Computers in Human Behavior 163 (2025) 108473

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

Socially (dis)connected in a connected world: The role of young people's digital maturity

Teresa Koch [a,*], Franziska Laaber [a], Alvaro Arenas [b], Arnd Florack [a]

[a] Department of Occupational, Economic, and Social Psychology, Faculty of Psychology, University of Vienna, Austria
[b] Department of Information Systems and Technologies, IE Business School, IE University, Spain

ARTICLE INFO

Handling Editor: Min Jou

Keywords:
Digital maturity
Social connectedness
Social media
Digital technology
Adolescents

ABSTRACT

Social media offer constant social interactions, but young people do not necessarily benefit from these regarding social connectedness. We investigated whether adolescents with higher digital maturity (Laaber et al., 2023) are better able to use social media to enhance social connectedness, and tested three mechanisms of how, who and why individuals engage with others online. The results of a longitudinal and cross-sectional study with adolescent-parent dyads from three European countries (N_{total} = 573) showed that with higher digital maturity, adolescents report higher social connectedness. The relation was not explained by higher active use, but engaging with real-life rather than virtual friends online and holding compassionate goals for others mediated the positive relationship between digital maturity and social connectedness. The findings support digital maturity as an important ability when using digital technologies, as it relates to beneficial social interactions, and suggest potential mechanisms to be strengthened to help adolescents experience positive interactions online.

The digital world presents manifold and constant opportunities for social connections. Considering the high use of digital technologies, especially by young people, digital interaction with others is omnipresent. However, it is not clear to what extent or in what ways these digital social interactions are beneficial or detrimental to young people' social connectedness (Kushlev et al., 2019; T. Ryan et al., 2017; Shensa et al., 2020; Verduyn et al., 2017; Winstone et al., 2021; Zhou et al., 2021). For example, reported rates of loneliness among young people are increasing rather than decreasing (Twenge et al., 2021), as might be expected given their constant online connectivity. This can serve as one indicator that using digital technologies might not necessarily benefit social connectedness, which involves a sense of belonging, experiencing positive relationships, and often relates to lower loneliness (McIntyre et al., 2015; T. Ryan et al., 2017; Winstone et al., 2021).

Arguably, the positive or negative effects of the digital world on social connectedness may depend on how young people use digital technologies. In this paper, we argue that adolescents' digital maturity relates to their social connectedness, as it influences how they use digital devices to engage with others. Digital maturity captures young people's general ability to use digital technologies in beneficial ways for their personal development and integration in society (Laaber et al., 2023). Specifically, we propose that with higher digital maturity, young people will experience greater social connectedness due to more beneficial ways of engaging with others online that establish and maintain social connectedness.

We investigate three potential mechanisms of how digital maturity might enable young people to engage in a kind of social media use that fosters social connectedness, by focusing on a) *how* young people interact with others online, b) *with whom* they interact online, and c) *why* they engage in these interactions, meaning which personal goals they pursue in their social interactions online.

This study takes a novel approach by investigating digital maturity as a fundamental general ability of young people enabling them to form positive social connections in the digital world. Previous research has looked at usage factors such as intensity or type of usage to predict social connectedness (Roberts & David, 2023; Verduyn et al., 2017; Wang et al., 2018), or considered social anxiety or personality traits as determinants of social connectedness (Casale & Fioravanti, 2015; Gerson et al., 2017; Scott et al., 2018; Sindermann et al., 2020). However, to the best of our knowledge, research has not yet investigated general abilities to exploit and properly use digital tools specifically, such as digital maturity, as predictors of social connectedness. Considering that the digital world is a unique and demanding environment, designed to capture users' attention and provide information and comparison with others at an unprecedented speed and intensity (Cara, 2020; Kozyreva et al., 2020; Lorenz-Spreen et al., 2020; Meshi et al., 2015), relying on

* Corresponding author.
E-mail address: teresa.koch@univie.ac.at (T. Koch).

https://doi.org/10.1016/j.chb.2024.108473
Received 7 July 2024; Received in revised form 4 October 2024; Accepted 11 October 2024
Available online 18 October 2024

digital maturity to understand individuals' use of the online world can add valuable insights and valid predictions of social connectedness. This study thus aims to provide explanations why some individuals can benefit more from online social interactions than others, identifying who might be at risk of maladaptive digital device use. Moreover, the study aims to investigate three mechanisms through which social connectedness can be influenced, providing further insights into how digital maturity can lead to higher social connectedness.

1. Theoretical background

1.1. Social connectedness online

Social connectedness can be defined as a sense of belonging, the experience of positive relationships, and perceived support. It can occur through active involvement with others, such as family, school, peers and the individual's community, and includes aspects of social capital and sense of community (Kim et al., 2016; McIntyre et al., 2015; T. Ryan et al., 2017; Winstone et al., 2021). As a related, but distinct construct, loneliness refers to the perception of being socially isolated from others (Hawkley & Cacioppo, 2010). Importantly, one can subjectively feel lonely while being surrounded by others and having many social interactions (Heinrich & Gullone, 2006). Conversely, social disconnectedness does not necessarily imply that individuals experience loneliness (Cornwell & Waite, 2009). Nevertheless, the two concepts are related, as with higher social connectedness individuals often tend to feel less lonely (McIntyre et al., 2015; T. Ryan et al., 2017; Winstone et al., 2021). Social connectedness is generally considered an important factor for well-being (Allen et al., 2014; Grieve et al., 2013; McIntyre et al., 2015; Winstone et al., 2021).

Table 1
Relevant empirical studies on social connectedness online, active use behavior, real friends online and compassionate and self-image goals online.

Study	Design	Key findings
Social connectedness online		
Laghi et al. (2013)	Experience sampling	• Shy individuals reported expressing more negative emotions online. • No difference in positive emotions to not shy individuals. • Shy individuals reported more negative interactions online.
McIntyre et al. (2015)	Online survey	• Introverted university students showed more compulsive use symptoms compared to extroverts. • With higher compulsive use, individuals reported lower social connectedness, partially mediated by introversion.
Yang (2016)	Online survey	• Instagram interaction and Instagram browsing correlated with lower loneliness, Instagram broadcasting correlated with higher loneliness. • Instagram interaction only related to lower loneliness for individuals with low social comparison orientation.
Winstone et al. (2021)	Interviews	• Examining social media and social connectedness in adolescents, 4 themes were identified: displacement of face-to-face socializing, (mis)trust, social obligations, personal and group identity. • Found evidence for a rich-get-richer and poor-get-poorer effect for family and peer connectedness, and a poor-get-richer effect in peer connectedness for adolescents who struggle with face-to-face interactions.
Active vs. passive use behavior		
Deters & Mehl (2013)	Experiment	• When posting more than usual on Facebook for one week, participants experienced reduced loneliness and felt more connected to friends, irrespective of direct social feedback.
Matook et al. (2015)	Three-wave online survey	• Social media use can relate to higher or lower loneliness, depending on individuals' relationship orientation and self-disclosure behavior online. • Passive social media use related to higher perceived loneliness.
Verduyn et al. (2015)	Experiment + Experience sampling	• Using Facebook passively led to lower affective well-being than active use. • Passive Facebook use related to lower affective well-being due to higher envy.
Escobar-Viera et al. (2018)	Online survey	• Passive social media use related to higher depressive symptoms, active social media use related to lower depressive symptoms.
Wang et al. (2018)	Two-wave study in schools	• Active Facebook use related to lower loneliness for low and moderate users, to higher loneliness for heavy users.
Thorisdottir et al. (2019)	Population survey data	• Passive social media use linked to higher anxiety and depressed mood, active social media use linked to lower anxiety and depressed mood. • The relation of passive use persisted even when controlling several risk and protective factors.
Pang (2021)	Online survey	• Passive WeChat use related to higher upward social comparison, which related to higher depressive mood and fear of missing out. • Active WeChat use related to lower upward social comparison.
Pit et al. (2022)	Experiment	• After being ostracized on a fake social media platform, active Facebook use restored perceived social connectedness, compared to using a non-social website (Wikipedia). • Passive Facebook use restored social connectedness to a similar level like a non-social website. • Participants who felt closer to other users restored social connectedness with passive use better than a non-social website.
Roberts and David (2023)	Experiment	• The study manipulated type of social media use (passive or active) and social media use intensity (heavy or light). • Heavy social media use led to lower social connectedness when use was passive, but higher social connectedness when use was active.
Real-life and virtual friends online		
Sharabi and Margalit (2011)	Questionnaire in schools	• Using the internet for communicating with real-life friends related to lower loneliness, communicating with virtual friends related to higher loneliness. • Social goals related negatively to loneliness, achievement goals related positively to loneliness.
Burke and Kraut (2016)	Three-wave online survey + Facebook activity log	• Direct online communication with close friends related to better well-being, viewing posts for wide audiences or one-click interactions (e.g., likes) did not relate to well-being.
Kushlev et al. (2019)	Field experiments, Experience sampling	• Constant connectivity hinders emotional benefit of personal interaction by reducing the emotional benefit because individuals do not pay full attention to their interaction partner, and by preventing social interactions to occur altogether.
Compassionate and self-image goals online		
Tobin et al. (2020)	Online survey	• Strong compassionate goals related positively to responsive behaviors to others on Facebook, in turn relating to higher social capital. • Strong self-image goals related positively to envy, mediated by more Facebook searching and social comparison.
Toh and Lee (2022)	Online survey	• Compassionate goals positively related to the intention to share prosocial Instagram content. • Self-image goals positively related to the intention to share self-promoting Instagram content.
Roper and Tobin (2022)	Online survey	• Strong compassionate goals related positively to behaviors that maintain online relationships, in turn relating to higher social connectedness.

Evidence regarding the relationship between the use of social media applications and social connectedness is mixed. On the one hand, social media can offer a way for shy or anxious individuals to interact with others (Allen et al., 2014; Winstone et al., 2021). Findings suggest that social networking sites can help extend offline relationships (Allen et al., 2014), create social capital and increase one's network of weak ties (T. Ryan et al., 2017; Verduyn et al., 2017), and strengthen offline ties (Chayko, 2014). On the other hand, social media have also been found to negatively relate to social connectedness. Studies have observed correlations between online communication and increased loneliness and isolation (Allen et al., 2014; Sharabi & Margalit, 2011; Shensa et al., 2020). Moreover, researchers conclude that digital device use negatively relates to in-person social connections and emotional support (Kushlev et al., 2019; Shensa et al., 2020). Table 1 presents an overview of studies investigating social connectedness online. Importantly, most studies point to nuanced results regarding social connectedness, emphasizing the importance of the types of online activities individuals engage in (McIntyre et al., 2015; Pandya & Lodha, 2021; T. Ryan et al., 2017; Verduyn et al., 2017).

1.2. Digital maturity and online social interaction

These nuanced findings raise the question of whether some individuals engage in more beneficial online interactions than others. Thus, it is crucial to explore who is better able to exploit social media applications to strengthen social connectedness and prevent potential isolation as a result of navigating through the digital world. The literature suggests that whether social media use relates to social connectedness or social isolation may depend on individual differences (Casale & Fioravanti, 2015; Gerson et al., 2016; Verduyn et al., 2017). Individual characteristics, such as social comparison orientation or self-esteem, may act as protective or risk factors that relate to negative outcomes of social media use (Verduyn et al., 2017). For example, social comparison orientation has been found to moderate the relation of Instagram use with loneliness (Yang, 2016). Moreover, individual characteristics can influence how individuals use social media and the types of activities they engage in online (Gerson et al., 2017). For instance, introverted individuals might rely more on online social connections, although this is not necessarily beneficial (McIntyre et al., 2015; Tobin et al., 2020; Winstone et al., 2021). The goals which individuals pursue in their online interactions can also link to the connectedness they experience. Focusing on the learning context, Sharabi and Margalit (2011) found that social goals negatively related to loneliness, and achievement goals positively related to loneliness. While such factors can influence the use of social media, it is still unclear which are the most important determinants of social connectedness (Tobin et al., 2020).

Until now, it has not been investigated if there are digital competences that influence whether individuals engage in beneficial or detrimental social interactions online. We propose that individuals can have a general underlying ability regarding their use of the digital world, which predisposes them to more beneficial online interactions, benefitting social connectedness. When individuals engage with social media in a digitally mature way, it can enable them to engage in more meaningful social interactions.

Digital maturity captures "capabilities and attitudes which enable individuals to use digital technologies in ways which support individual development and integration into society" (Laaber et al., 2023, p. 2). It is a holistic concept that addresses both the risks and opportunities that the digital world offers (Arenas & Yazdi, 2022; Christensen et al., 2023; Hofmans et al., 2024; Koniakou et al., 2024). With high digital maturity, individuals tend to use the opportunities of the digital world for learning and pursuing their interests, engage in positive interactions with others, but also avoid potential digital risks (Koch et al., 2024; Laaber et al., 2024). Digital maturity is a broad construct that can thus capture a general approach of individuals to their interactions with the digital world across various situations, platforms and functionalities. It includes 10 dimensions, some of which are especially relevant to social connections online, such as *Regulation of Negative Emotions in Digital Contexts* and *Respect Towards Others in Digital Contexts*. The digital maturity concept is based on psychosocial maturity, which includes the effective adjustment to the social world (Bleidorn, 2015; Greenberger et al., 1975), and self-determination theory, assuming that individuals have a need for autonomy, competence and relatedness (Deci & Ryan, 2008; R. Ryan et al., 2008). However, digital maturity specifically focuses on the digital context, addressing specific characteristics and challenges that come with the digital world (Laaber et al., 2023), such as its pervasive nature capturing users' attention (Cara, 2020), and the differences between online and face-to-face interactions (Wright, 2013) with higher psychological distance and anonymity online (Bastiaensens et al., 2016; Chui, 2014; Lipinski-Harten & Tafarodi, 2013). It has relations with general personality maturity, but goes beyond the predictive power of personality maturity regarding outcomes in the context of digital technologies (Laaber et al., 2023). Maturely engaging with digital technologies includes both autonomous use for personal development and interacting with others online in a mature way. Hence, we argue that young people with high digital maturity have abilities and attitudes which enable them to engage in meaningful social interactions online and thus benefit regarding their social connectedness. We expect that digital maturity positively relates to social connectedness:

H1. Digital maturity relates positively to higher social connectedness.

We argue that digital maturity relates to social connectedness due to the way how young people with high digital maturity engage with others online. Digital maturity involves competencies for adequate interactions with others online, engaging with others in a respectful manner, and regulating one's own emotions and impulses when experiencing frustrations in online interactions. Moreover, with high digital maturity individuals show more autonomous and self-determined use of digital devices. Specifically, this means that individuals show autonomy regarding when and how they use digital technologies, choosing online contexts and contents which they experience as positive for themselves (Laaber et al., 2023). Supporting this, Laaber et al. (2024) found in two studies that with higher digital maturity, individuals were more proficient in satisfying their needs for autonomy, competence, and relatedness and avoiding need frustration. Hence, we expect that with higher digital maturity, individuals will engage with others online in ways which benefit their social connectedness. While the theoretical conceptualization of digital maturity inherently includes a relation to social embeddedness (Greenberger et al., 1975; Laaber et al., 2023), no theoretical mechanisms are suggested for this relation. Therefore, we investigate three mechanisms of young people's social interactions online: how, who, and why they engage in social interactions. We expect that digital maturity relates to higher social connectedness via these mechanisms.

1.3. The how – active and passive use

As the kind of online activities are influential regarding social connectedness, an important aspect that has often been discussed in research is *how* individuals engage with others online – whether they engage in active or passive use of social media. Generally, research evaluates passive use of social media, like viewing others' posts, as detrimental to outcomes such as well-being, while active use, such as commenting or posting, is rather seen as positive, although the results are less robust for active use (Escobar-Viera et al., 2018; Matook et al., 2015; Pang, 2021; Roberts & David, 2023; Thorisdottir et al., 2019; Verduyn et al., 2015, 2017; Wang et al., 2018). Relevant studies on

active and passive social media use and their key findings are presented in Table 1. In their active-passive model of social media use, Verduyn et al. (2017) argue that passive social media use can lead to social comparison and envy, while active use can enable social capital and feelings of social connectedness. For instance, passive use was shown to relate to increased loneliness (Matook et al., 2015); while posting more online than usual was experimentally found to increase social connectedness and decrease loneliness (Deters & Mehl, 2013). Addressing the lack of experimental research regarding social media use (Clark et al., 2018), Roberts and David (2023) experimentally tested the effect of heavy or light social media use and passive or active type of use. They observed that heavy use of social media only had a negative effect on social connectedness when used passively, and a positive effect when used actively. These findings underscore the importance of how individuals engage with others online for the effects on social connectedness, suggesting that active social media use relates to higher social connectedness than passive use. Therefore, we hypothesize that with higher digital maturity, young people will engage in more active engagement with others online. We expect this to mediate the relation to social connectedness.

H2. With higher digital maturity, individuals show higher active (rather than passive) use of digital technologies.

H3. The positive relation of digital maturity to social connectedness is mediated by more active use of digital technologies.

1.4. The who – real or virtual friends online

However, the literature on social connectedness online has pointed towards various factors that might explain the differential effects of the use of social media applications on online social connectedness (Pandya & Lodha, 2021; Pit et al., 2022; Verduyn et al., 2022; Yang, 2016). Thus, we assume that active or passive use is not necessarily the only mechanism that might explain how digital maturity relates to social connectedness.

Another aspect which seems important regarding benefits of using social media applications for social connectedness, is *who* individuals engage with online. Using digital communication to compensate for a lack of offline connections does not necessarily alleviate loneliness, while using digital communication to augment one's offline social network can relate to higher social connectedness (Clark et al., 2018; McIntyre et al., 2015; T. Ryan et al., 2017). Previous study results are summarized in Table 1. For instance, Winstone et al. (2021) found support that social media can effectively be used to enhance existing relations and argue that direct peer communication online can be beneficial especially for individuals who have good offline relationships, while excessive online communication does not necessarily benefit social connectedness. Similarly, personal online communication with close ties relates positively to well-being, but superficial interactions like one-click feedback do not (Burke & Kraut, 2016). Sharabi and Margalit (2011) argue that online communication with purely virtual contacts relates to higher loneliness, but that supporting existing real-life relations with online communication can reduce loneliness. Overall, research suggests that when social media are used for meaningful social connections, it can benefit social connectedness and satisfy the need for belonging (Clark et al., 2018; Kushlev et al., 2019; T. Ryan et al., 2017). However, when no meaningful social connections are established online (e.g., superficial interaction, virtual-only friends), this can be detrimental (Burke & Kraut, 2016; Sharabi & Margalit, 2011).

Hence, we investigate whether individuals with higher digital maturity engage more with real-life friends online than with virtual-only friends, and expect the engagement with real-life friends to mediate the relation to social connectedness.

H4. With higher digital maturity, young people report higher social connectedness, which is mediated by their increased engagement with real-life friends online.

1.5. The why – compassionate and self-image goals

Lastly, digital maturity may also be related to the type of goals individuals have in their online interactions, which can influence social connectedness. When individuals hold compassionate goals, they are supportive and considerate of others, intending to be constructive and not to harm relationship partners out of concern for others' wellbeing. In contrast, when individuals hold self-image goals, they focus on portraying a desired image of themselves so that others will recognize their desirable qualities. In this case, support to others is provided to create a positive self-image and out of expectations of reciprocity (Crocker & Canevello, 2008; Crocker et al., 2009; Jiang et al., 2023).

Longitudinal studies have found that support provided out of strong compassionate goals predicted perceived closeness and connectedness to others, as well as increased social support reciprocated by others (Crocker & Canevello, 2008; Crocker et al., 2009). However, strong self-image goals attenuate this effect as recipients are sensitive to the intentions behind support provision. Rather, strong self-image goals predict increased loneliness and interpersonal conflict (Crocker & Canevello, 2008; Crocker et al., 2009). Thus, strong compassionate goals are likely to lead to higher feelings of social connectedness and improved relationship quality, especially when self-image goals are low, whereas self-image goals tend to be detrimental to feelings of belonging (Canevello & Crocker, 2017; Crocker et al., 2009; Jiang et al., 2023; Roper & Tobin, 2022).

Two initial studies have started to investigate the impact of compassionate and self-image goals on social relationships in the online context (Roper & Tobin, 2022; Tobin et al., 2020). Tobin and colleagues (2020) found that with stronger compassionate goals, individuals engaged in more responsive behaviors to others on Facebook, which was associated with improved social capital and positive outcomes such as emotional support. Further findings supported that with stronger compassionate goals, individuals engaged in more behaviors to maintain their online relationships, which was positively related to their social connectedness on Facebook (Roper & Tobin, 2022; see Table 1 for a study overview). These studies suggest that individuals' goals for social interactions are also relevant in the digital context, and that social media can be beneficial to social connectedness when used in ways that strengthen connections with others.

Hence, we hypothesized that compassionate goals act as another mechanism which enables individuals with high digital maturity to benefit from online interactions regarding their social connectedness.

H5. With higher digital maturity, young people follow more compassionate goals in the online context, which enables higher social connectedness.

Moreover, as previous research points to the attenuating effect of self-image goals on the relation between compassionate goals and social connections to others, we hypothesize:

H6. The effect of compassionate goals on social connectedness is attenuated by self-image goals.

2. Study 1

Study 1 tested the relation of digital maturity to social connectedness longitudinally over one year, and examined active use behavior as a mechanism, using both parent and adolescent report (see Fig. 1). The data used for this study was part of the EU-project DIGYMATEX. In this data collection several constructs were investigated, some of which are used to answer our specific hypotheses. The study obtained ethics approval from the Ethics Committee of the University of Vienna (reference number 00615). The study used a sample of adolescents, who are an age group which is especially vulnerable regarding social

relations with their peers and engage in high social media use (Bozzola et al., 2022; Mascheroni et al., 2022).

2.1. Method

2.1.1. Design

The study had a two-wave longitudinal design, with a one-year interval between the two waves. It was an online survey, collecting responses from parent-adolescent dyads at both time points. In Wave 1, adolescents' digital maturity was measured. In Wave 2, adolescents' active use behavior was reported by the parent and the adolescent, and adolescents reported their perceived social connectedness, digital addiction and screen time.

2.1.2. Participants

Responses were collected in a longitudinal online survey with parent-adolescent dyads in Germany and Austria, using the online panel provider *Bilendi*. Overall, 468 dyads completed Wave 2, of which 150 were excluded due to poor data quality as the parents did not consistently report the same year and/or month of birth of the adolescent as in Wave 1, or the adolescent fell outside the recruited age range. Moreover, two dyads were excluded as the adolescent failed both attention checks in Wave 2. The final sample included 316 parent-adolescent dyads. Regarding the adolescents, 53.2% (168) were female, 46.5% (147) were male, 1 identified as non-binary/third gender. The average age at Wave 2 was 14.92 (SD = 1.42). Regarding the parents, 64.9% (205) were female, 35.1% (111) were male. Accordingly, 63.9% (202) were the adolescent's mother, 34.5% (109) the father, five indicated some other relation to the adolescent. Parents average age at Wave 2 was 46.57 (SD = 7.68). Table 2 lists more detailed demographics of parents and adolescents, for a detailed description of the education levels, refer to Online Appendix A.

2.1.3. Measures

Digital Maturity Inventory. Adolescents' digital maturity was measured using the Digital Maturity Inventory (DIMI, Laaber et al., 2023). The scale consists of 32 items, measuring digital maturity across 10 dimensions, such as *Regulation of Negative Emotions in Digital Contexts* (e.g., "When using a mobile device, and I become annoyed or upset online, it takes me a long time to feel better", reverse coded), *Respect Towards Others in Digital Contexts* (e.g., "When using a mobile device, I watch my language when I disagree with someone, so that what I say doesn't come across as mean"), or *Individual Growth* (e.g., "When using a mobile device, I learn something useful"). Responses are measured on a scale from 1 (*never*) to 5 (*always*), except for the *Digital Literacy* dimension which is scored on a scale from 1 (*not at all true of me*) to 5 (*very true of me*). The overall digital maturity composite score was computed according to Laaber et al. (2023). Items and further details about the scale can also be found in Laaber et al. (2023). Cronbach's alpha was .84, for Cronbach's alpha per dimension, refer to Appendix A.

Active use behavior. To measure whether adolescents engage with the online world actively or passively, a self-generated semantic differential scale with five items was used, asking what best describes adolescents' way of using mobile devices and social media on an 11-point scale, with one end of the scale representing passive and the other active engagement. The scale was presented to both the parent (Cronbach's $\alpha = .71$) and the adolescent (Cronbach's $\alpha = .79$) regarding the adolescent's use behavior (see Appendix B).

Social connectedness. A scale by Kushlev et al. (2017) was used to measure general social connectedness with eight items, such as "I feel close to people" on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*), averaged into a composite social connectedness score (Cronbach's $\alpha = .84$). The items are shown in Online Appendix B.

Digital addiction. Digital addiction was measured using the Digital Addiction Scale for Teenagers (Seema et al., 2022). The scale consists of 10 items measuring how often situations occur on an 11-point scale from 1 (*never*) to 11 (*very often*), for example, "I keep an eye on the mobile device even when I talk to someone" (Cronbach's $\alpha = .91$; Online Appendix B).

Screen time. To measure screen time, adolescents were asked to report how many hours per day they spend on mobile devices in their free time, using a continuous slider ranging from 0 to 24 hours per day (Online Appendix B).

2.1.4. Procedure

In both waves, parents were first asked to provide informed consent and completed several questions regarding themselves and the adolescent. They were then asked to pass the survey on to the adolescent, giving them privacy to respond freely. The adolescent received an explanation of the study in easy language and was asked for informed assent. They then completed several questions. In the end, the adolescent was debriefed and asked whether they allow their data to be used. Finally, the parents were debriefed and also provided final consent.

2.1.5. Analysis method

Correlations were used to investigate the relationships between the constructs of interest using SPSS (Version 28). Moreover, the PROCESS macro for SPSS (Hayes, 2017) was used to test the hypothesized effects using model 4 for mediation analysis, setting 5000 bootstrap samples with 95% percentile bootstrap confidence intervals. The data and supplemental material are available on the Open Science Framework (https://osf.io/4yubd/).

2.2. Results

2.2.1. Preliminary analyses

Descriptive statistics and correlations of the variables of interest are shown in Table 3. The correlations show that digital maturity related negatively to active use reported by the parent, but did not correlate with active use reported by the child. Digital maturity and social connectedness both related negatively to digital addiction and screen time. Both active use scales correlated positively with digital addiction. Hypothesis-relevant correlations are further discussed below.

Moreover, adolescents were asked to indicate their reasons for using social media. We computed the correlations of these reasons with digital maturity and social connectedness (Table 4). Digital maturity correlated positively with using social media to stay up to date with news and events, and negatively with using social media to fill spare time. Using

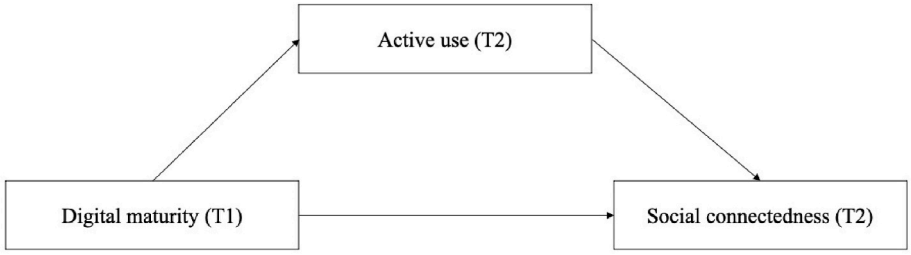

Fig. 1. Conceptual Model Tested in Study 1.

Table 2
Sample demographics Study 1.

Variable	Category	Value
Age adolescents (T2)	(range 13–18)	14.92 (*SD* = 1.42)
Gender adolescents (T2)	female	53.2 %
	male	46.5 %
	non-binary/third gender	.3 %
Age parents (T2)		46.57 (*SD* = 7.68)
Gender parents (T2)	female	64.9 %
	male	35.1 %
Relation to adolescent (T2)	mother	63.9 %
	father	34.5 %
	some other relation	1.6%
Currently attended school level* (T2)	primary education	0 %
**(classified according to ISCED)*	secondary education first stage	51.3 %
	secondary education second stage	38.3 %
	tertiary education first stage	1.3 %
	other current school level	2.8 %
	completed primary education	.6 %
	completed secondary education first stage	5.4 %
	completed secondary education second stage	0 %
	other completed education	.3 %
Degree parent* (T2)	primary education	0 %
**(classified according to ISCED)*	secondary education first stage	24.4 %
	secondary education second stage	42.4 %
	short tertiary education	3.8 %
	bachelor	11.7 %
	master	15.8 %
	doctor/PhD	1.6 %
	other	.3 %
Current employment parent (T1)	more than 35 hrs	49.7 %
	15–34 hrs	35.1 %
	less than 15 hrs	5.7 %
	currently on leave	1.3 %
	currently not working	6.3 %
	other	1.9 %
Subjective socioeconomic status parent (T2)	(range 1–10)	5.96 (*SD* = 1.41)
Devices available at home (T2)	mobile phone/smartphone	99.1 %
	laptop/computer	94.9 %
	(games) console	75.3 %
	tablet/iPad	75.0 %
	smartwatch	29.4 %
	e-reader	27.8 %
Screen time (T2)	average hours	3.76 (*SD* = 2.37)
Age first own smartphone (T1)		9.27 (*SD* = 2.15)
	do not own a phone	.6 %
Mobile devices used every day (T1)	mobile phone/smartphone	98.7 %
	laptop/computer	44.0 %
	(games) console	22.5 %
	tablet/iPad	27.5 %
	smartwatch	8.9 %
	e-reader	1.9 %
	other	.6 %
Age first social media account (T1)	average age	12.17 (*SD* = 1.52)
	no own social media account	19.0 %

social media for reasons relating to friends correlated positively with social connectedness. Using social media to fill spare time related negatively to social connectedness.

2.2.2. Hypothesis testing

The first hypothesis was that digital maturity relates positively to higher social connectedness. This hypothesis was supported by the positive correlation between digital maturity at Time 1 and social connectedness at Time 2 one year later ($r = .288$, $p < .001$), which suggests a strong relationship over time. The second hypothesis tested was that with higher digital maturity, individuals show higher active use of digital technologies. Interestingly, there was no correlation between digital maturity and active use for the adolescent-report ($r = -.070$, $p = .215$), but a significant negative correlation for the parent-report ($r = -.140$, $p = .013$), suggesting the opposite direction of the relationship than hypothesized.

The third hypothesis stated that the relation of digital maturity to social connectedness is mediated by more active use, which was tested using model 4 in PROCESS (Hayes, 2017). Using the adolescent-reported active use, the mediation hypothesis was not supported by the indirect effect of the model, $b = -.003$, $SE = .006$, 95% CI [-.017, .007] (Fig. 2). As can be seen in Table 5, adolescents' digital maturity did not relate to their active use of digital technologies and social media ($b = -.068$, $p = .215$), and active use behavior was not related to their perceived social connectedness ($b = .042$, $p = .445$). However, also in this model, the direct positive relation of digital maturity to social connectedness (H1) remained significant ($b = .288$, $p < .001$).

Repeating the analysis with the parent-report of the adolescent's active use behavior, the indirect effect suggests a mediation, $b = -.018$, $SE = .011$, 95% CI [-.044, −.001] (Fig. 3). In contrast to the adolescent-report, there is now a significant negative relation of digital maturity to active use behavior ($b = -.138$, $p = .013$), and a significant positive relation of active use to social connectedness ($b = .131$, $p = .017$; Table 6). Thus, the results support that there is a mediation effect, although the direction of the relation of digital maturity to active use is contrary to expectations.

2.3. Discussion

The aim of Study 1 was to test whether adolescents with higher digital maturity report higher social connectedness, and whether this relationship can be explained by higher active engagement in the digital world. The results support that digital maturity relates positively to social connectedness as expected. This relationship was found across a time span of one year, supporting the robustness of the effect. However, the positive relationship between digital maturity and active use was not supported, and there was only weak evidence for a mediation, which was opposite to our expectation.

We hypothesized that with higher digital maturity, adolescents might use digital technologies and social media more actively, which enhances their social connections. This hypothesis was not supported. While the parent-reported active use behavior suggested a mediation effect, the path from digital maturity to active use behavior was negative, contrary to expectations. The mediation result of the parent-report indicated that with higher digital maturity adolescents engage in less active use, but that active use positively relates to social connectedness. Nevertheless, digital maturity also related positively to social connectedness. Potentially, this could be interpreted in a way that both digital maturity and active use enable social connectedness but via separate mechanisms, as digital maturity and active use were negatively associated. Interestingly, active use (both parent and adolescent-report) correlated positively with digital addiction, and positively with screen time (in case of the adolescent-report). Thus, active engagement online might go hand in hand with excessive use behavior, providing adolescents with some form of social connections, while digital maturity enables social connectedness via different mechanisms. These findings might link to research which suggests that whether active and passive use are detrimental to social connectedness depends on further factors (Pit et al., 2022; Wang et al., 2018), warranting further investigation. However, the found mediation effect via parent-reported active use should be interpreted with caution. First of all, the adolescent-report did not suggest a mediated effect. Second, parent-reported active use showed no correlation with social connectedness, raising concerns

Table 3
Means, standard deviations and correlations of the main study variables (S0tudy 1).

	M (SD)	Digital maturity (T1)	Active use adolescent (T2)	Active use parent (T2)	Social connectedness (T2)	Digital addiction (T2)
Digital maturity (T1)	363.99 (39.43)	1				
Active use adolescent-reported (T2)	4.22 (1.94)	−.070	1			
Active use parent-reported (T2)	4.73 (1.87)	−.140*	.749***	1		
Social connectedness (T2)	5.11 (1.06)	.288***	.021	.087	1	
Digital addiction (T2)	5.01 (2.13)	−.382***	.157**	.152**	−.251***	1
Screen time in hours (T2)	3.76 (2.37)	−.234***	.129*	.070	−.262***	.439***

Note. *$p < .05$, **$p < .01$, ***$p < .001$. $N = 316$.

Table 4
Correlation of digital maturity and social connectedness with different reasons for using social media platforms (Study 1).

Reasons for using social media (T1)	%	Digital maturity (T1)	Social connectedness (T2)
To stay in touch with what my friends are doing	59.2	.078	.118*
To stay up to date with news and current events	25.3	.173**	−.039
To fill up spare time	27.5	−.194***	−.157**
To find funny and entertaining content	56.0	−.053	−.083
To share photos or videos with others	34.8	−.029	.038
To share my opinion	16.8	.055	.034
To research new products to buy	12.3	−.002	−.060
To meet new people	10.1	.074	−.071
Because all my friends do	43.4	.018	.162**
To play with others	31.0	.086	−.085
To talk or write with others	43.7	.053	−.003
Other	2.5	.153**	−.003

Note. *$p < .05$, **$p < .01$, ***$p < .001$. Percentages are the percentage of adolescents who indicated this option as a reason for using social media (binary choice yes/no).

whether the mediation via parent-reported active use might only occur due to suppressor effects in the model (MacKinnon, Krull, & Lockwood, 2000). Hence, there is no convincing evidence for a mediating effect of active use behavior explaining the relation between digital maturity and social connectedness. Overall, the study provides strong support for a relation between digital maturity and social connectedness, which could be identified over the timespan of one year. There is no evidence for the hypothesized positive mediating effect of active use behavior.

3. Study 2

Study 1 illustrated the hypothesized relationship between digital maturity and social connectedness, but also emphasized that more research is needed to identify the mechanisms by which digital maturity relates to social connectedness. In Study 2, we further investigated the relationship between digital maturity and social connectedness by testing the second and third proposed mechanisms, again focusing on adolescents. As such, we examined whether increased engagement with real-life friends and compassionate goals mediate the relationship between digital maturity and social connectedness (Fig. 4). Moreover, we tested whether the relationship between compassionate goals and social connectedness is attenuated by self-image goals. Like Study 1, the study obtained ethics approval from the Ethics Committee of the University of Vienna (reference number 00615).

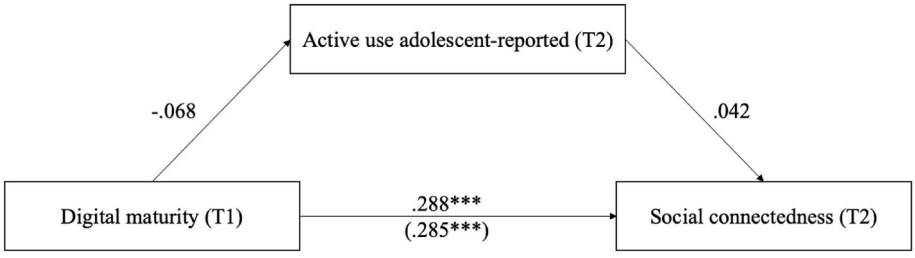

Fig. 2. Mediation Model of Digital Maturity Predicting Social Connectedness via Adolescent-Reported Active Use (Study 1)
Note. ***$p < .001$. $N = 316$. Values are standardized.

Table 5
Direct effects of the mediation model of digital maturity predicting social connectedness via adolescent-reported active use (Study 1).

	Dependent Measure							
	Active use adolescent-reported (T2)				Social connectedness (T2)			
Antecedent	*b*	*SE*	*p*	95% CI	*b*	*SE*	*p*	95% CI
Digital maturity (T1)	−.068	.055	.215	[-.175, .040]	.288	.054	<.001	[.182, .393]
Active use adolescent-reported (T2)					.042	.055	.445	[-.067, .151]
Constant	−.071	.054	.195	[-.178, .036]	−.041	.054	.447	[-.146, .065]
	$R^2 = .005$ $F(1, 314) = 1.542$ $p = .215$				$R^2 = .085$ $F(2, 313) = 14.490$ $p < .001$			

Note. *b* = standardized regression coefficient. $N = 316$.

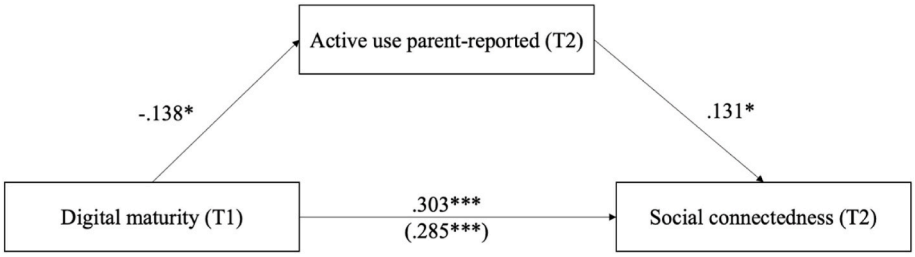

Fig. 3. Mediation Model of Digital Maturity Predicting Social Connectedness via Parent-Reported Active Use (Study 1)
Note. $^{*}p < .05$, $^{***}p < .001$. $N = 316$. Values are standardized.

Table 6
Direct effects of the mediation model of digital maturity predicting social connectedness via parent-reported active use (Study 1).

	Dependent measure							
	Active use parent-reported (T2)				Social connectedness (T2)			
Antecedent	*b*	*SE*	*p*	95% CI	*b*	*SE*	*p*	95% CI
Digital maturity (T1)	−.138	.055	.013	[-.245, −.030]	.303	.054	<.001	[.198, .408]
Active use parent-reported (T2)					.131	.055	.017	[.023, .238]
Constant	−.048	.055	.386	[-.155, .060]	−.038	.053	.480	[-.142, .067]
	$R^2 = .020$ $F(1, 314) = 6.290$ $p = .013$				$R^2 = .100$ $F(2, 313) = 17.304$ $p < .001$			

Note. b = standardized regression coefficient. $N = 316$.

3.1. Method

3.1.1. Design

The study was designed as a cross-sectional online survey, collecting responses from parent-adolescent dyads. Adolescents completed measures of digital maturity, contact with real friends online, compassionate and self-image goals, social connectedness and screen time.

3.1.2. Participants

This study was also part of the EU-project DIGYMATEX assessing adolescents' use of digital technology. Using the online panel *Bilendi*, parent-adolescent dyads from Spain were recruited to participate in the survey. For the present analysis, responses from 278 parent-adolescent dyads with adolescents aged 12 to 18 were used, as they completed additional questions integral to the hypotheses. Of these, 18 dyads were excluded as the parent and adolescent reported different years of birth for the adolescent or the adolescent failed all three attention checks, three were excluded due to missing data. Hence, the final sample included 257 parent-adolescent dyads. Of the adolescents in the final sample, 49.0% (126) were female, 51.0% (131) were male. The average age was 14.45 years ($SD = 1.63$). Of the parents, 53.7% (138) were female, and 46.3% (119) were male. Further, 56.0% (144) indicated to be the participating adolescent's mother, 43.2% (111) the father, 2 indicated some other relation. The parents' mean age was 47.65 years ($SD = 6.59$). Table 7 outlines further demographics of the sample.

3.1.3. Measures

Digital Maturity Inventory, social connectedness and screen time. To measure digital maturity, social connectedness, and screen time, the same items were used as in Study 1. For digital maturity, Cronbach's alpha for Study 2 was .81, for alpha values per dimension refer to Appendix C. For social connectedness, Cronbach's alpha was .90.

Real friends online. In order to measure whether adolescents are more likely to engage with others online who they know in real life or with virtual friends they met online, eight items were created (see Appendix D), some of which were adapted from Sharabi et al. (2016) and Sharabi and Margalit (2011). Four items formed a virtual friends subscale (e.g., "I use the internet to talk to people I do not know in real life"), four items formed a subscale for real-life friends online (e.g., "I am in touch with my friends from everyday life on the internet"), all on a scale from 1 (*not*

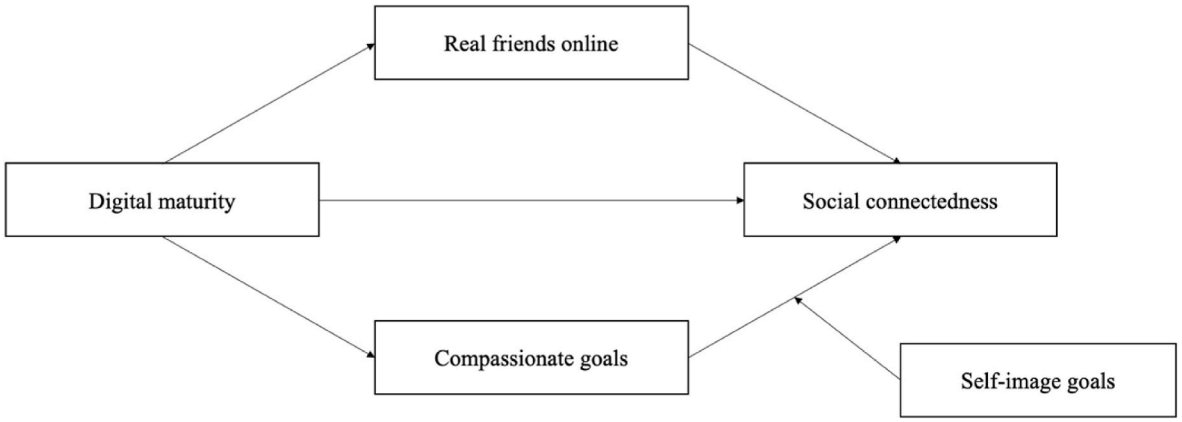

Fig. 4. Conceptual Model Tested in Study 2.

at all true of me) to 5 (*very true of me*). Cronbach's alpha for the *virtual friends subscale* was .94. For the *real friends subscale*, the item "My online friends are the same as my real-life friends" was deleted because alpha increased from .78 to .86 without it and an exploratory factor analysis using varimax rotation suggested a two-factor solution for the scale, with the item cross-loading onto both subscales. For an overall *real friends online* score, the virtual friends items were reversed and all seven items were averaged into a composite score (Cronbach's $\alpha = .73$).

Compassionate and self-image goals. To measure adolescents' goals for engaging with others online, 13 items adapted from Crocker and Canevello (2008) were used. Adolescents were asked to "Please think about what you do online, for example when you use social media. When you were online in the last month, in the area of friendships, how much did you want to or try to", with items scored on a scale from 1 (*not at all*) to 5 (*always*). Example items include "be supportive of others" (compassionate goals) and "get others to recognize or acknowledge your positive qualities" (self-image goals), see Online Appendix C. Items were averaged in order to form overall compassionate (Cronbach's $\alpha = .86$) and self-image goals scores (Cronbach's $\alpha = .77$).

3.1.4. Procedure

The procedure was identical to Study 1.

3.1.5. Analysis method

In the first step, the relationships between the constructs were examined using correlations in SPSS (Version 28). The SPSS macro PROCESS (Hayes, 2017) was used to test indirect effects, using model 4 for double mediation analysis and model 14 for moderated double mediation analysis, with 5000 bootstrap samples for 95% bootstrap confidence intervals. The data are available on the Open Science Framework (https://osf.io/4yubd/), including supplemental material. The study was pre-registered on AsPredicted (https://aspredicted.org/4NB_H8G).

3.2. Results

3.2.1. Preliminary analyses

Table 8 shows descriptive statistics and correlations of the investigated variables. Digital maturity correlated positively with the real friends, but not with the virtual friends subscale. Digital maturity also correlated positively with compassionate and self-image goals, as well as social connectedness. The real friends subscale correlated positively with compassionate goals and social connectedness, the virtual friends subscale correlated positively with self-image goals and negatively with social connectedness. Engaging with virtual friends correlated positively with screen time. The compassionate and self-image goals showed a strong positive correlation, but only compassionate goals correlated with social connectedness, while self-image goals correlated with screen time.

An exploratory factor analysis (EFA) with all items of the digital maturity, compassionate and self-image goals, friends online and social connectedness scales showed that the first factor only accounted for 13.022% of variance in the unrotated factor structure. According to Harman's one-factor test for common method bias, this is below the 50% cut-off recommendation (Podsakoff & Organ, 1986), indicating that there is not one general factor accounting for the variance in the data. Moreover, an EFA with varimax rotation showed that the real friends subscale, virtual friends subscale, compassionate and self-image goals did not load on the same factors as the digital maturity dimensions.

Composite reliability for all constructs was good. The average variance extracted (AVE) of the constructs ranged from .353 to .653, with all AVEs falling above the squared inter-construct correlations, supporting discriminant validity (see Table 9; Fornell & Larcker, 1981).

3.2.2. Hypothesis testing

The first hypothesis tested in Study 2 was that with higher digital

Table 7
Sample demographics Study 2.

Variable	Category	Value
Age adolescents	(range 12–18)	14.45 (*SD* = 1.63)
Gender adolescents	female	49.0 %
	male	51.0 %
Age parents		47.65 (*SD* = 6.59)
Gender parents	female	53.7 %
	male	46.3 %
Relation to adolescent	mother	56.0 %
	father	43.2 %
	some other relation	.78 %
Currently attended school level*	primary education	1.9 %
**(classified according to ISCED)*	secondary education first stage	44.4 %
	secondary education second stage	51.8 %
	tertiary education first stage	.8 %
	other	.4 %
	completed primary education	0 %
	completed secondary education first stage	.8 %
	completed secondary education second stage	0 %
	other	0 %
Degree parent*	primary education	1.6 %
**(classified according to ISCED)*	secondary education first stage	10.1 %
	secondary education second stage	21.0 %
	bachelor	47.1 %
	master	14.8 %
	doctor/PhD	2.7 %
	other	2.7 %
Current employment parent	more than 35 hrs	71.6 %
	15–34 hrs	9.3 %
	less than 15 hrs	1.9 %
	currently on leave	0 %
	currently not working	15.2 %
	other	1.9 %
Subjective socioeconomic status parent	(range 1–10)	5.86 (*SD* = 1.47)
Devices available at home	mobile phone/smartphone	98.1 %
	laptop/computer	95.3 %
	(games) console	87.2 %
	tablet/iPad	76.3 %
	smartwatch	39.3 %
	e-reader	42.8 %
Screen time	average hours	4.10 (*SD* = 3.97)
Age first own smartphone		10.48 (*SD* = 2.65)
	do not own a phone	4.7%
Mobile devices used every day	mobile phone/smartphone	93.4 %
	laptop/computer	61.9 %
	(games) console	22.6 %
	tablet/iPad	27.2 %
	smartwatch	20.2 %
	e-reader	9.7 %
	other	.8 %
Social media accounts	Facebook	25.3 %
	Instagram	59.9 %
	WhatsApp	75.9 %
	TikTok	50.2 %
	Snapchat	11.7 %
	Signal	1.6 %
	Twitter	12.1 %
	YouTube	26.8 %
	Telegram	12.8 %
	Discord	8.9 %
	Other	1.2 %
Age first social media account		13.05 (*SD* = 1.92)
	no own social media account	16.3 %

maturity, young people report higher social connectedness. This hypothesis was supported by the positive correlation of digital maturity and social connectedness ($r = .400$, $p < .001$).

The second hypothesis was that this relationship is mediated by increased engagement with real-life friends, and the third hypothesis was that the relationship is mediated by more compassionate goals in the online context. The fourth hypothesis was that the effect of compassionate goals on social connectedness is attenuated by self-image goals. These hypotheses were tested using a moderated mediation model with real-life friends and compassionate goals as the mediators, and self-image goals moderating the relation of compassionate goals to social connectedness, depicted in Fig. 5. The model supported both indirect effects via real friends online, $b = .042$, $SE = .019$, 95% CI [.008, .083], and compassionate goals, $b = .099$, $SE = .031$, 95% CI [.041, .162] (computed using PROCESS model 4). Using model 14 for the moderated mediation analysis, the indirect effects via both real-life friends and compassionate goals remained significant at all levels of the moderator (Appendix E). The direct effect of digital maturity on social connectedness (H1) remained significant despite the mediations ($b = .245$, $p < .001$; Table 10).

Interestingly, the results also suggested a significant positive interaction of self-image goals with compassionate goals ($b = .077$, $p = .030$). This is contrary to expectations, as the effect of compassionate goals was expected to be weakened rather than strengthened by self-image goals. Thus, this hypothesis was not supported. Despite the moderation, compassionate goals related positively to social connectedness at all levels of the moderator (Table 11). Self-image goals had no direct effect on social connectedness ($b = -.032$, $p = .612$) and did not interact with real-life friends online ($b = -.018$, $p = .763$).

3.2.3. Exploratory analyses

Interestingly, the correlations revealed that the virtual and real friends subscales performed very differently with regards to digital maturity, with the real friends subscale correlating positively ($r = .160$, $p = .010$), but the virtual friends subscale not correlating with digital maturity ($r = -.079$, $p = .205$). Moreover, the EFA supported a two-factor solution for the real friends online scale (see Method section). Thus, the mediating role of the virtual vs. real friends subscales was examined on an exploratory basis. A mediation model (PROCESS model 4) with the two subscales as mediators showed that digital maturity related to the extent to which adolescents engage with friends from their real life online, but not to their engagement with friends who they only know virtually (Fig. 6). The effect of digital maturity on social connectedness was hence only mediated through the real friends subscale ($b = .034$, $SE = .017$, 95% CI [.007, .073]), not through the virtual friends subscale ($b = .016$, $SE = .015$, 95% CI [-.009, .049]). For the direct effects, refer to Appendix F. For further exploratory analyses of the digital maturity dimensions, as pre-registered, refer to the supplemental material.

Table 9
Discriminant validity (Study 2).

Construct	*CR*	1	2	3	4	5
1. Digital maturity[a]	.854	***.653***				
2. Real friends online	.673	.025	***.548***			
3. Compassionate goals	.858	.210	.001	***.467***		
4. Self-image goals	.762	.031	.014	.214	***.353***	
5. Social connectedness	.883	.160	.098	.117	.010	***.569***

Note. *CR* = composite reliability. The diagonal values in bold italics show AVEs, the numbers below are squared inter-construct correlations.
[a] AVE and CR are averaged across digital maturity dimensions.

Moreover, we exploratively tested whether adolescents' digital maturity, social connectedness, engagement with real-life friends online and compassionate goals related to which social media platforms adolescents had an account for (Table 12). Digital maturity did not correlate with the kind of social media accounts, except for a small positive correlation with having a YouTube account. Social connectedness and compassionate goals also showed no relations, but several platforms showed negative relations with engaging with real-life friends online, suggesting that these platforms might encourage more virtual contacts, or are relied on less for real-life contacts.

3.3. Discussion

The aim of Study 2 was to test the mechanisms of *who* individuals engage with online and *why* they engage in these interactions, to explain the relationship between digital maturity and social connectedness. The results again support the strong positive relationship between digital maturity and social connectedness. Moreover, the results indicate that one mechanism of the relationship is engaging with real-life friends online, which corresponds to previous literature on the relation of real-life friends to social connectedness (Clark et al., 2018; T. Ryan et al., 2017; Sharabi & Margalit, 2011). The finding was also supported by the exploratory analysis, which showed that the mediation effect was driven by the real friends subscale, while the virtual friends subscale did not relate to digital maturity. Hence, digital maturity does not influence social connections via engagement with virtual friends, only real-life friends.

In addition, the link between digital maturity and social connectedness was mediated by compassionate goals. The correlation between compassionate goals and social connectedness corresponds to the reasoning that strong compassionate goals are a key to establishing sustainable interpersonal relations (Crocker & Canevello, 2008; Crocker et al., 2009; Jiang et al., 2023). The findings of the present study suggest that digital maturity is linked to compassionate goals and might therefore contribute to forming interpersonal relations even if digital environments carry the risk to focus more on the virtual world than on real relationships.

Table 8
Means, standard deviations, and correlations of the main study variables (Study 2).

	M (SD)	Digital maturity	Real friends online	Real friends subscale	Virtual friends subscale	Compassionate goals	Self-image goals	Social connectedness
Digital maturity	374.31 (37.63)	1						
Real friends online	3.85 (.73)	.157*	1					
Real friends subscale	4.07 (.88)	.160*	-[a]	1				
Virtual friends subscale	2.31 (1.18)	−.079	-[a]	.138*	1			
Compassionate goals	3.96 (.69)	.458***	.024	.122°	.043	1		
Self-image goals	3.64 (.66)	.177**	−.119	.071	.168**	.463***	1	
Social connectedness	5.30 (1.21)	.400***	.313***	.237***	−.204***	.342***	.099	1
Screen time (hrs)	4.10 (3.97)	−.077	−.305***	−.105	.270***	.004	.181**	−.052

Note. ° $p = .05$, *$p < .05$, **$p < .01$, ***$p < .001$. $N = 257$.
[a] The real friends subscale and virtual friends subscale are included in the real friends online overall scale, thus no correlations are provided here.

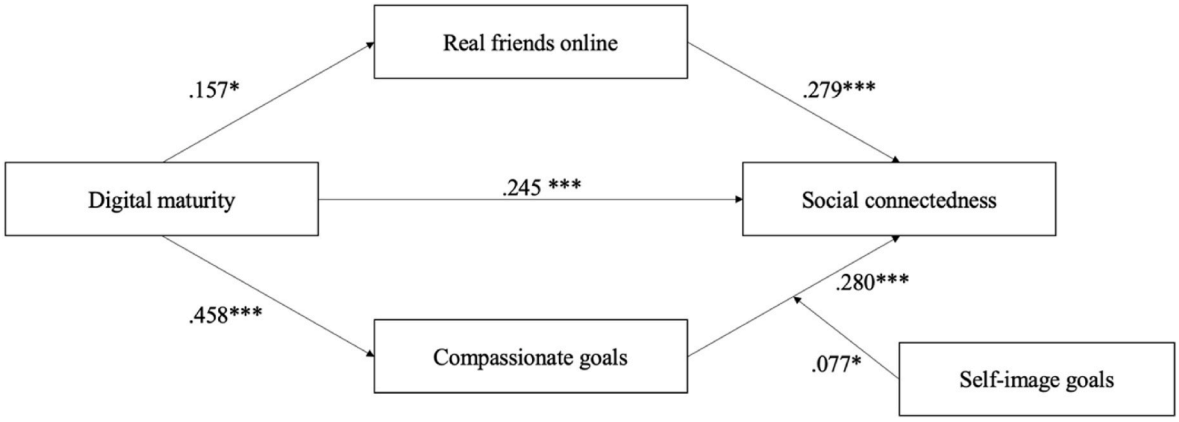

Fig. 5. Moderated Double Mediation Model of Digital Maturity Predicting Social Connectedness via Real Friends Online and Compassionate Goals, Moderated by Self-Image Goals (Study 2)
Note. $*p < .05$, $***p < .001$. $N = 257$. Values are standardized.

Table 10
Direct effects of the moderated double mediation model of digital maturity predicting social connectedness via real friends online and compassionate goals, moderated by self-image goals (Study 2).

	Dependent measure											
	Real friends online				Compassionate goals				Social connectedness			
Antecedent	*b*	*SE*	*p*	95% CI	*b*	*SE*	*p*	95% CI	*b*	*SE*	*p*	95% CI
Digital maturity	.157	.062	.012	[.035, .279]	.458	.056	<.001	[.348, .567]	.245	.062	<.001	[.123, .366]
Real friends online									.279	.056	<.001	[.169, .388]
Compassionate goals									.280	.074	<.001	[.135, .424]
Self-image goals									−.032	.062	.612	[-.153, .090]
Compassionate x self-image goals									.077	.035	.030	[.008, 146]
Real friends x self-image goals									−.018	.060	.763	[-.135, .099]
Constant	.000	.062	1.00	[-.122, .122]	.000	.056	1.00	[-.109, .109]	−.038	.056	.505	[-.149, .074]
	$R^2 = .025$				$R^2 = .209$				$R^2 = .276$			
	F (1, 255) = 6.447				F (1, 255) = 67.517				F (6, 250) = 15.898			
	$p = .012$				$p < .001$				$p < .001$			

Note. b = standardized regression coefficient. $N = 257$.

Table 11
Conditional effect of compassionate goals on social connectedness at levels of the moderator (Study 2).

Self-image goals	*b*	*SE*	*p*	95% CI
Low (−1 SD)	.203	.069	.004	[.067, .338]
Medium (mean)	.280	.074	<.001	[.135, .424]
High (+1 SD)	.356	.092	<.011	[.174, .538]

Note. 95% percentile bootstrap confidence intervals are based on 5000 bootstrap samples. b = standardized coefficient. $N = 257$.

Interestingly, we did not find that high self-image goals reduce the positive effect of compassionate goals on social connectedness. Previous studies have observed that high self-image goals can reduce the beneficial effects of compassionate goals on committed social relationships (Crocker & Canevello, 2008; Crocker et al., 2009), which was not the case in the present study.

One interesting observation was that engagement with real friends was positively linked to compassionate goals, while engagement with virtual friends was positively linked with self-image goals and not vice versa. One potential explanation for these differential links is that with strong compassionate goals, individuals might be inclined to engage with real-life friends online to maintain and intensify these meaningful and supportive relationships. In contrast, individuals with strong self-image goals might see engagement with virtual-only friends as an opportunity to portray themselves in an idealized way. Hence, compassionate goals might lead to a focus on existing relationships, while self-image goals might lead to a focus on selective aspects related to status and respect from others in virtual communities.

Our findings provide initial indications that some social media platforms rather link to engaging with virtual-only friends. The null correlations of accounts for other platforms, like Instagram, with engaging with real-life friends might suggest that these platforms are used for both real-life and virtual friend contact. Interestingly, there are no correlations of digital maturity with which platforms adolescents have accounts for. This corresponds to our argument that digital maturity influences how digital technologies are used. Adolescents with higher digital maturity show similar engagement with different kinds of social media platforms, but might be more likely to use these for engaging with real-life friends, as the correlation of digital maturity with real friends online suggests.

4. General discussion

The goal of this research was to investigate the relationship of digital maturity to social connectedness and three mechanisms of how, who and why young people engage with others online, to explain this relationship. The studies presented here consistently showed that digital maturity relates positively to social connectedness, and identified the communication with real-life friends online and holding strong compassionate goals as two mechanisms of this relationship. The results provide insights into who can benefit from digital technologies regarding social connectedness and the mechanisms enabling this.

The findings provide strong support for a positive relation of digital

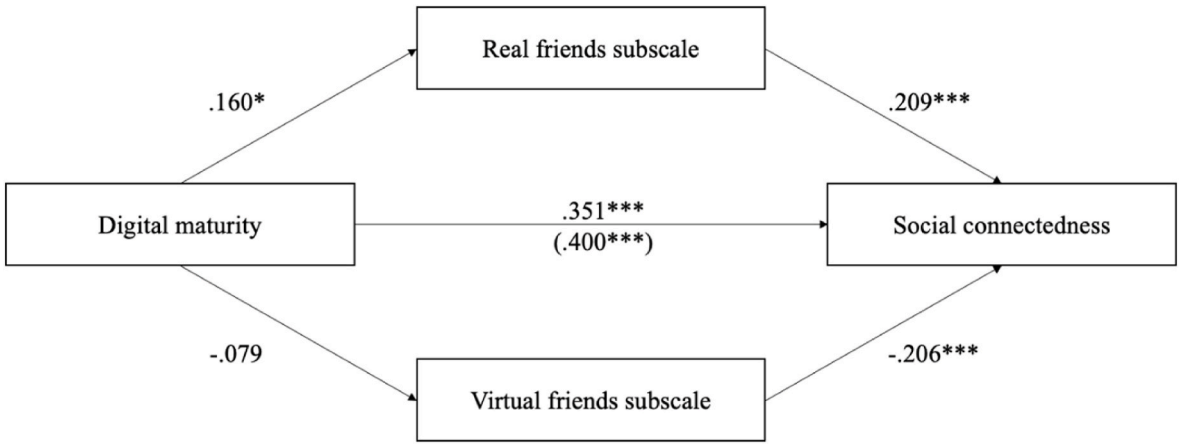

Fig. 6. Double Mediation Model Using the Real Friends and Virtual Friends Subscales as Mediators (Study 2)
Note. $^{*}p < .05$, $^{***}p < .001$. $N = 257$. Values are standardized.

Table 12
Correlations of the investigated constructs with social media accounts (Study 2).

Social media account	%	Digital maturity	Social connectedn.	Real friends online	Compass. goals
Facebook	25.3	.092	−.048	−.252***	.024
Instagram	59.9	.068	.086	−.003	.095
WhatsApp	75.9	−.033	.030	−.046	−.023
TikTok	50.2	−.005	.109	−.092	.037
Snapchat	11.7	−.112	−.050	.037	−.108
Signal	1.6	.045	−.071	−.110	−.012
Twitter	12.1	.070	−.018	−.143*	−.026
YouTube	26.8	.130*	.025	−.147*	.103
Telegram	12.8	.012	−.028	−.132*	−.029
Discord	8.9	.029	−.070	−.086	−.093
Other	1.2	.025	.029	.051	.044

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. Percentages are the percentage of adolescents who indicated to have a social media account on this platform (binary choice yes/no).

maturity to social connectedness, as digital maturity related to higher social connectedness cross-sectionally and longitudinally over the course of one year. Digital maturity is a broad concept of individuals' abilities and attitudes enabling a beneficial use of digital technologies (Laaber et al., 2023, 2024). It relates to the idea of psychosocial maturation (Bleidorn, 2015; Greenberger et al., 1975) and self-determination theory, stating that individuals hold the needs for autonomy, competence and relatedness (Deci & Ryan, 2008; Laaber et al., 2023; R. Ryan et al., 2008). Hence, based on the theoretical foundation, one important aspect of high digital maturity inherently is social integration. Supporting the construct validity of digital maturity, the present research is the first to show that adolescents with higher digital maturity indeed experience higher social connectedness, suggesting digital maturity as a relevant ability in the interaction with others online.

Building on the mixed literature regarding the influence of social media on social connectedness (Pandya & Lodha, 2021; T. Ryan et al., 2017; Verduyn et al., 2022), the relation to digital maturity is highly relevant as it shows who is better able to profit from social media use regarding their social connectedness. Notably, while digital maturity is specifically focused on the digital context, social connectedness was always asked on a general level and not limited to digital contexts. This emphasizes that the use of the digital world relates to adolescents' general social integration (Köbler et al., 2010). The findings indicate that with higher digital maturity, adolescents seem to satisfy their need for relatedness more effectively in the digital context, as suggested by previous literature (Laaber et al., 2024).

While the digital maturity concept implies a relationship to social integration, no theory of how digital maturity enables social integration has yet been provided or tested. Thus, the present study investigated several mechanisms and provided first evidence of how digital maturity links to social connectedness. As a first mechanism of this relationship, we investigated adolescents' active use behavior, which was not supported. Contrary to expectations, adolescent-reported active use behavior did not relate to digital maturity and social connectedness. While the parent-reported active use indicated a mediation effect, the relation of digital maturity to active use was opposite than expected and we question the robustness of this finding (see the Discussion Section of Study 1). The active use measure might have neglected *who* adolescents actively interact with online, which is identified as an important aspect in Study 2. The applied active use scale could also include active engagement in larger chatrooms or online games, which might explain why active use positively related to digital addiction. Overall, further research is required to understand this relation in more detail.

As a second mechanism, who individuals engage with online was examined. With higher digital maturity, individuals interacted with real rather than virtual friends online, which related positively to social connectedness. The positive relation of real friends online to social connectedness corresponds to previous research, which outlines that using social media for meaningful social connections and to strengthen offline relationships can enhance social connectedness, while engagement with virtual-only friends might contribute to or at least not reduce loneliness (Clark et al., 2018; Kushlev et al., 2019; T. Ryan et al., 2017; Sharabi & Margalit, 2011). The findings suggest that as individuals are more digitally mature, they use social media platforms to enhance their existing relationships rather than creating new, solely virtual ones. Consequently, the benefit of this for social connectedness implies that social media platforms could be designed with a focus on fostering and promoting real-world connections.

As a third mechanism, we tested young people's compassionate goals and the moderating effect of self-image goals. With higher digital maturity, adolescents reported stronger compassionate goals, benefitting social connectedness. The findings again indicate that with higher digital maturity adolescents are proficient at engaging with others in beneficial ways and satisfying their need for relatedness also in the digital world (Laaber et al., 2023, 2024). This result adds to a currently small research base which shows that compassionate goals are relevant in the digital context as well (Roper & Tobin, 2022; Tobin et al., 2020). Interestingly, self-image goals positively moderated the relation of compassionate goals to social connectedness, contrary to expectations (Crocker & Canevello, 2008; Crocker et al., 2009). Potentially, idealized self-portrayal might be more accepted online than offline, and thus hinder social connectedness less in the digital context. As this effect was not expected, further research could examine why self-image goals

positively interact with compassionate goals online.

A limitation of the applied cross-sectional and longitudinal design is that we cannot rule out whether social connectedness and adolescents' social network size might influence adolescents' behavior online. In other words, adolescents with large social networks might be more likely to engage with real-life friends online, simply because they have more contacts. However, it is important to note that the social network should not be equated with social connectedness.

Social connectedness goes beyond a quantification of a person's social ties, as it includes the subjective perception of how connected individuals feel (Goswami et al., 2010), which was the focus in the present study. Moreover, Riedl et al. (2013) found that social network size does not directly relate to social connectedness and conclude that network size is not crucial for whether individuals feel socially connected. Hence, it still seems reasonable that adolescents' general perceived social connectedness is affected by their behavior online despite social network size (Köbler et al., 2010). Moreover, it seems unlikely that social network size would affect digital maturity, as a collection of abilities and attitudes regarding the digital world, spanning emotion regulation, as well as digital skills and self-determined behavior.

4.1. Limitations and future directions

As mentioned above, a main limitation of the present research is that we applied correlational designs and cannot definitely conclude whether digital maturity leads to social connectedness or whether social connectedness contributes to digital maturity. In order to examine in more detail whether digital maturity temporally develops first and then influences social connectedness, longitudinal designs over a longer time span than in the present research and with more measurement points could be applied. Such a design could also include important moments of change in adolescents' lives, such as changing schools, in order to capture changes in social relations, which could help to determine the influence of adolescents' social network size. Also, a design with a training group to increase digital maturity compared to a control group is conceivable as a route for future research on the effects of digital maturity on social connectedness. Moreover, future studies might attempt to test social relations using other methods, for example social media log data of online communication, which can further help to reduce concerns regarding common-method bias.

A further limitation of the present research is that we did not measure the engagement with social media platforms in detail. Hence, we could not consider the frequency and importance of specific platforms for adolescents' online communication and the relation to social connectedness. It is an open question how the use of different social media platforms relates to who adolescents engage with online and whether specific platforms are used by adolescents to strengthen their real-life friendships.

Moreover, further investigation is required to understand how active use relates to digital maturity, excessive use and social connectedness. The negative relation of parent-reported active use with digital maturity, and the positive relation to digital addiction and screen time raise several points for future testing. Potentially, active use behavior could have both positive and negative aspects, for example when considering gamers who have online relations with others, but engage in excessive use behavior. Thus, different facets of active use should be compared in more detail to understand this relation better.

Further, future research could examine via which behaviors compassionate goals enable higher social connectedness. Previous literature on compassionate and self-image goals focused on support-provision (Crocker & Canevello, 2008; Crocker et al., 2009), which is not included in the present research. Thus, it could be investigated what kind of behaviors individuals engage in online, as support provision might be of a different nature compared to the offline context. Future research could also dive deeper into the suggested relations of real friends online with compassionate goals and virtual friends with self-image goals.

Overall, several new avenues for future research present themselves based on the findings, which will be interesting to explore in order to understand the relation of adolescents' online behavior to social connectedness in more detail.

5. Conclusion

To conclude, this study provides evidence that digital maturity relates to higher social connectedness, as postulated by the theoretical foundation of the digital maturity concept (Laaber et al., 2023, 2024), and is the first to provide two mechanisms explaining this relationship. The results provide initial evidence how digital maturity relates to social connectedness, which is useful to further develop the theory around digital maturity and understand the relation of digital maturity to outcomes of digital technology use. Moreover, the study showed that active use is not necessarily a relevant mechanism by which digital maturity enables social connectedness. This is interesting, as active vs. passive use has often been focused on in discussions of positive social media use (Matook et al., 2015; Roberts & David, 2023; Verduyn et al., 2015, 2017). Our findings suggest that other aspects which have been focused on less, such as who individuals engage with online and the goals they hold, should be focused on as well. Thus, the present research provides important insights how social media can be used to benefit adolescents' social relations. The findings support the high relevance of the digital context for adolescents' social relations, which is an important topic considering the omnipresence of social media in society.

We have no conflict of interest to disclose. The work presented here has been developed in the context of the Digymatex project. This project has received funding from the European Union's Horizon 2020 research and innovation programme [grant agreement No 870578].

CRediT authorship contribution statement

Teresa Koch: Writing – original draft, Software, Methodology, Formal analysis, Conceptualization. **Franziska Laaber:** Writing – review & editing, Validation, Software. **Alvaro Arenas:** Writing – review & editing, Conceptualization. **Arnd Florack:** Writing – review & editing, Supervision, Project administration, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The work presented here has been developed in the context of the Digymatex project. This project has received funding form the European Union's Horizon 2020 research and innovation programme (grant agreement No. 870578).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chb.2024.108473.

Appendix A

Study 1 Reliability Analysis of the Digital Maturity Dimensions at Wave 1 ($N = 316$).

Dimension	Number of items	Cronbach's α
Autonomous Choice to Use Mobile Devices	3	.848
Autonomy Within Digital Contexts	3	.845
Digital Literacy	3	.843
Individual Growth in Digital Contexts	3	.871
Digital Risk Awareness	3	.905
Support-Seeking Regarding Digital Problems	4	.877
Regulation of Negative Emotions in Digital Contexts	3	.903
Regulation of Impulses in Digital Contexts	3	.831
Respect Towards Others in Digital Contexts	4	.826
Digital Citizenship	3	.827
Across all items	32	.840

Appendix B

Active Use Semantic Differential Scale: Parent-Reported.

We now ask you to assess your child:

When you think about how your child uses mobile devices/social media (WhatsApp, Instagram, TikTok …), which words best describe your child?

You always see two descriptions. With the response options in-between, you indicate which description rather fits for your child.

	Item												
1	**Pictures/Videos/Text**												
	View	o	o	o	o	o	o	o	o	o	o	o	Create
2	**Posts**												
	View passively	o	o	o	o	o	o	o	o	o	o	o	Comment actively
3	**When my child views posts**												
	He/she is relaxed	o	o	o	o	o	o	o	o	o	o	o	He/she is full of drive to try things out
4	**When using social media**												
	He/she is rather active	o	o	o	o	o	o	o	o	o	o	o	He/she is rather passive
5	**Discussions**												
	Follow	o	o	o	o	o	o	o	o	o	o	o	Participate

Active Use Semantic Differential Scale: Child-Reported.

When you think about how you use mobile devices/social media (WhatsApp, Instagram, TikTok …), which words best describe you?

You always see two descriptions. With the response options in-between, you indicate which description rather fits for you.

	Item												
1	**Pictures/Videos/Text**												
	View	o	o	o	o	o	o	o	o	o	o	o	Create
2	**Posts**												
	View passively	o	o	o	o	o	o	o	o	o	o	o	Comment actively
3	**When I view posts**												
	I am relaxed	o	o	o	o	o	o	o	o	o	o	o	I am full of drive to try things out
4	**When using social media**												
	I am rather active	o	o	o	o	o	o	o	o	o	o	o	I am rather passive
5	**Discussions**												
	Follow	o	o	o	o	o	o	o	o	o	o	o	Participate

Appendix C

Study 2 Reliability Analysis of the Digital Maturity Dimensions ($N = 257$).

Dimension	Number of items	Cronbach's α
Autonomous Choice to Use Mobile Devices	3	.765
Autonomy Within Digital Contexts	3	.819
Digital Literacy	3	.791
Individual Growth in Digital Contexts	3	.900
Digital Risk Awareness	3	.875
Support-Seeking Regarding Digital Problems	4	.872
Regulation of Negative Emotions in Digital Contexts	3	.886
Regulation of Impulses in Digital Contexts	3	.871
Respect Towards Others in Digital Contexts	4	.791
Digital Citizenship	3	.915
Across all items	32	.811

Appendix D

Real Friends Online Scale.
The following statements are about who you interact with online. Please indicate how much these statements apply to you.

Subscale	Item	
Virtual friends	1	I talk to people on the internet who I met through the internet
	2	I use the internet to talk to people I do not know in real life
	3	I use the internet to meet new people online
	4	I have friends who I know only through the internet
Real friends	5	I use the internet to talk to real-life friends and acquaintances
	6	I use the internet to make plans with real-life friends
	7	I am in touch with my friends from everyday life on the internet
	8	(My online friends are the same as my real-life friends)[a]

Note. [a]Item 8 was not included in the analyses.

Appendix E

Table E1
Indirect Mediation Effect via Real-life Friends Online at Different Levels of the Moderator ($N = 257$)

Self-image goals	*b*	*SE*	95% CI
Low (−1 SD)	.047	.025	[.007, .101]
Medium (mean)	.044	.020	[.009, .086]
High (+1 SD)	.041	.021	[.006, .089]

Note. 95% percentile bootstrap confidence interval are based on 5000 bootstrap samples. b = standardized coefficient.

Table E2
Indirect Mediation Effect via Compassionate Goals at Different Levels of the Moderator ($N = 257$)

Self-image goals	*b*	*SE*	95% CI
Low (−1 SD)	.093	.036	[.016, .164]
Medium (mean)	.128	.039	[.055, .206]
High (+1 SD)	.163	.048	[.070, .260]

Note. 95% percentile bootstrap confidence intervals are based on 5000 bootstrap samples. b = standardized coefficient.

Appendix F

Direct Effects of the Exploratory Double Mediation Model of Digital Maturity Predicting Social Connectedness via the Real and Virtual Friends Subscales (Study 2)

	Dependent Measure											
	Real friends subscale				Virtual friends subscale				Social connectedness			
Antecedent	*b*	*SE*	*p*	95% CI	*b*	*SE*	*p*	95% CI	*b*	*SE*	*p*	95% CI
Digital maturity	.160	.062	.010	[.039, .282]	−.079	.062	.205	[-.202, .044]	.351	.056	<.001	[.240, .461]
Real friends subscale									.209	.057	<.001	[.098, .320]
Virtual friends subscale									−.206	.056	<.001	[-.316, −.095]
Constant	.000	.062	1.00	[-.122, .122]	.000	.062	1.00	[-.123, .123]	.000	.055	1.00	[-.108, .108]
	$R^2 = .026$				$R^2 = .006$				$R^2 = .232$			
	$F(1, 255) = 6.716$				$F(1, 255) = 1.616$				$F(3, 253) = 25.441$			
	$p = .010$				$p = .205$				$p < .001$			

Note. b = standardized regression coefficient. $N = 257$.

Data availability

The data is openly available on OSF (https://osf.io/4yubd/).

References

Allen, K. A., Ryan, T., Gray, D. L., McInerney, D. M., & Waters, L. (2014). Social media use and social connectedness in adolescents: The positives and the potential pitfalls. *Australian Educational and Developmental Psychologist, 31*(1), 18–31. https://doi.org/10.1017/edp.2014.2

Arenas, A., & Yazdi, P. (2022). Towards a model of technology usage and digital maturity in children: A grounded-theory approach. *ECIS 2022 Research Papers, 107*. https://aisel.aisnet.org/ecis2022_rp/107.

Bastiaensens, S., Pabian, S., Vandebosch, H., Poels, K., Van Cleemput, K., DeSmet, A., & De Bourdeaudhuij, I. (2016). From normative influence to social pressure: How relevant others affect whether bystanders join in cyberbullying: Normative influence on cyberbullying bystanders. *Social Development, 25*(1), 193–211. https://doi.org/10.1111/sode.12134

Bleidorn, W. (2015). What accounts for personality maturation in early adulthood? *Current Directions in Psychological Science, 24*(3), 245–252. https://doi.org/10.1177/0963721414568662

Bozzola, E., Spina, G., Agostiniani, R., Barni, S., Russo, R., Scarpato, E., Di Mauro, A., Di Stefano, A. V., Caruso, C., Corsello, G., & Staiano, A. (2022). The use of social media in children and adolescents: Scoping review on the potential risks. *International Journal of Environmental Research and Public Health, 19*(16), 9960. https://doi.org/10.3390/ijerph19169960

Burke, M., & Kraut, R. E. (2016). The relationship between Facebook use and well-being depends on communication type and tie strength: Facebook and well-being. *Journal of Computer-Mediated Communication, 21*(4), 265–281. https://doi.org/10.1111/jcc4.12162

Canevello, A., & Crocker, J. (2017). Compassionate goals and affect in social situations. *Motivation and Emotion, 41*(2), 158–179. https://doi.org/10.1007/s11031-016-9599-x

Cara, C. (2020). Dark patterns in the media: A systematic review. *Network Intelligence Studies, 7*(14), 105–113.

Casale, S., & Fioravanti, G. (2015). Satisfying needs through social networking sites: A pathway towards problematic internet use for socially anxious people? *Addictive Behaviors Reports, 1*, 34–39. https://doi.org/10.1016/j.abrep.2015.03.008

Chayko, M. (2014). Techno-social life: The internet, digital technology, and social connectedness. *Sociology Compass, 8*(7), 976–991. https://doi.org/10.1111/soc4.12190

Christensen, R. N., Siddiqui, A., Valogianni, K., Florack, A., & Hubert, M. (2023). Towards a composite index for digital maturity: An unsupervised machine learning approach. In *The 15th mediterranean conference on information systems (MCIS) and the 6th Middle East & north africa conference on digital information systems (MENACIS)*, Article 10903. https://easychair.org/publications/preprint/wvtx.

Chui, R. (2014). A multi-faceted approach to anonymity online: Examining the relations between anonymity and antisocial behaviour. *Journal For Virtual Worlds Research, 7*(2). https://doi.org/10.4101/jvwr.v7i2.7073

Clark, J. L., Algoe, S. B., & Green, M. C. (2018). Social network sites and well-being: The role of social connection. *Current Directions in Psychological Science, 27*(1), 32–37. https://doi.org/10.1177/0963721417730833

Cornwell, E. Y., & Waite, L. J. (2009). Social disconnectedness, perceived isolation, and health among older adults. *Journal of Health and Social Behavior, 50*(1), 31–48. https://doi.org/10.1177/002214650905000103

Crocker, J., & Canevello, A. (2008). Creating and undermining social support in communal relationships: The role of compassionate and self-image goals. *Journal of Personality and Social Psychology, 95*(3), 555–575. https://doi.org/10.1037/0022-3514.95.3.555

Crocker, J., Olivier, M.-A., & Nuer, N. (2009). Self-image goals and compassionate goals: Costs and benefits. *Self and Identity: The Journal of the International Society for Self and Identity, 8*(2–3), 251–269. https://doi.org/10.1080/15298860802505160

Deci, E. L., & Ryan, R. M. (2008). Hedonia, eudaimonia, and well-being: An introduction. *Journal of Happiness Studies, 9*(1), 1–11. https://doi.org/10.1007/s10902-006-9018-1

Deters, F. G., & Mehl, M. R. (2013). Does posting Facebook status updates increase or decrease loneliness? An online social networking experiment. *Social Psychological and Personality Science, 4*(5). https://doi.org/10.1177/1948550612469233

Escobar-Viera, C. G., Shensa, A., Bowman, N. D., Sidani, J. E., Knight, J., James, A. E., & Primack, B. A. (2018). Passive and active social media use and depressive symptoms among United States adults. *Cyberpsychology, Behavior, and Social Networking, 21*(7), 437–443. https://doi.org/10.1089/cyber.2017.0668

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Gerson, J., Plagnol, A. C., & Corr, P. J. (2016). Subjective well-being and social media use: Do personality traits moderate the impact of social comparison on Facebook? *Computers in Human Behavior, 63*, 813–822. https://doi.org/10.1016/j.chb.2016.06.023

Gerson, J., Plagnol, A. C., & Corr, P. J. (2017). Passive and active Facebook use measure (PAUM): Validation and relationship to the reinforcement sensitivity theory. *Personality and Individual Differences, 117*, 81–90. https://doi.org/10.1016/j.paid.2017.05.034

Goswami, S., Köbler, F., Leimeister, J. M., & Krcmar, H.. Using online social networking to enhance social connectedness and social support for the elderly. ICIS 2010 Proceedings, 109. https://aisel.aisnet.org/icis2010_submissions/109/.

Greenberger, E., Josselson, R., Knerr, C., & Knerr, B. (1975). The measurement and structure of psychosocial maturity. *Journal of Youth and Adolescence, 4*, 127–143. https://doi.org/10.1007/BF01537437

Grieve, R., Indian, M., Witteveen, K., Anne Tolan, G., & Marrington, J. (2013). Face-to-face or Facebook: Can social connectedness be derived online? *Computers in Human Behavior, 29*(3), 604–609. https://doi.org/10.1016/j.chb.2012.11.017

Hawkley, L. C., & Cacioppo, J. T. (2010). Loneliness matters: A theoretical and empirical review of consequences and mechanisms. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine, 40*(2). https://doi.org/10.1007/s12160-010-9210–9218

Hayes, A. F. (2017). Introduction to mediation, moderation, and conditional process analysis. *A regression-based approach* (2nd ed.). Guilford Publications.

Heinrich, L., & Gullone, E. (2006). The clinical significance of loneliness: A literature review. *Clinical Psychology Review, 26*, 695–718. https://doi.org/10.1016/j.cpr.2006.04.002

Hofmans, L., van der Stappen, A., & van den Bos, W. (2024). Developmental structure of digital maturity. *Computers in Human Behavior, 157*, Article 108239. https://doi.org/10.1016/j.chb.2024.108239

Jiang, T., Canevello, A., & Crocker, J. (2023). Compassionate goals, responsiveness, and well-being. *Current Opinion in Psychology, 52*, Article 101634. https://doi.org/10.1016/j.copsyc.2023.101634

Kim, D. A., Benjamin, E. J., Fowler, J. H., & Christakis, N. A. (2016). Social connectedness is associated with fibrinogen level in a human social network. *Proceedings of the Royal Society B: Biological Sciences, 283*(1837), Article 20160958. https://doi.org/10.1098/rspb.2016.0958

Köbler, F., Riedl, C., Vetter, C., Leimeister, J. M., & Krcmar, H. (2010). Social connectedness on Facebook—an explorative study on status message usage. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1953431

Koch, T., Laaber, F., & Florack, A. (2024). Socioeconomic status and young people's digital maturity: The role of parental mediation. *Computers in Human Behavior, 154*, Article 108157. https://doi.org/10.1016/j.chb.2024.108157

Koniakou, V., Pouloudi, N., Chronaki, V., & Lekakos, G. (2024). Identifying stakeholders of children's digital maturity: Looking beyond digital literacy. *ECIS 2024 TREOS, 79*. https://aisel.aisnet.org/treos_ecis2024/79.

Kozyreva, A., Lewandowsky, S., & Hertwig, R. (2020). Citizens versus the Internet: Confronting digital challenges with cognitive tools. *Psychological Science in the Public Interest, 21*(3), 103–156. https://doi.org/10.1177/1529100620946707

Kushlev, K., Dwyer, R., & Dunn, E. W. (2019). The social price of constant connectivity: Smartphones impose subtle costs on well-being. *Current Directions in Psychological Science, 28*(4), 347–352. https://doi.org/10.1177/0963721419847200

Kushlev, K., Proulx, J. D. E., & Dunn, E. W. (2017). Digitally connected, socially disconnected: The effects of relying on technology rather than other people. *Computers in Human Behavior, 76*, 68–74. https://doi.org/10.1016/j.chb.2017.07.001

Laaber, F., Florack, A., Koch, T., & Hubert, M. (2023). Digital maturity: Development and validation of the digital maturity inventory (DIMI). *Computers in Human Behavior, 143*, Article 107709. https://doi.org/10.1016/j.chb.2023.107709

Laaber, F., Koch, T., Hubert, M., & Florack, A. (2024). Young people's digital maturity relates to different forms of well-being through basic psychological need satisfaction and frustration. *Computers in Human Behavior, 152*, Article 108077. https://doi.org/10.1016/j.chb.2023.108077

Laghi, F., Schneider, B. H., Vitoroulis, I., Coplan, R. J., Baiocco, R., Amichai-Hamburger, Y., Hudek, N., Koszycki, D., Miller, S., & Flament, M. (2013). Knowing when not to use the Internet: Shyness and adolescents' on-line and off-line interactions with friends. *Computers in Human Behavior, 29*(1), 51–57. https://doi.org/10.1016/j.chb.2012.07.015

Lipinski-Harten, M., & Tafarodi, R. W. (2013). Attitude moderation: A comparison of online chat and face-to-face conversation. *Computers in Human Behavior, 29*(6), 2490–2493. https://doi.org/10.1016/j.chb.2013.06.004

Lorenz-Spreen, P., Lewandowsky, S., Sunstein, C. R., & Hertwig, R. (2020). How behavioural sciences can promote truth, autonomy and democratic discourse online. *Nature Human Behaviour, 4*(11), 1102–1109. https://doi.org/10.1038/s41562-020-0889-7

MacKinnon, D. P., Krull, J. L., & Lockwood, C. M. (2000). Equivalence of the mediation, confounding and suppression effect. *Prevention Science: The Official Journal of the Society for Prevention Research, 1*(4), 173. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2819361/.

Mascheroni, G., Cino, D., Mikuška, J., & Smahel, D. (2022). Explaining inequalities in vulnerable children's digital skills: The effect of individual and social discrimination. *New Media & Society, 24*(2), 437–457. https://doi.org/10.1177/14614448211063184

Matook, S., Cummings, J., & Bala, H. (2015). Are you feeling lonely? The impact of relationship characteristics and online social network features on loneliness. *Journal of Management Information Systems, 31*(4), 278–310. https://doi.org/10.1080/07421222.2014.1001282

McIntyre, E., Wiener, K. K. K., & Saliba, A. J. (2015). Compulsive internet use and relations between social connectedness, and introversion. *Computers in Human Behavior, 48*, 569–574. https://doi.org/10.1016/j.chb.2015.02.021

Meshi, D., Tamir, D. I., & Heekeren, H. R. (2015). The emerging neuroscience of social media. *Trends in Cognitive Sciences, 19*(12), 771–782. https://doi.org/10.1016/j.tics.2015.09.004

Pandya, A., & Lodha, P. (2021). Social connectedness, excessive screen time during COVID-19 and mental health: A review of current evidence. *Frontiers in Human Dynamics, 3*. https://www.frontiersin.org/articles/10.3389/fhumd.2021.684137.

Pang, H. (2021). Unraveling the influence of passive and active WeChat interactions on upward social comparison and negative psychological consequences among university students. *Telematics and Informatics, 57*, Article 101510. https://doi.org/10.1016/j.tele.2020.101510

Pit, I. L., Veling, H., & Karremans, J. C. (2022). Does passive Facebook use promote feelings of social connectedness? *Media and Communication, 10*(2), 119–129. https://doi.org/10.17645/mac.v10i2.5004

Podsakoff, P., & Organ, D. (1986). Self-report in organizational research: Problems and prospects. *Journal of Management - J MANAGE, 12*(4), 531–544. https://doi.org/10.1177/014920638601200408

Riedl, C., Köbler, F., Goswami, S., & Krcmar, H. (2013). Tweeting to feel connected: a model for social connectedness in online social networks. *International Journal of Human-Computer Interaction, 29*, 670–687. https://doi.org/10.1080/10447318.2013.768137.

Roberts, J. A., & David, M. E. (2023). On the outside looking in: Social media intensity, social connection, and user well-being: The moderating role of passive social media use. *Canadian Journal of Behavioural Science/Revue Canadienne des Sciences du Comportement, 55*(3), 240–252. https://doi.org/10.1037/cbs0000323

Roper, M., & Tobin, S. J. (2022). Compassionate goals, Facebook use, and subjective well-being: Examining the roles of relationship maintenance and connectedness. *Cyberpsychology, Behavior, and Social Networking, 25*(8), 527–533. https://doi.org/10.1089/cyber.2021.0259

Ryan, T., Allen, K.-A., Gray, D., & McInerney, D. (2017). How social are social media? A review of online social behaviour and connectedness. *Journal of Relationships Research, 8*. https://doi.org/10.1017/jrr.2017.13

Ryan, R., Huta, V., & Deci, E. (2008). Living well: A self-determination theory perspective on eudaimonia. *Journal of Happiness Studies, 9*, 139–170. https://doi.org/10.1007/s10902-006-9023-4

Scott, G. G., Boyle, E. A., Czerniawska, K., & Courtney, A. (2018). Posting photos on Facebook: The impact of narcissism, social anxiety, loneliness, and shyness. *Personality and Individual Differences, 133*, 67–72. https://doi.org/10.1016/j.paid.2016.12.039

Seema, R., Heidmets, M., Konstabel, K., & Varik-Maasik, E. (2022). Development and validation of the digital addiction scale for Teenagers (DAST). *Journal of Psychoeducational Assessment, 40*(2), 293–304. https://doi.org/10.1177/07342829211056394

Sharabi, A., & Margalit, M. (2011). The mediating role of internet connection, virtual friends, and mood in predicting loneliness among students with and without learning disabilities in different educational environments. *Journal of Learning Disabilities, 44*(3), 215–227. https://doi.org/10.1177/0022219409357080

Sharabi, A., Sade, S., & Margalit, M. (2016). Virtual connections, personal resources, loneliness, and academic self-efficacy among college students with and without LD. *European Journal of Special Needs Education, 31*(3), 376–390. https://doi.org/10.1080/08856257.2016.1141542

Shensa, A., Sidani, J. E., Escobar-Viera, C. G., Switzer, G. E., Primack, B. A., & Choukas-Bradley, S. (2020). Emotional support from social media and face-to-face relationships: Associations with depression risk among young adults. *Journal of Affective Disorders, 260*, 38–44. https://doi.org/10.1016/j.jad.2019.08.092

Sindermann, C., Elhai, J. D., & Montag, C. (2020). Predicting tendencies towards the disordered use of Facebook's social media platforms: On the role of personality, impulsivity, and social anxiety. *Psychiatry Research, 285*, Article 112793. https://doi.org/10.1016/j.psychres.2020.112793

Thorisdottir, I. E., Sigurvinsdottir, R., Asgeirsdottir, B. B., Allegrante, J. P., & Sigfusdottir, I. D. (2019). Active and passive social media use and symptoms of anxiety and depressed mood among Icelandic adolescents. *Cyberpsychology, Behavior, and Social Networking, 22*(8), 535–542. https://doi.org/10.1089/cyber.2019.0079

Tobin, S. J., Chant, G., & Clay, R. (2020). Interpersonal goals as predictors of Facebook use, social capital, and envy. *Cyberpsychology, Behavior, and Social Networking, 23*(4), 257–263. https://doi.org/10.1089/cyber.2019.0446

Toh, Z., & Lee, D. S. (2022). Is that insta worthy? Predicting content sharing behavior on social media through interpersonal goals. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace, 16*(4). https://doi.org/10.5817/CP2022-4-5

Twenge, J. M., Haidt, J., Blake, A. B., McAllister, C., Lemon, H., & Le Roy, A. (2021). Worldwide increases in adolescent loneliness. *Journal of Adolescence, 93*, 257–269. https://doi.org/10.1016/j.adolescence.2021.06.006

Verduyn, P., Gugushvili, N., & Kross, E. (2022). Do social networking sites influence well-being? The extended active-passive model. *Current Directions in Psychological Science, 31*(1), 62–68. https://doi.org/10.1177/09637214211053637

Verduyn, P., Lee, D. S., Park, J., Shablack, H., Orvell, A., Bayer, J., Ybarra, O., Jonides, J., & Kross, E. (2015). Passive Facebook usage undermines affective well-being: Experimental and longitudinal evidence. *Journal of Experimental Psychology: General, 144*(2), 480–488. https://doi.org/10.1037/xge0000057

Verduyn, P., Ybarra, O., Résibois, M., Jonides, J., & Kross, E. (2017). Do social network sites enhance or undermine subjective well-being? A critical review. *Social Issues and Policy Review, 11*(1), 274–302. https://doi.org/10.1111/sipr.12033

Wang, K., Frison, E., Eggermont, S., & Vandenbosch, L. (2018). Active public Facebook use and adolescents' feelings of loneliness: Evidence for a curvilinear relationship. *Journal of Adolescence, 67*, 35–44. https://doi.org/10.1016/j.adolescence.2018.05.008

Winstone, L., Mars, B., Haworth, C. M. A., & Kidger, J. (2021). Social media use and social connectedness among adolescents in the United Kingdom: A qualitative exploration of displacement and stimulation. *BMC Public Health, 21*(1), 1736. https://doi.org/10.1186/s12889-021-11802-9

Wright, M. F. (2013). The relationship between young adults' beliefs about anonymity and subsequent cyber aggression. *Cyberpsychology, Behavior, and Social Networking, 16*(12), 858–862. https://doi.org/10.1089/cyber.2013.0009

Yang, C. (2016). Instagram use, loneliness, and social comparison orientation: Interact and browse on social media, but don't compare. *Cyberpsychology, Behavior, and Social Networking, 19*(12), 703–708. https://doi.org/10.1089/cyber.2016.0201

Zhou, B., Su, C., & Liu, J. (2021). Multimodal connectedness and communication patterns: A comparative study across europe, the United States, and China. *New Media & Society, 23*, Article 146144482110159. https://doi.org/10.1177/14614448211015986