mixed, with effects generally categorized as small, if present at all (Best et al., 2014; Fumagalli et al., 2024; Kross et al., 2021; Odgers et al., 2020; Santos et al., 2023; Valkenburg, 2022). Authors of these reviews attribute this mixed evidence to several factors, which are also identified as critical gaps in existing research. Firstly, it's crucial to conduct *age-specific analyses* as the association between social media and well-being varies significantly with age, being most pronounced in adolescence and considerably less so before and after this period (Mader et al., 2025; Odgers et al., 2020; Orben et al., 2022). Specifically, some prior research identifies a distinct window of sensitivity, indicating that the association between SMU and life satisfaction is particularly strong for adolescents aged 12–15 (Mader et al., 2025; Orben & Blakemore, 2023; Orben et al., 2022). The strong link between SMU and well-being in adolescence could be driven by the simultaneous increase in the relevance of peer groups and the school context, which heightens adolescents' need for peer acceptance, belonging, and social integration and also intensifies their sensitivity to rejection (Cook et al., 2019; Eagly & Wood, 2012; Huyge et al., 2015). Secondly, analyses should be *gender-specific* rather than pooled, given that the association between SMU and well-being may differ by gender; as certain studies suggest, girls, for instance, might exhibit a stronger negative relationship between SMU and well-being (Fumagalli et al., 2024; Keyes & Platt, 2024; Lenhart, 2015; Mader et al., 2025). Theoretically, this disparity may stem from girls' greater tendency toward appearance-related social comparisons that threaten self-worth, as well as a stronger general susceptibility to interpersonal stressors (Nesi & Prinstein, 2015). Furthermore, existing research is criticized for often failing to account for important *confounders* such as socioeconomic status (SES) and bullying experiences (Odgers et al., 2020). Prior research clearly demonstrates a link between SES and both life satisfaction and SMU [regarding both time and content (Lenhart, 2015; Mader et al., 2025; Repo et al., 2025; Skogen et al., 2022)]. Similarly, we know from existing literature that there is a connection between bullying experiences and SMU, as well as an association between bullying and life satisfaction (Chen et al., 2024; Guo et al., 2024). Lastly, there remains considerable uncertainty in the literature regarding the *functional form* (e.g., a linear decrease or a J-shaped pattern) of the relationship between SMU time and life satisfaction (Loban et al., 2024).

Our research aims to build upon existing scholarship and contribute to the understanding of the relationship between SMU and life satisfaction among adolescents (around 15 years old) in OECD countries. We specifically contribute to the literature by investigating the functional form of this association, examining it gender-specifically, and controlling for key confounders such as socioeconomic status (SES) and bullying experiences. Our focus on OECD countries is driven by recent paradoxical findings that indicate comparatively low life satisfaction among adolescents (though not among adults) in countries with higher GDP (Rudolf & Bethmann, 2023). These findings are considered paradoxical because life satisfaction research typically demonstrates a positive correlation between national wealth and well-being. The fact that adolescents in high-GDP countries report lower life satisfaction challenges this established pattern. For our analyses, we use data from the latest Programme for International Student Assessment (PISA) cycle from 2022, encompassing 159,185 students from 24 countries. To capture both overarching trends and national variations, we first analyze the data with

all countries pooled to identify general patterns, followed by country-specific analyses to account for potential heterogeneity.

Methods

Data

We utilize data from the 2022 administration of the PISA. The PISA 2022 study involved a two-stage stratified sampling design to obtain a representative sample of 15-year-old students enrolled in educational institutions within participating OECD and partner countries (OECD, 2023a). In the first stage, schools were systematically selected with probabilities proportional to their estimated size. Within each selected school, a random sample of age-eligible students was drawn in the second stage. The target population was 15-year-old students, defined as those aged between 15 years and 3 months to 16 years and 2 months at the beginning of the testing period. For more information on the sampling, see OECD (2023b). The main assessment domains in PISA 2022 were mathematics (as the major domain), reading, and science. Students and school principals also completed questionnaires to provide context for the achievement data.

In some countries, additional questions were administered regarding bullying, as well as life satisfaction and SMU. Our subsequent analyses focus on the OECD countries where this information was collected, which are the following 24 countries: Austria, Chile, Czechia, Denmark, Estonia, Finland, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Poland, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom (UK).

Operationalization

Table 1 details the operationalization of the model variables. Regarding SMU we aggregated the categories "5–7 h" and "more than 7 h per day" due to sample size considerations. To capture life satisfaction, we utilize students' responses (on a 0–10 scale) to the

Table 1 Operationalization of model variables

Variable	Question	Answer categories
Social media usage	During a typical weekday, how much time do you spend doing the following leisure activities? Browse social networks (e.g. Instagram, Facebook)	No time at all Less than 1 h a day Between 1 and 3 h a day More than 3 h and up to 5 h a day More than 5 h and up to 7 h a day More than 7 h a day
Life satisfaction	Overall, how satisfied are you with your life as a whole these days?	Scale from 0 to 10
Gender	Are you female or male?	Female or male
SES	Index of economic, social and cultural status (ESCS)	ESCS composite index generated by data provider
Bullying experiences	During the past 12 months, how often have you had the following experiences in school? (Some experiences can also happen in social media)	WLE generated by data provider
	Other students left me out of things on purpose. Other students made fun of me. I was threatened by other students. Other students took away or destroyed things that belonged to me. I got hit or pushed around by other students. Other students spread nasty rumours about me	Never or almost never, a few times a year, a few times a month, once a week or more

item: "Overall, how satisfied are you with your life as a whole these days?" (Diener, 1984; Diener et al., 2013). To represent socioeconomic status, we utilized the existing ESCS score within the dataset, where higher values indicate a more privileged socioeconomic background. For bullying experiences, we employed the provided weighted likelihood estimate (WLE) score, which is derived from responses to several items. A higher WLE score for bullying experiences indicates a greater degree of being affected by bullying. Since the questions regarding bullying frequency are phrased generally, prompting students to consider both online and in-person experiences, this metric makes no distinction between bullying overall and specific online or social media-based experiences.

Analytical strategy

Drawing upon theoretical considerations and the existing body of research, we constructed a directed acyclic graph (DAG) illustrating the relationship between SMU and life satisfaction (see Fig. 1).[1] In accordance with causal analysis terminology, we classify SES (Jensen et al., 2019; Knies, 2022; Repo et al., 2025; Skogen et al., 2022) and bullying experiences (Chen et al., 2024) as confounders because they conceptually influence both the *cause* (SMU) and the *outcome* (life satisfaction). Therefore, these variables necessitate control to accurately estimate the direct effect of SMU on life satisfaction, which constitutes the *estimand* of our study (Lundberg et al., 2021).[2]

Our analytical approach is twofold: we first use pooled data from all 24 countries to highlight general trends, and subsequently conduct country-specific analyses to account for potential heterogeneity among countries.

We commence our analyses by presenting bivariate findings. First, we illustrate the proportion of girls and boys within the different SMU groups (see Fig. 2). Subsequently,

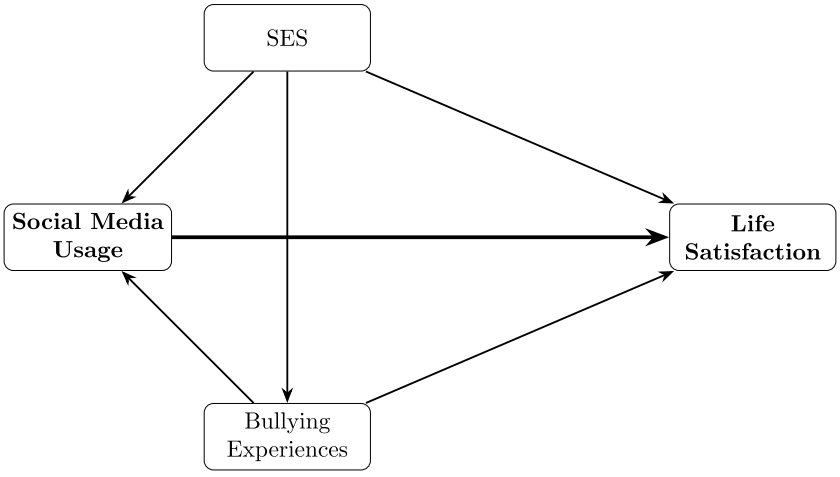

Fig. 1 Directed acyclic graph (DAG) illustrating the hypothesized relationship between social media usage and life satisfaction, with SES and bullying experiences as potential confounders

[1] Alternatively, when examining the impact of SMU on life satisfaction, one could argue that bullying functions as a mediator rather than a confounder (Guo et al., 2024). However, to estimate the direct effect of SMU on life satisfaction, the same model would still need to be estimated if this adjustment were made in the DAG.

[2] In supplementary models (using a subsample of students with no missing values in these variables), we additionally included age (in years), immigrant status (native, first generation, or second generation), as well as WLE scores for assertiveness, curiosity, and stress resistance (Brannigan et al., 2023; Knies et al., 2016; Loban et al., 2024; Mader et al., 2025; Repo et al., 2025; Safi, 2009). The results of these models are presented in Table B1 in Online Appendix B. The coefficients and significance levels of SMU on life satisfaction in these models are highly similar to those reported in the main body of the paper.

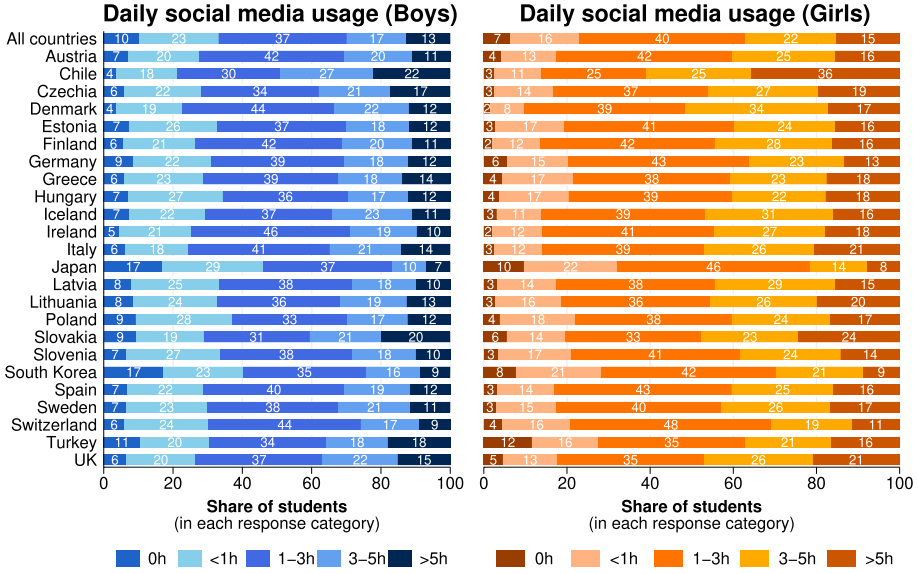

Fig. 2 Daily social media usage among boys and girls. *Note*: This bar chart shows how many of the surveyed students reported spending a specific number of hours per day on social media.*Source*: PISA 2022; our own calculations

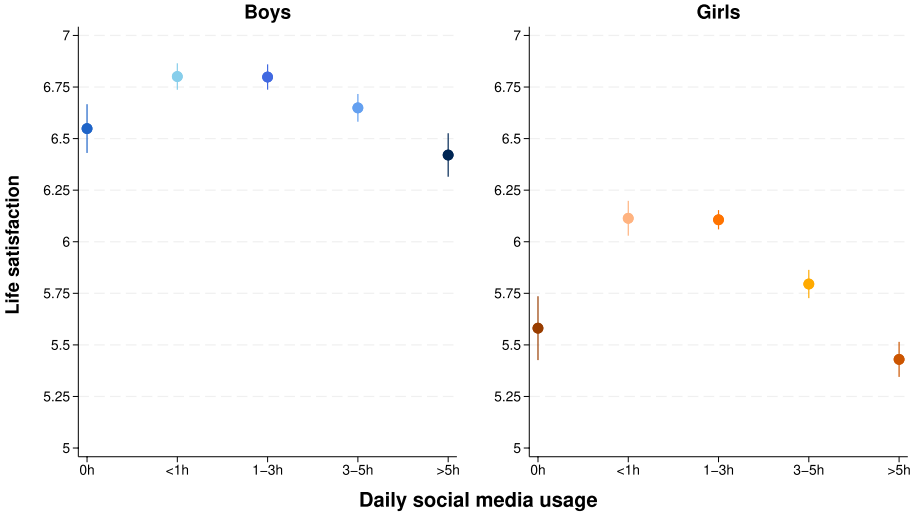

Fig. 3 Average life satisfaction for boys and girls across social media usage groups (pooled across all countries). *Source*: PISA 2022; our own calculations

we present the mean life satisfaction of boys and girls across the various SMU groups (see Figs. 3 and 4).

In an initial model (M0), we estimate the raw effect of SMU on life satisfaction. In a second model (M1), we additionally control for the confounders SES and bullying experiences to estimate the direct SMU effect. Due to potential gender-specific differences in the hypothesized relationships, we first estimate the models separately for boys and girls (Bertoni et al., 2025; Cosma et al., 2022; Fumagalli et al., 2024; Odgers et al., 2020; Orben et al., 2019). Subsequently, we estimate the models jointly for boys and girls and include interaction effects between gender and SMU to examine whether the SMU effects differ statistically significantly for boys and girls. We ran these models on both the pooled

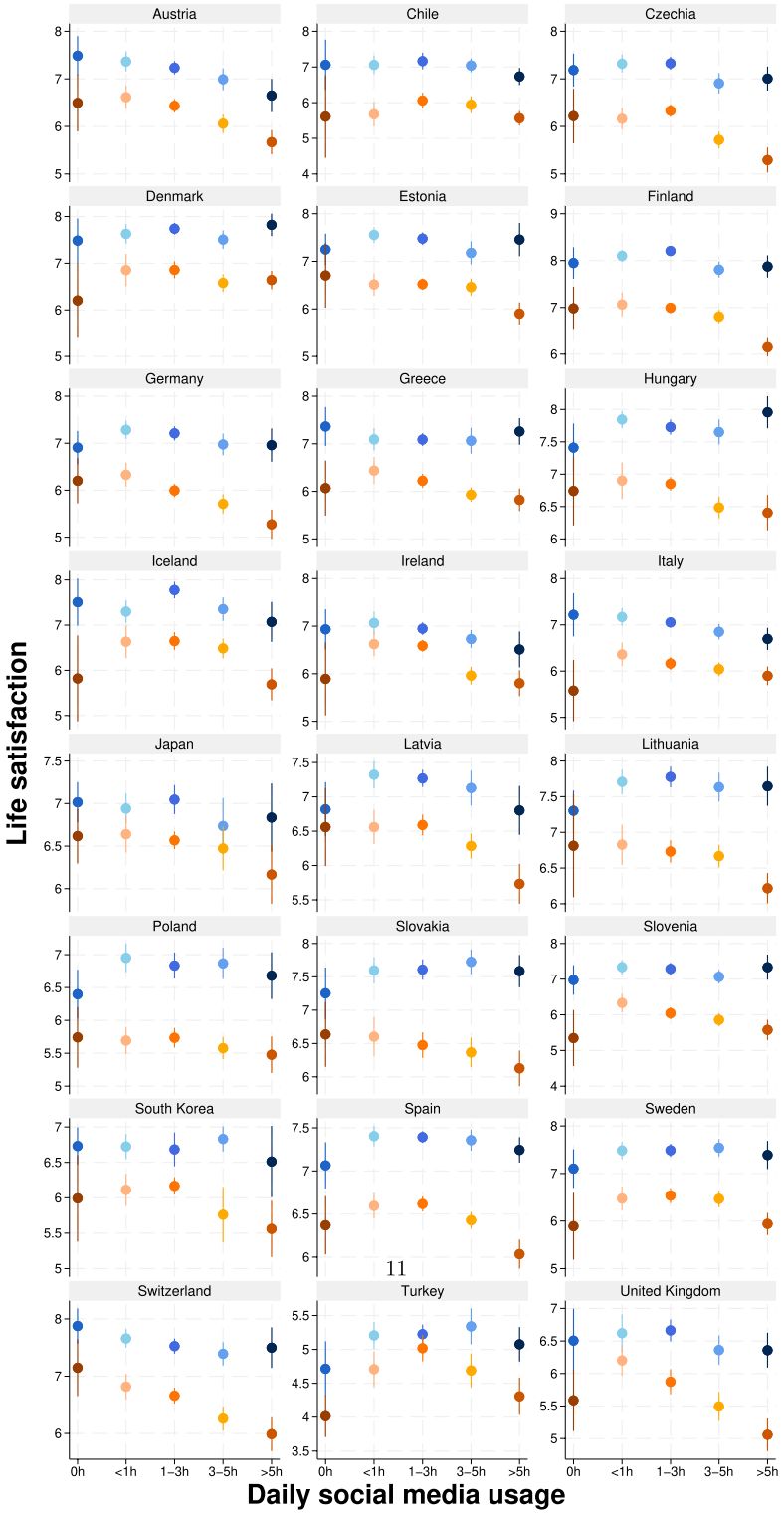

Fig. 4 Average life satisfaction for boys and girls across social media usage groups (disaggregated by country). *Note*: Dots are color-coded by gender, with blue representing boys and orange representing girls. *Source*: PISA 2022; our own calculations

data from all countries and on a country-by-country basis. In the analyses based on the pooled data, all models incorporate country-fixed effects to account for cross-country heterogeneity (Repo et al., 2025; Rudolf & Bethmann, 2023).

The results of the pooled regression models are presented in Table 2. The coefficients of SMU on life satisfaction (from country-specific models with and without control for confounders) are depicted for all 24 countries in the Figs. A1, A2, A3, A4 within Online Appendix A. Finally, based on these models (M1), we calculate predicted values for boys and girls for each SMU category and present these results graphically (see Figs. 4, 5 and 6).

We estimate these models using Ordinary Least Squares (OLS) regression within a complete case analysis. To appropriately account for the sampling design and the complex data structure, we utilize the *repest* package (Avvisati & Keslair, 2014). The total analytical sample comprises 159,185 students from 24 OECD countries.

Results

Bivariate results

Figure 2 illustrates the daily SMU for boys and girls. Based on the pooled data, it is evident that the modal category for both boys and girls is 1–3 h. Girls are more frequently represented than boys in the 1–3 h, 3–5 h, and over 5 h categories, whereas boys are more prevalent in the no usage and under 1 h usage categories. Thus, girls exhibit a higher daily SMU than boys. Notably, only 10% of boys and 6% of girls report no daily social media use. Conversely, this indicates that the vast majority of students engage with social media daily, with substantial heterogeneity in the amount of time spent. More than a third of both boys and girls spend 3 or more hours per day on social media. A country-specific view of SMU reveals considerable heterogeneity across the 24 nations. Despite these national differences, two findings are remarkably consistent. First, 1–3 h remains the modal category for both boys and girls in every single country. Second, the general trend of higher social media engagement among girls holds true universally. In all countries, girls are less likely than boys to report zero usage and are more frequently represented in the highest usage category (over 5 h daily). Some notable outliers, with a comparatively high proportion of students reporting no social media use, are Japan, South Korea, and Turkey.

Figure 3 displays the mean life satisfaction for boys and girls across the different SMU groups (pooled across all countries). Several observations are noteworthy. First, boys report significantly higher life satisfaction than girls across all usage categories. Second, for both boys and girls, life satisfaction exhibits an inverted J-shaped relationship with the time spent on social media. Those with no usage report lower life satisfaction than those with usage under 1 h or between 1 and 3 h. With usage time exceeding 3 h, life satisfaction decreases, and those with over 5 h of daily usage report the lowest life satisfaction for both genders. Third, the inverted J-shaped trend appears more pronounced among girls, suggesting that the differences in mean life satisfaction based on SMU seem more substantial for girls than for boys.

Figure 4 displays the mean life satisfaction for boys and girls across the different SMU groups, disaggregated by country. Several key findings emerge from this cross-country comparison. First, the absolute level of life satisfaction varies considerably between nations, as indicated by the different scales on the y-axis for countries like Turkey and

Table 2 OLS regression coefficients predicting life satisfaction across different models

	Boys				Girls				All			
	M0		M1		M0		M1		M0		M1	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Daily social media usage (ref. 1–3 h)												
0 h	**– 0.17**	0.07	– 0.09	0.07	**– 0.32**	0.07	**– 0.21**	0.07	**– 0.21**	0.07	– 0.12	0.07
0–1 h	0.00	0.04	– 0.01	0.04	0.03	0.04	0.03	0.04	– 0.01	0.04	– 0.01	0.04
3–5 h	**– 0.11**	0.04	– 0.04	0.04	**– 0.25**	0.04	**– 0.15**	0.04	**– 0.09**	0.04	– 0.01	0.04
> 5 h	**– 0.21**	0.06	– 0.07	0.05	**– 0.56**	0.05	**– 0.32**	0.04	**– 0.20**	0.06	– 0.05	0.05
SES			**0.16**	0.02			**0.22**	0.02			**0.19**	0.02
Bullying experiences			**– 0.59**	0.02			**– 0.70**	0.02			**– 0.64**	0.01
Gender (ref. Boys)												
Girls									**– 0.70**	0.04	**– 0.77**	0.03
Interaction effects												
Girls × 0 h									– 0.05	0.10	– 0.06	0.09
Girls × 0–1 h									0.05	0.06	0.06	0.06
Girls × 3–5 h									**– 0.18**	0.06	**– 0.16**	0.06
Girls × > 5 h									**– 0.38**	0.07	**– 0.31**	0.06
Constant	**7.41**	0.03	**7.13**	0.03	**6.62**	0.03	**6.29**	0.03	**7.37**	0.03	**7.10**	0.03
N	79,195		79,195		79,990		79,990		159,185		159,185	
R^2	0.08		0.14		0.07		0.14		0.10		0.16	

Statistically significant coefficients ($\alpha = 0.05$) are printed in bold. All models include country-fixed effects (ref. Spain). Source: PISA 2022; our own calculations

Finland. Despite this, one pattern is common: boys report higher life satisfaction than girls across all SMU categories in every country. Interestingly, the inverted J-shaped relationship that was evident in the pooled analysis is only apparent in a few countries, and when it does appear, it is predominantly among girls. For girls, this pattern is visible in Greece, Hungary, Iceland, Ireland, Slovenia, Spain, Sweden, Turkey, and the United Kingdom. For boys, no single country exhibits a clear inverted J-shaped curve. While boys with no social media use do report comparatively low life satisfaction in some countries (e.g., Hungary, Latvia, Lithuania, Poland, Slovakia, Spain, Turkey), their satisfaction levels show little variation across the other SMU groups within these countries. Generally, life satisfaction for boys remains relatively stable across the SMU categories in many countries. In contrast, it fluctuates more for girls, for whom there is a stronger tendency toward lower life satisfaction at higher durations of use.

Regression results

Gendered associations between SMU and life satisfaction

Table 2 presents the regression coefficients of the various OLS models for boys, girls, and a combined model. Examining the results of Model M0 reveals—consistent with Fig. 1—an inverted J-shaped trend in life satisfaction for both girls and boys. This trend is significantly more pronounced for girls (as indicated by the interaction effects in the combined model). Compared to those with a usage time of 1–3 h, individuals with no SMU and those with over 5 h of usage exhibit the lowest life satisfaction. Overall, those with over 5 h of usage demonstrate the lowest life satisfaction. Turning to the results of Models (M1), which control for the confounders SES and bullying experiences, the following emerges. Firstly, students with higher SES report significantly higher life satisfaction. Secondly, increasing bullying experiences are associated with a statistically significant and substantial decrease in life satisfaction. Regarding the influence of SMU on life satisfaction, no statistically significant differences between the groups are observed for boys after controlling for these confounders, suggesting that the association observed in the bivariate analyses and Model M0 was likely due to confounding. For girls, however, the previously observed associations persist, albeit with reduced magnitudes. This also indicates some degree of confounding, but statistically significant associations between SMU and life satisfaction remain for girls. In the combined model for boys and girls, the main effects of SMU are no longer statistically significant. However, the interaction effects for usage times exceeding 3 h per day for girls remain statistically significant, indicating that for girls, higher SMU is associated with a significant reduction in life satisfaction, a pattern not observed for boys.

The regression coefficients from the country-specific models are presented graphically in Online Appendix A. These figures illustrate the effect of different SMU groups on life satisfaction (compared to the 1–3 h reference group) for the unadjusted model (M0) in Figs. A1 and A2, and the confounder adjusted model (M1) in Figs. A3 and A4. For boys, the unadjusted Model M0 (see Fig. A1) shows few statistically significant differences between the usage groups. In some countries, boys with over 5 h of usage report lower life satisfaction (e.g., Austria, Chile, Czechia, Finland, Iceland, Ireland, Italy, Latvia, and Spain). After controlling for confounders in Model M1 (see Fig. A3), even fewer significant differences remain, and most coefficients are statistically insignificant. In line with the results based on pooled data, this suggests that boys' life satisfaction does not

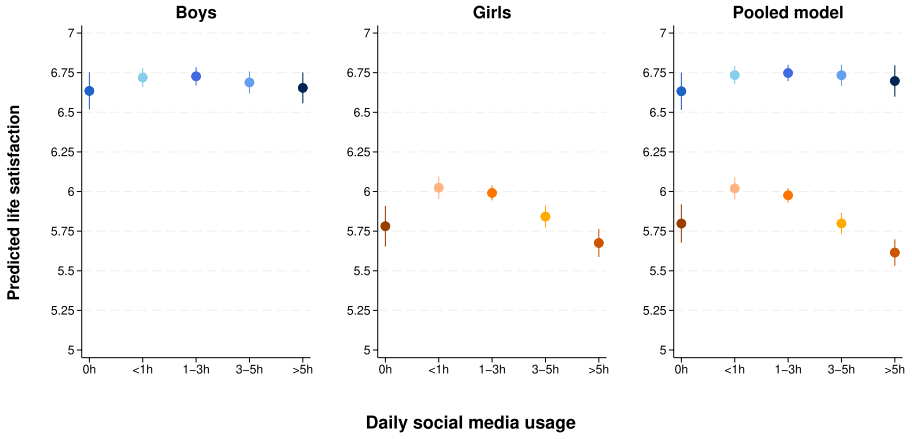

Fig. 5 Predicted life satisfaction for boys and girls across social media usage groups (pooled across all countries). *Note*: Estimates based on regression models (M1) depicted in Table 2. *Source*: PISA 2022; our own calculations

vary strongly or systematically with their SMU. For girls, the findings present a different picture. In the unadjusted Model M0 (see Fig. A2), girls with 5 or more hours of daily social media use have statistically significantly lower life satisfaction than the reference group in most countries. After controlling for confounders (Model M1, see Fig. A4), similar like in the models based on pooled data, the magnitudes of these group differences decrease in many countries. Nevertheless, the pattern persists: in many countries, girls with 5 or more hours of usage continue to show statistically significantly lower life satisfaction than those in the 1–3 h usage group.

Predicted life satisfaction for boys and girls across SMU groups

We predicted life satisfaction for boys and girls across SMU groups using confounder-adjusted regression models (M1). These predicted values are depicted in Fig. 5 (pooled data), and Figs. 6 and 7 (country-specific models). Looking at the pooled data results, one see that boys exhibit higher life satisfaction than girls. Furthermore, there is no statistically significant association between SMU and predicted life satisfaction among boys. For girls, however, an inverted J-shaped relationship is evident between SMU and predicted life satisfaction. Girls with a usage time exceeding 5 h have the lowest predicted life satisfaction, followed by those with a usage time of 3–5 h and those with no SMU. These results clearly demonstrate the gendered association between SMU and life satisfaction.

Similar findings emerge from the country-specific models. For boys, most countries show no substantial differences in predicted life satisfaction across the various SMU groups (see Fig. 6). A consistent pattern is observable in only a few nations. For instance, in Austria and Italy, predicted life satisfaction decreases as social media use increases. Ireland and Latvia exhibit a slight inverted J-shaped curve, while Switzerland and Greece show a U-shaped pattern, where boys with either no or very high usage report the highest predicted life satisfaction. Notably, in several other countries (Sweden, Slovakia, Poland, and Lithuania), boys with no SMU have the lowest predicted life satisfaction. For girls, consistent with the previous analyses, life satisfaction varies more substantially across SMU groups (see Fig. 7). The general trend indicates that higher SMU is associated with lower life satisfaction. In nearly all countries, girls with 5 or more hours of

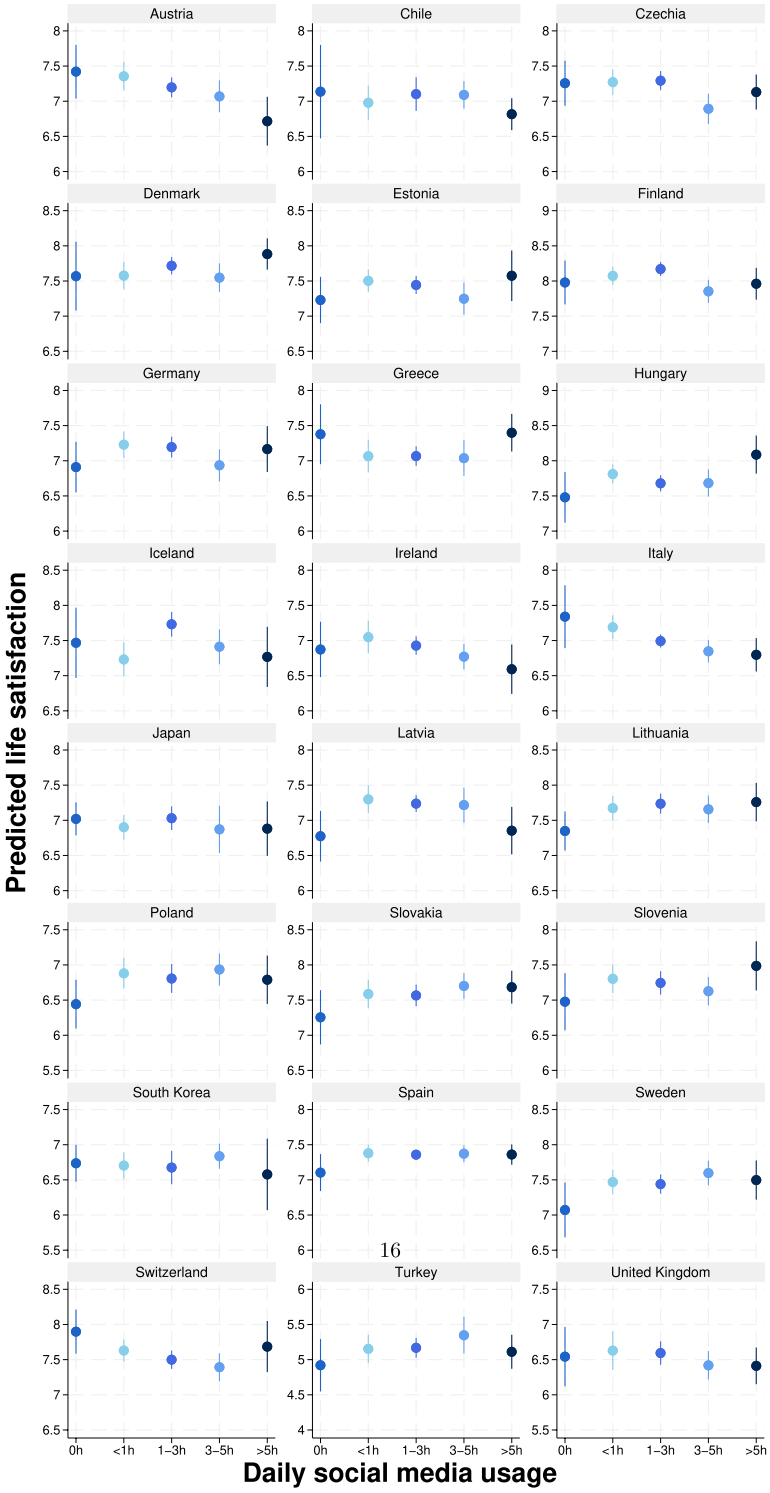

Fig. 6 Predicted life satisfaction for boys across social media usage groups (disaggregated by countries). *Note*: Estimates based on country specific regression models (M1). *Source*: PISA 2022; our own calculations

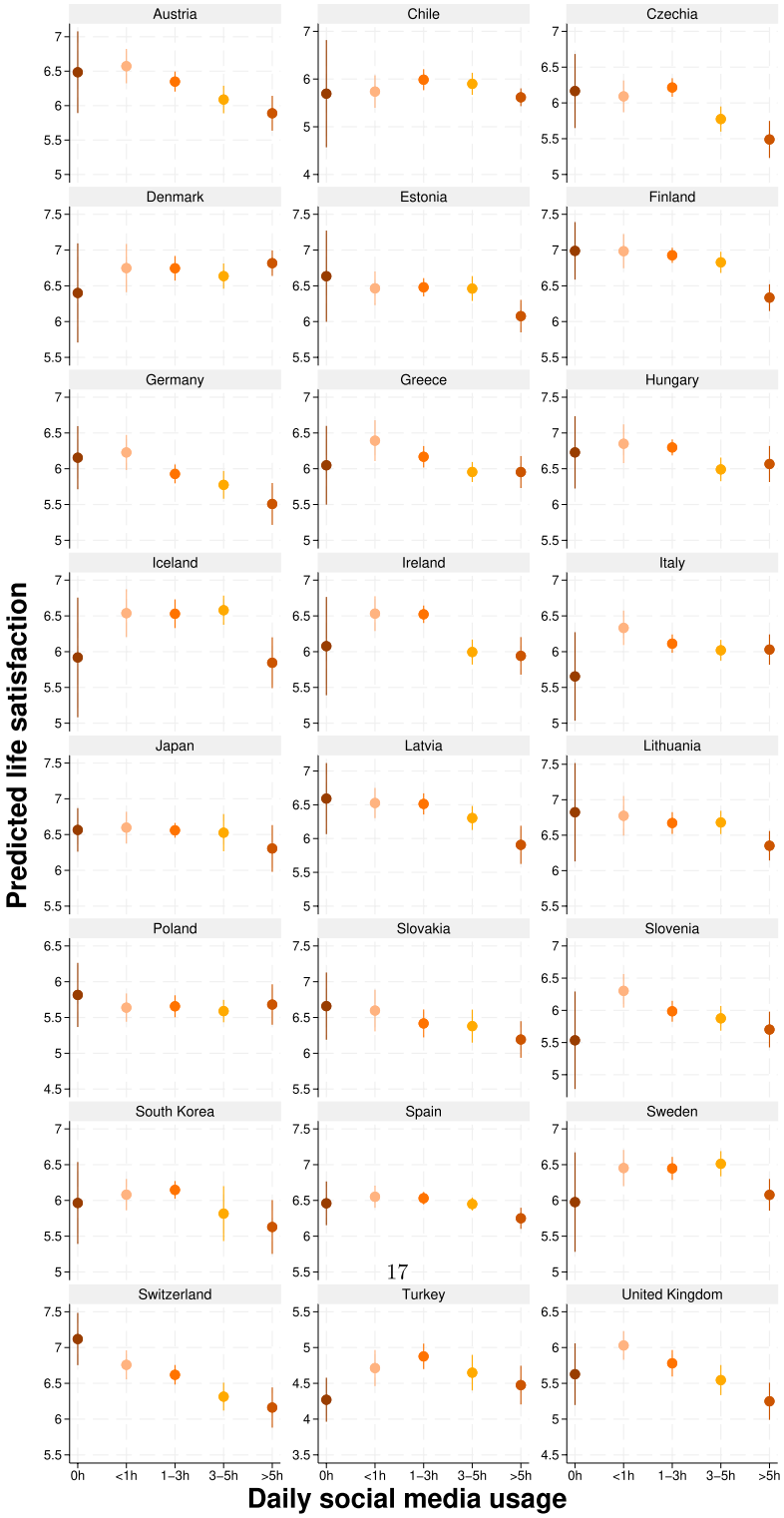

Fig. 7 Predicted life satisfaction for girls across social media usage groups (disaggregated by countries). *Note*: Estimates based on country specific regression models (M1). *Source*: PISA 2022; our own calculations

usage report the lowest life satisfaction (with exceptions such as Denmark, Greece, Hungary, Italy, and Poland). A particularly clear, linear decreasing pattern—where girls with no usage have the highest life satisfaction—is evident in Austria, Germany, Switzerland, Latvia, and Slovakia. However, several other countries display an inverted J-shaped relationship, where girls with no social media use also report comparatively low life satisfaction (e.g., Iceland, Ireland, Italy, Slovenia, Sweden, Turkey, and the United Kingdom).

Robustness checks

Our analyses focused on OECD countries because previous studies indicate that adolescent life satisfaction has particularly declined in these nations in recent years (Rudolf & Bethmann, 2023). As a robustness check, we repeated our analyses for the 22 non-OECD countries that participated in the PISA assessment and whose students answered questions on social media use, bullying, and life satisfaction. These additional analyses allow us to examine the extent to which our findings from OECD countries generalize to other contexts. The 22 countries included in this check are: Albania, Argentina, Brazil, Brunei, Bulgaria, Croatia, Dominican Republic, Georgia, Hong Kong, Jordan, Kazakhstan, Macao, Malaysia, Malta, Morocco, Panama, Romania, Saudi Arabia, Chinese Taipei, Thailand, Ukrainian regions, and Uruguay. The results of these supplementary analyses are presented in Figs. A5 through A14 in Online Appendix A.

Regarding usage time, children in non-OECD countries tend to report higher usage, but there is also greater variation. The distribution across usage categories is more diverse, and the proportion of non-users is sometimes significantly higher than in OECD countries (see Fig. A5). Interestingly, while girls generally show higher usage times, there are several countries where boys are more likely than girls to be in the highest usage category of over 5 h per day (e.g., Albania and Jordan). Consistent with the OECD sample, boys in these countries report higher mean life satisfaction than girls across all SMU groups (see Figs. A6 and A7). The pooled data again reveals a bivariate inverted J-shaped relationship between SMU and life satisfaction, particularly for girls. However, the country-specific analyses confirm that this inverted J-shaped pattern among girls is only evident in a minority of countries (e.g., Croatia, Kazakhstan, Morocco, Uruguay).

For boys, the models controlled for confounders show few differences in predicted life satisfaction among the SMU groups (see Figs. A8 and A9). Notably, boys in the non-usage group report the lowest life satisfaction in several countries (e.g., Argentina, Brazil, Brunei, Bulgaria, Dominican Republic, Hong Kong, Macao, Malaysia, Malta, Morocco, Romania, Uruguay, and Ukrainian regions), while no clear trend emerges across the other usage categories. For girls, there is generally a more pronounced association between increasing social media use and decreasing life satisfaction (see Figs. A8 and A10). The pooled data shows an inverted J-shaped relationship, but this pattern is only replicated in the country-specific models for a few nations (e.g., Argentina, Croatia, Jordan, Kazakhstan, Macao, Morocco, and Saudi Arabia). Nevertheless, a general finding is that girls with very high SMU report the lowest life satisfaction in many countries.

Compared to the results from the OECD countries, these findings are largely comparable. This is reassuring, as it suggests our reported results are not merely an artifact of the initial country selection. However, these analyses once again highlight the considerable cross-country heterogeneity in the functional form of the relationship between SMU and life satisfaction. It is also noteworthy that life satisfaction is, on average, lower

among the studied OECD countries than among the non-OECD countries (Rudolf & Bethmann, 2023).

Discussion

Our study reveals a nuanced and complex association between SMU time and adolescent life satisfaction, a relationship that is significantly shaped by gender and, as our country-specific analyses show, varies considerably across different national contexts. While the pooled data for all countries supports the *digital Goldilocks hypothesis* (Przybylski & Weinstein, 2017) with a clear inverted J-shaped trend, this pattern is not universal. Given this variation, the results based solely on pooled data should be interpreted with caution, as they may overstate the uniformity of the effect and obscure distinct national patterns. The country-specific results are more varied: some countries clearly exhibit the Goldilocks curve, particularly for girls, while others show a more linear, negative association consistent with the *displacement hypothesis*. This heterogeneity suggests that there is no single, uniform effect of social media. Nonetheless, a consistent finding across most contexts is that the lowest levels of life satisfaction are found in adolescents with either no usage or very high usage (exceeding 5 h per day). These findings align with a growing body of literature indicating that excessive social media use is particularly detrimental to adolescent well-being (Bertoni et al., 2025; Brannigan et al., 2023; Wheatley & Buglass, 2019).

Furthermore, our analysis underscores the critical importance of statistically controlling for confounding variables, notably SES and bullying experiences (Odgers et al., 2020). Consistent with prior research, higher SES is associated with greater life satisfaction (Lenhart, 2015; Mader et al., 2025; Repo et al., 2025; Skogen et al., 2022), and increased victimization experiences (Chen et al., 2024; Guo et al., 2024) are linked to significantly diminished life satisfaction. The most striking finding, consistent across both pooled and country-specific analyses, is the profound gender disparity. For girls, a significant—but less pronounced—relationship between social media use and life satisfaction persists even after controlling for confounders like SES and bullying experiences. The functional form varies by country, but the link remains robust, a finding that resonates with studies predominantly identifying an impact of SMU on well-being for girls (Fumagalli et al., 2024; Keyes & Platt, 2024; Lenhart, 2015). For boys, the picture is entirely different. After accounting for these confounders, the association between usage time and life satisfaction largely disappears in the vast majority of countries. This suggests that for boys in our sample, neither the Goldilocks nor the displacement hypothesis finds substantial support. Future research should delve deeper into the underlying mechanisms explaining this gender disparity, particularly considering that girls, on average, report lower mean life satisfaction than boys.

Considering the practical significance of these findings, the controlled differences (based on the pooled data) in life satisfaction between social media groups are noteworthy. For girls, those with no SMU exhibit approximately 0.21 scale points lower life satisfaction than those with 1–3 h of daily usage. Furthermore, girls engaging in over 5 h of daily usage report approximately 0.32 scale points lower life satisfaction compared to their peers with 1–3 h of daily usage. When juxtaposed with the effects of critical life events, these observed differences in life satisfaction are by no means negligible

(Krämer et al., 2025), highlighting the substantive impact of SMU patterns on adolescent well-being.

Although the country-specific analyses do not reveal a single, consistent functional form, a key pattern is nonetheless evident across many nations. The groups at the extremes—those with no social media use and those with very high use—frequently report the lowest life satisfaction. This finding can be interpreted as providing partial support for elements of both the digital Goldilocks (Przybylski & Weinstein, 2017) and the displacement hypotheses (Neuman, 1988). It suggests that while the overall shape of the relationship is context-dependent, both the complete absence of social media and its excessive use are often associated with lower adolescent well-being.

Despite providing valuable insights, our study is subject to several limitations. Foremost, its cross-sectional structure and non-experimental design preclude direct causal inferences (Jensen et al., 2019; Rutkowski et al., 2024; Smith et al., 2024; Stavrova & Denissen, 2021; Tromholt, 2016). Moreover, our reliance on a between-individual rather than a within-individual design (Beyens et al., 2020; Odgers et al., 2020) limits the ability to capture dynamic changes in individuals over time. These limitations are inherent to the cross-sectional data structure of the PISA large-scale assessments. We therefore echo existing calls for more longitudinal, experimental, and within-individual studies to rigorously establish causal relationships. Nevertheless, the study's strengths lie in its extensive sample size, encompassing over 150,000 students from numerous countries, which allowed us to identify a robust partial correlation for girls. A particularly intriguing avenue for future longitudinal research is to investigate the characteristics and experiences of the small group of students reporting no SMU (less than 10% of the sample). Rather than non-use causing dissatisfaction, this may reflect a selection effect. Adolescents who experience negative social events like bullying may withdraw from social media, meaning their lower life satisfaction could stem from these underlying experiences, not the absence of social media itself. Furthermore, the small and shrinking size of this non-user group presents a statistical challenge. In many country-specific models, the lack of a significant effect for this group could be due to low statistical power, an issue that will likely intensify as non-use becomes even rarer.

While our analyses reveal significant cross-country heterogeneity, a deep exploration of the cultural and societal factors driving these differences is beyond the scope of this paper. However, we think that this variation might be explained by how social media is used in different national contexts (e.g., the specific contents, features, and habits). The relationship between usage time and well-being is likely moderated by the specific content consumed, the nature of engagement—such as active social use versus passive consumption—and the dominant social media platforms popular among adolescents in each nation. Consequently, future research should adopt a culturally responsive approach to investigate how these specific usage patterns influence life satisfaction across different regions. Furthermore, a critical limitation is that our dataset relies on usage duration and cannot differentiate between the specific ways in which students engage with these platforms. The term social media encompasses a wide range of activities with distinct psychological mechanisms; for instance, fostering community in a forum differs fundamentally from posting content to seek peer validation (Gentile et al., 2017; Zhang et al., 2023). We therefore join calls for future research to move beyond aggregate time spent (Fumagalli et al., 2024; Keyes & Platt, 2024; Odgers et al., 2020). Future research should

therefore not only employ longitudinal and experimental designs but also incorporate these more granular measures of online activity—such as active social use versus passive consumption—alongside macro-level moderators to understand this complex, context-dependent relationship.

Conclusion

This study investigated the relationship between SMU time and life satisfaction among adolescents across 24 OECD countries, revealing a complex and highly context-dependent association. Our findings challenge the notion of a uniform effect. While pooled analyses provide broad support for the *digital Goldilocks hypothesis* (Przybylski & Weinstein, 2017), demonstrating an inverted J-shaped association where moderate SMU is linked to the highest life satisfaction, while both non-use and excessive use (over 5 h daily) are associated with lower well-being, country-specific models show significant heterogeneity, with patterns in some countries aligning more closely with the *displacement hypothesis* (Neuman, 1988).

A central contribution of this research is its demonstration of pronounced gender-specific effects. For boys, the initial, unadjusted association between SMU and life satisfaction largely disappears after controlling for key confounders. For girls, however, a robust and practically significant relationship persists. While the pooled data points to a consistent inverted J-shaped curve, our country-specific analyses reveal that this functional form is not universal; in many contexts, the pattern is a more linear decline in well-being at higher usage levels. This divergence confirms that the impact of social media is not uniform across genders, reinforcing calls for gender-sensitive research and interventions. The magnitude of these effects for girls, comparable to those of critical life events (Krämer et al., 2025), underscores the substantive relevance of addressing their SMU patterns.

Despite the inherent limitations of cross-sectional data, particularly in inferring causality (Rutkowski et al., 2024), the large-scale, cross-country design of our study offers unique strengths in identifying robust partial correlations and illuminating broad patterns across diverse contexts. Furthermore, these results underscore that broad generalizations about the effects of social media are inadequate. The pronounced heterogeneity across countries and the stark differences between genders highlight the need for context-sensitive and gender-specific approaches from researchers, policymakers, and educators. Our findings also suggest that the lower well-being of non-users may be a product of selection effects rather than a direct consequence of non-engagement, warranting further investigation. Ultimately, to move the debate forward, future research must shift from asking if social media is harmful to understanding how, for whom, and under what circumstances it impacts adolescent well-being. This requires a focus on the content of use, the nature of engagement, and the moderating role of national and cultural contexts, providing a more nuanced evidence base to guide the well-being of young people in the digital age.

Abbreviations

DAG	Directed acyclic graph
ESCS	Index of economic, social and cultural status
GDP	Gross domestic product
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary least squares
PISA	Programme for international student assessment

SES Socioeconomic status
SMU Social media usage
UK United Kingdom
WLE Weighted likelihood estimate

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40536-026-00284-z.

Supplementary Material 1.

Author contributions

R.N.: Supervision; formal analysis; visualization; writing original draft; writing review and editing. R.U.: Writing original draft; writing review and editing.

Data availability

We use data from PISA 2022. The data can be obtained from the following URL: https://www.oecd.org/en/data/datasets/pisa-2022-database.html. The code to reproduce the results is available on OSF at the following link https://osf.io/4kzt3/overview.

Declarations

Competing interests

The authors declare no competing interests.

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