



DISSERTATION | DOCTORAL THESIS

Titel | Title

The Positive Use of Digital Technologies

verfasst von | submitted by

Teresa Koch BSc (Hons) MSc

angestrebter akademischer Grad | in partial fulfilment of the requirements for the degree of
Doktorin der Naturwissenschaften (Dr.rer.nat.)

Wien | Vienna, 2025

Studienkennzahl lt. Studienblatt | Degree
programme code as it appears on the
student record sheet:

UA 796 605 298

Dissertationsgebiet lt. Studienblatt | Field of
study as it appears on the student record
sheet:

Psychologie

Betreut von | Supervisor:

Univ.-Prof. Dipl.-Psych. Dr. Arnd Florack

Acknowledgements



During my PhD journey, I always had people who supported me and cheered me on along the way. First and foremost, I want to thank my parents Edith and Rudi, and my sister Hannah, for their unwavering optimism and support. I am looking forward to cheering to this success with you. 🥂

[Get the facts about mail-in ballots](#)

4:17 PM. March 04, 2025 · [Twitter for Android](#)

5 Retweets 160 Likes



[@PhDtobe](#) · 4h
[@PhDtobe](#) Replying to

Special thanks go to my supervisor Arnd Florack for his guidance both before and during the PhD. I have learned a lot from you.



[@PhDtobe](#) · 4h
[@PhDtobe](#) Replying to

Also, I want to thank all my SoKo colleagues. The lunches and evenings with you all are invaluable, pushing through the annoying and celebrating the exciting parts of academic life together. I especially want to thank my colleague Franziska. Working with you has been a great joy, and you contributed so much to our joint work.



[@PhDtobe](#) · 4h
[@PhDtobe](#) Replying to

To my best friend Tina - No matter where I decided to go in the world, our relationship always persisted. Thank you for always going against all hypotheses.



[@PhDtobe](#) · 4h
[@PhDtobe](#) Replying to

Lastly, but importantly – just like they were often the last, but important, highlight of my day – I want to thank my friends. During my entire academic career, dancing with you was always a crucial counterbalance to any stress. Now that this dissertation is complete, let's see what comes next. Dame! 🍷



<https://zcoob.com/fake-tweet-generator/>

Table of Contents

Abstract	3
German Abstract / Zusammenfassung	4
Introduction.....	6
Digital Maturity.....	9
Antecedents and Outcomes of Digital Maturity.....	13
Chapter 1: Antecedents of Digital Maturity – SES, Parental Mediation, Personality	21
Discussion Chapter 1: Antecedents of Digital Maturity	25
Chapter 2: Outcomes of Digital Maturity	29
Digital Maturity and Well-being	30
Digital Maturity and Social Connectedness.....	34
Digital Maturity and Task Choice.....	39
Discussion Chapter 2: Outcomes of Digital Maturity	43
General Discussion	48
Strengths, Limitations and Future Research	50
Practical Implications.....	54
Conclusion.....	57
References.....	58
Appendix.....	78
Credit Author Statement	78
Article I	80
Article II.....	81
Article III.....	93
Article IV	125

Abstract

Young people engage in many hours of digital technology use every day, and it is often not clear when this use behavior is beneficial or harmful for them. Previous research has focused on understanding specific aspects of digital device use, but a general understanding of what enables young people to benefit from the opportunities of digital device use, while avoiding digital risks, is lacking. In this dissertation, I investigated the positive use of digital technologies by relying on digital maturity theory, as a holistic concept capturing abilities and attitudes which enable a beneficial use of digital devices for personal growth and social integration across functionalities and applications. The aim was to study antecedents and outcomes of digital maturity. The first objective of my dissertation was to identify antecedents that enable young people to develop a mature use of digital technologies. In a large-scale study with adolescent-parent dyads, I identified socioeconomic status, active parental mediation and personality traits as factors which relate to young people's digital maturity level. The second objective was to examine how digital maturity relates to beneficial use behavior outcomes by using digital technologies as a tool for personal advancement and social integration. Across several studies with young people, I showed that higher digital maturity relates to using digital devices as tools, experiencing higher well-being and social connectedness. The third objective was to investigate how digital maturity relates to beneficial behavior for personal development in demanding situations. In an experiment, I found that after experiencing high performance expectations, individuals with low digital maturity rather prefer easy and meaningless tasks over difficult and meaningful tasks, while individuals with higher digital maturity are not affected in their task choice. Overall, this dissertation advances digital maturity theory by contributing insights into antecedents of digital maturity and supporting that digital maturity relates to beneficial outcomes of digital technology use.

German Abstract / Zusammenfassung

Junge Menschen nutzen digitale Technologien mehrere Stunden täglich, und es ist oft nicht klar, wann dieses Nutzungsverhalten sich positiv oder negativ auswirkt. Bisherige Forschung konzentrierte sich auf spezifische Aspekte digitaler Gerätenutzung, aber es fehlt ein allgemeines Verständnis dafür, wie junge Menschen von den Chancen digitaler Geräte profitieren und gleichzeitig digitale Risiken vermeiden können. In dieser Dissertation untersuchte ich die positive Nutzung digitaler Technologien durch Anwendung der Theorie der digitalen Reife. Dieses ganzheitliche Konzept erfasst Fähigkeiten und Einstellungen, die eine vorteilhafte Nutzung digitaler Geräte für die persönliche Entwicklung und soziale Integration über Funktionen und Anwendungen hinweg ermöglichen. Erforscht wurden die Determinanten und Ergebnisse der digitalen Reife. Das erste Ziel dieser Dissertation war die Untersuchung potenzieller Determinanten der digitalen Reife, die jungen Menschen die Entwicklung einer reifen Nutzung digitaler Technologien ermöglichen. In einer groß angelegten Studie mit Jugendlichen-Eltern-Dyaden identifizierte ich den sozioökonomischen Status, die aktive Unterstützung der Eltern und Persönlichkeitsmerkmale als Faktoren, die mit dem digitalen Reifegrad junger Menschen zusammenhängen. Das zweite Ziel bestand darin zu verstehen, wie digitale Reife vorteilhafte Ergebnisse digitaler Gerätenutzung fördert, indem digitale Technologien als Werkzeug zur persönlichen Weiterentwicklung und sozialen Integration eingesetzt werden. Mehrere Studien mit Jugendlichen zeigten, dass eine höhere digitale Reife mit der Nutzung digitaler Geräte als Werkzeug sowie mit höherem Wohlbefinden und sozialer Verbundenheit korreliert. Das dritte Ziel bestand darin, den Zusammenhang zwischen digitaler Reife und für die persönliche Entwicklung vorteilhaftem Verhalten in anspruchsvollen Situationen zu untersuchen. Ein Experiment zeigte, dass Personen mit geringer digitaler Reife nach dem Erleben hoher Leistungserwartungen eher leichte und bedeutungslose Aufgaben gegenüber schwierigen und bedeutungsvollen

Aufgaben bevorzugen, während Personen mit höherer digitaler Reife in ihrer Aufgabenwahl nicht beeinflusst werden. Insgesamt trägt diese Dissertation zur Weiterentwicklung der Theorie der digitalen Reife bei, indem sie Erkenntnisse über deren Determinanten liefert und ihren Zusammenhang mit positiven Nutzungsergebnissen digitaler Technologien aufzeigt.

Introduction

Digital technologies have become omnipresent in today's society, with high usage especially prominent in younger people (Crone & Konijn, 2018; Odgers & Jensen, 2020). For instance, in 2023 adolescents in Germany reported an average daily screen time of 3.5 hours (Statista, 2023), and a Gallup survey of US adolescents found an average daily social media use of 4.8 hours (Rothwell, 2023). There has been a growing body of research into the psychological ramifications of digital technology use. On the one hand, research has identified several negative effects of digital device use (Cavallini & Caravita, 2021; Erreygers et al., 2018), such as addiction, excessive screen time, decreased well-being (Hawi et al., 2019; Przybylski & Weinstein, 2017; Seema et al., 2022; Twenge & Campbell, 2018), or sleep deprivation (Brautsch et al., 2023). On the other hand, digital technologies can also be used as a tool to achieve positive outcomes (Haddon & Livingstone, 2017; Laaber et al., 2023; Steinfeld, 2021). For example, digital technologies offer opportunities for learning and growth (Adachi & Willoughby, 2013; Livingstone & Helsper, 2010; Nebel et al., 2017), identity development (Huang et al., 2021; Valkenburg & Peter, 2011), social connections and support (Chen et al., 2019; Green et al., 2021; Vossen & Valkenburg, 2016; Younas et al., 2020).

While there is research on both the positive and negative aspects of digital device use, it is unclear when one or the other occurs. Attempts to explain the effects of digital device use on well-being with the amount of screen time have been inconclusive (Orben & Przybylski, 2019; Przybylski & Weinstein, 2017, 2019; Twenge & Campbell, 2018), and research has acknowledged the necessity to investigate not only the quantity but the quality of use behavior to understand whether users will experience benefit or harm (Bohnert & Gracia, 2021; Orben, 2020). Findings on positive or negative effects are often nuanced and factors such as the type of digital technology use and individual differences can influence how

adolescents react to digital device use (Beyens et al., 2020; Orben, 2020). For example, digital technology use can link to social connectedness or social isolation, depending on personality traits and how individuals engage with the online world (McIntyre et al., 2015; Ryan et al., 2017; Verduyn et al., 2017). Other studies partly explained young people's use behavior outcomes with factors like sociodemographic variables, parental mediation or digital literacy (Faltýnková et al., 2020; Helsper et al., 2020; Liang et al., 2021; Livingstone et al., 2011; Nikken & Oprea, 2018; Ren et al., 2022; Sun et al., 2021). Nevertheless, explaining who will experience the opportunities rather than the risks of the digital world necessitates a more thorough understanding going beyond these specific factors.

What is lacking is a general understanding of what enables young people to engage in more positive use generally, across different affordances and aspects of digital technology. Most studies examined digital literacy, which focuses on technical skills but neglects other aspects such as mature social interaction online or autonomous engagement with online content (Helsper et al., 2020; Pyżalski, 2023). Little research has focused on general abilities which enable young people to use digital technologies beneficially. Hence, in my dissertation I examined how digital maturity, as a holistic approach to young people's use of digital devices, relates to and explains whether young people can reap the benefits which digital technologies offer for their own development, while avoiding the accompanying risks. Moreover, I examined antecedents of the development of high digital maturity in young people.

Specifically, the objectives of this dissertation were:

- (1) to examine potential antecedents of digital maturity, enabling young people to develop a mature use of digital technologies (addressed in Article I),

- (2) to examine how digital maturity relates to beneficial use behavior outcomes by using digital technologies as a tool for personal advancement and social integration (addressed in Article II and III),
- (3) to investigate how digital maturity relates to beneficial behavior for personal development in demanding situations (addressed in Article IV).

The research gap, research question and objectives of the dissertation are summarized in Table 1.

Table 1

Overview of Research Gap, Research Questions and Objectives

Research gap & research question:	It is unclear who can take advantage of the opportunities of digital device use, while avoiding potential risks. We lack a general understanding of what enables young people to engage in a positive use of digital technologies, and how such an ability develops. This dissertation focused on digital maturity, a set of abilities and attitudes which could enable a beneficial use of digital devices. The aim of the dissertation was to investigate antecedents of digital maturity and how digital maturity relates to and explains positive outcomes of digital device use.
Objectives:	1. to examine potential antecedents of digital maturity, enabling young people to develop a mature use of digital technologies 2. to examine how digital maturity relates to beneficial use behavior outcomes by using digital technologies as a tool for personal advancement and social integration 3. to investigate how digital maturity relates to beneficial behavior for personal development in demanding situations

To address these objectives, I investigated antecedents relating to young people's digital maturity level, as well as the relation of digital maturity to use behavior outcomes. I did so across several samples of adolescent-parent dyads ($N_{total} = 2279$) in cross-sectional and longitudinal studies. Moreover, I examined how digital maturity influences the engagement with meaningful tasks under demanding conditions in an online experiment with adults

($N = 305$). The studies point to environmental and intrapersonal factors which relate to the development of high digital maturity. Moreover, they support that digital maturity enables a beneficial interaction with the digital world for personal growth and social integration, using digital technologies as a tool for beneficial experiences, and enabling mature reactions in demanding digital situations.

By examining antecedents and outcomes of digital maturity, this dissertation advances the theoretical understanding of digital maturity and the beneficial use of digital technologies. The studies go beyond previous research by relying on the holistic concept of digital maturity which addresses interactions with the digital world across devices and functions. The research encourages the further development of literature in the field, looking at both antecedents and outcomes of a general ability to use digital technologies beneficially. Further, the dissertation provides information for educational approaches aiming to address young people's engagement with the digital world.

Digital Maturity

The concept of digital maturity provides a framework to investigate the beneficial use of digital technologies. Digital maturity is defined as “the capabilities and attitudes which enable individuals to use digital technologies in ways which support individual development (growth) and integration into society (adjustment)” (Laaber et al., 2023, p. 2). As a holistic concept, it captures several competencies which enable individuals to make use of digital opportunities while avoiding accompanying risks (Arenas & Yazdi, 2022; Christensen et al., 2023; Hofmans et al., 2024) across different devices, situations and functions.

Digital maturity links to but goes beyond general personality maturation, as it specifically focuses on the digital context, and the challenges and opportunities which individuals are confronted with therein (Laaber et al., 2023). Further, it integrates digital literacy as one of its dimensions, but includes several further concepts which are crucial for

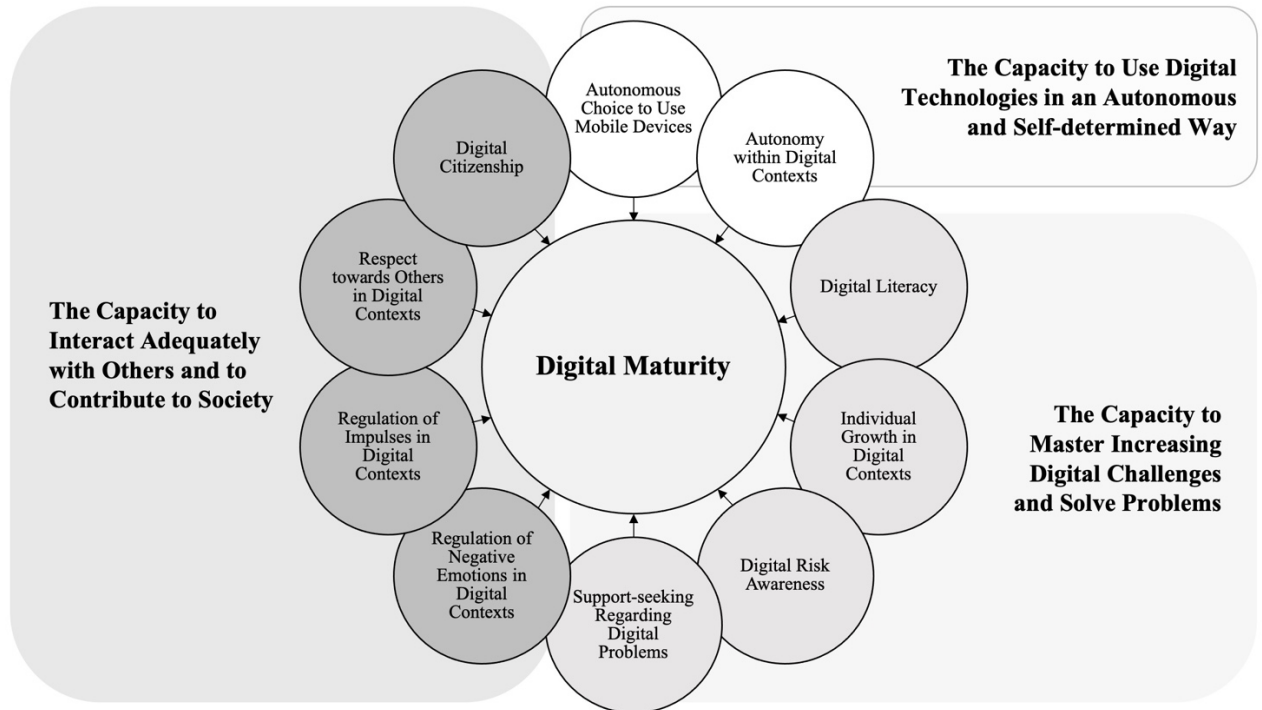
the successful navigation of the online world, such as social skills, self-determined use and the ability to use digital devices for personal growth. Some existing approaches already include aspects like autonomous experience online (Przybylski et al., 2010) or online social responsibility (Richardson & Milovidov, 2019; Wang & Xing, 2018). Digital maturity incorporates these considerations and adds further influential aspects. Hence, assuming a more holistic perspective, digital maturity includes technical abilities to use digital technologies, but assumes that further skills are equally needed for an adequate engagement with the digital world (Koniakou et al., 2024; Laaber et al., 2023).

Overall, digital maturity comprises of 10 dimensions, which can be grouped into three capacities (Figure 1). These capacities address three challenges, which individuals are specifically faced with in the digital world (Arenas & Yazdi, 2022; Christensen et al., 2023; Hofmans et al., 2024). First, digital technologies are designed to capture attention and manipulate behavior in unprecedented ways, creating a highly challenging environment for autonomous and self-determined behavior (Cara, 2020; Kozyreva et al., 2020), which is addressed by the *capacity to use digital technologies in an autonomous and self-determined way*. Second, the digital environment is constantly evolving, requiring adaptive skills and problem-solving capacities to enable the competent use of digital technologies (Gretter & Yadav, 2016; Livingstone & Helsper, 2010), addressed by the *capacity to master increasing digital challenges and solve problems*. Third, social interactions online qualitatively differ from personal interactions. For example, anonymity enhances the tendency for cyberaggression and the lack of nonverbal cues online can reduce feelings of social relatedness (Lieberman & Schroeder, 2020; Lipinski-Harten & Tafarodi, 2013; Wright, 2013). This challenge is addressed by the *capacity to interact adequately with others and contribute to society*. The dimensions of digital maturity are specifically designed to capture

abilities to adequately deal with these challenges of the digital environment, managing both the risks and opportunities which individuals are confronted with.

Figure 1

Digital Maturity



Conceptually, digital maturity is based on psychosocial maturity and self-determination theory (Laaber et al., 2023). Psychosocial maturity incorporates the aspects of growth and adjustment (Greenberger et al., 1975; Staudinger & Kunzmann, 2005). Growth refers to positive personality development, such as achieving insight, wisdom, making experiences and developing one's thinking. Adjustment refers to an effective functioning in the community and adjusting to the societal environment, and relates to higher agreeableness, conscientiousness and emotional stability (Bleidorn, 2015; Staudinger & Kunzmann, 2005). Extending these aspects to the digital world, we assume that individuals with higher digital maturity can use the opportunities of digital technologies better for their personal growth and social adjustment.

Further, the digital maturity concept assumes that with higher digital maturity, individuals are better able to satisfy their basic needs in the digital environment. Self-determination theory states that individuals feel the innate drive to satisfy their needs for autonomy, competence and relatedness (Deci & Ryan, 2000, 2008; Ryan et al., 2008). Individuals are viewed as growth-oriented, striving for interesting activities, the possibility to exercise their capabilities and social connectedness. Satisfaction of these needs enables growth, integrity and well-being (Chen et al., 2015; Deci & Ryan, 2000). Digital maturity incorporates these needs as important factors for the beneficial use of digital technologies. However, it addresses the needs specifically regarding the digital environment, which poses unique challenges, as discussed above.

Overall, based on this conceptualization, we expect that higher digital maturity enables a more beneficial use of the digital world. Individuals with high digital maturity will have the ability to use digital technologies to satisfy their needs, achieve well-being and experience individual growth and social integration. As previous literature has mostly focused on understanding specific aspects of use behavior, like the role of active and passive Facebook use in depressed mood (Frison & Eggermont, 2015), digital maturity provides an important theoretical foundation to investigate whether individuals are able to use digital technologies for positive outcomes across different contexts and applications. Supporting the theoretical conceptualization, initial results indicate that digital maturity captures positive use behavior, as it predicted lower addictive device use (Laaber et al., 2023). However, more research is required regarding positive outcomes of digital maturity. Therefore, in my dissertation I tested the relation of digital maturity to further outcomes of digital device use, in order to establish a profound understanding of the processes how digital maturity interacts with the digital world and enables beneficial use.

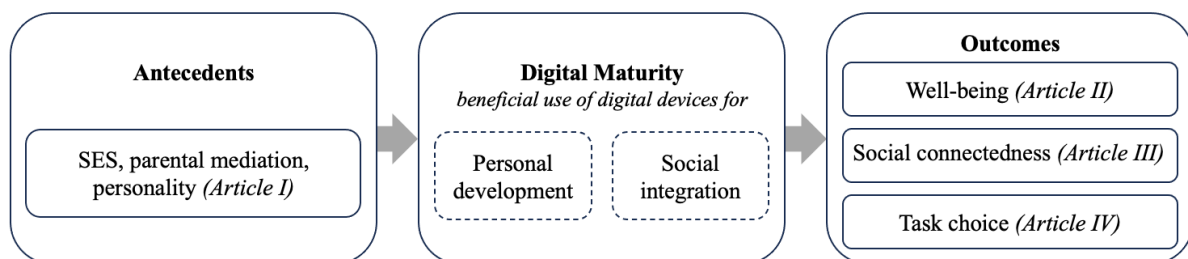
I postulate three basic assumptions how digital maturity enables beneficial use behavior outcomes. First, high digital maturity enables the use of digital devices as tools in an autonomous and self-determined way. Individuals can use digital technologies in an instrumental way to satisfy needs, achieve growth and well-being. Second, high digital maturity enables the use of the digital world for overall (offline and online) benefit, benefitting from digital device use for general well-being and social integration. Third, high digital maturity enables mature reactions in challenging digital situations. Individuals with high digital maturity possess the required competencies to adequately deal with issues such as high expectations. In my dissertation, I present the findings of several studies which support these general points by providing insights regarding various specific outcomes of digital technology use. The studies advance the understanding of how digital maturity interacts with processes of digital technology use and provide support for digital maturity theory.

Antecedents and Outcomes of Digital Maturity

The main goal of this dissertation was to investigate antecedents and outcomes of digital maturity (Figure 2), in order to address the stated objectives.

Figure 2

Overview of the Dissertation Articles



I have investigated the objectives of my dissertation across four articles, mostly relying on data from adolescents and their parents. These articles provide support for the overarching theoretical framework of digital maturity by identifying factors which relate to the development of high digital maturity, and showing how digital maturity relates to the use

of digital technologies as a tool for beneficial outcomes and mature behavior in challenging situations. The articles provide insights how digital maturity comes to play across specific aspects of the digital world, such as social connectedness or task choice. Three of the articles have been published to date, one is currently under review. While three studies have focused on the digital maturity of young people, collecting data from adolescent-parent dyads, one experimental study relied on adults, extending digital maturity research to a wider population. Table 2 provides an overview of the articles, their contribution and study design.

Table 2*Overview of Articles, Contribution and Study Design*

Article	Contribution	Study Design
Chapter I: Antecedents of Digital Maturity (Objective I)		
<i>Article I:</i> Koch, T., Laaber, F., & Florack, A. (2024). <i>Computers in Human Behavior.</i>	Identifies socioeconomic status, active parental mediation and the personality traits agreeableness, conscientiousness and negative emotionality as influential antecedents relating to young people's digital maturity.	Cross-sectional survey of adolescent-parent dyads ($N = 1065$) in Germany and Austria.
Chapter II: Outcomes of Digital Maturity (Objective II & III)		
<i>Article II:</i> Laaber, F., Koch, T., Hubert, M., & Florack, A. (2024). <i>Computers in Human Behavior.</i>	Supports the positive relation of digital maturity to well-being outcomes. Digital maturity positively relates to life satisfaction, positive affect and psychological richness and negatively relates to negative affect and psychological distress, via instrumental device use, need satisfaction and need frustration.	Two cross-sectional surveys of adolescent-parent dyads (total $N = 641$) in Germany and Austria.
<i>Article III:</i> Koch, T., Laaber, F., Arenas, A., & Florack, A. (2025). <i>Computers in Human Behavior.</i>	Shows the positive relation of digital maturity to social integration outcomes. Adolescents with higher digital maturity report higher social connectedness. The relationship is not explained by more active use behavior, but by engagement with real-life rather than virtual friends online and stronger compassionate goals.	One longitudinal survey (Austria, Germany, $N = 316$) and one cross-sectional survey (Spain, $N = 257$) of adolescent-parent dyads.
<i>Article IV:</i> Koch, T., Laaber, F., & Florack, A. (2025). [Manuscript submitted for publication].	Examines the effect of high difficulty and high expectations on task choice, moderated by digital maturity. The experiment shows that with low digital maturity, individuals are sensitive to high expectations and rather choose an easy and meaningless task over a difficult but meaningful task. With medium and high digital maturity, individuals are not affected by expectations. Difficulty did not affect task choice.	Experiment with adults (Germany, $N = 305$).

Chapter I entitled “Antecedents of Digital Maturity” addresses the first objective, aiming to examine potential antecedents of digital maturity which enable young people to develop a mature use of digital technologies (p. 21). Besides Laaber et al. (2023) who tested the relation of personality to digital maturity, no previous literature has examined potential antecedents. Hence, we examined environmental and intrapersonal factors which could be relevant for adolescents’ digital maturity. Previous literature indicates that lower socioeconomic status could be a risk factor for maladaptive technology use (Faltýnková et al., 2020; Ren et al., 2022; Sun et al., 2021; Urbanova et al., 2019) and emphasizes the influence of parental strategies to mediate children’s technology use (Duerager & Livingstone, 2012; Livingstone et al., 2017; Steinfeld, 2021; Wright, 2017). Moreover, based on psychosocial maturation principles, the personality factors agreeableness, conscientiousness and negative emotionality could relate to a mature use of digital devices (Bleidorn, 2015; Staudinger & Kunzmann, 2005). Hence, in *Article I* we tested the relation of socioeconomic status, active parental mediation and the mentioned personality traits to digital maturity. The results from 1065 adolescent-parent dyads supported that higher socioeconomic status related positively to higher digital maturity, albeit fully mediated by parents’ active mediation. In families with higher socioeconomic background, parents seem to more actively guide and support their child’s digital device use, which relates positively to their digital maturity. Moreover, agreeableness and conscientiousness related positively, and negative emotionality related negatively to digital maturity, as expected. Thus, the results pointed to environmental and intrapersonal factors which relate to adolescents’ development of high digital maturity. Moreover, the findings supported that pre-existing societal inequalities persist in the digital context (Helsper et al., 2020; Mascheroni & Ólafsson, 2015), emphasizing the importance of interventions to counteract inequalities.

Chapter II entitled “Outcomes of Digital Maturity”, addresses the second and third objective (p. 29). Regarding the second objective, to examine how digital maturity relates to beneficial use behavior outcomes by using digital technologies as a tool for personal advancement and social integration, we tested the relation of digital maturity to positive use behavior outcomes of well-being (*Article II*) and social integration (*Article III*). In *Article II*, we investigated whether digital maturity relates to higher need satisfaction and well-being in two studies with adolescents. Digital technologies can potentially satisfy or frustrate needs, for example in videogames (Peng et al., 2012; Przybylski et al., 2009, 2010), making a mature use essential. As digital maturity is grounded in self-determination theory, it should link to higher well-being, but the relation to needs and well-being was not tested before. We expected that digital maturity would link to higher need satisfaction and lower need frustration, which would relate to better well-being (Deci & Ryan, 2000, 2008; Ryan et al., 2008). Moreover, the article addressed the assumption that higher digital maturity enables the autonomous use of digital technologies as a tool for own goals. The positive relationship between higher digital maturity and need satisfaction, instrumental device use (using technology as a tool) and well-being was supported, as well as the negative relationship with need frustration and ill-being. Need satisfaction and frustration were mediators between digital maturity and a variety of well-being and ill-being outcomes. The findings support that digital maturity can relate to general online and offline benefit, as digital maturity and instrumental device use explained variance in general well-being outcomes, which were not specific to the digital world.

In *Article III*, we focused on the relationship between digital maturity and adolescents’ social connectedness. Based on self-determination theory and psychosocial maturation, digital maturity should enable effective adjustment to the social environment (Bleidorn, 2015; Greenberger et al., 1975) and relatedness to others (Deci & Ryan, 2008;

Ryan et al., 2008) in the digital world. Hence, with higher digital maturity, young people should be better able to engage with others online in ways which establish and maintain social connectedness. The findings support that individuals with higher digital maturity seem more capable of using digital technologies as a tool to achieve social integration, because a positive relation between digital maturity and social connectedness was found both longitudinally and cross-sectionally. While active vs. passive use of digital devices (Matook et al., 2015; Roberts & David, 2023; Verduyn et al., 2017) could not explain this relationship, the engagement with real-life friends online (rather than virtual friends) was identified as an important mediator enhancing social connectedness (Burke & Kraut, 2016; Sharabi & Margalit, 2011). Moreover, with higher digital maturity, individuals held stronger compassionate goals for others, also benefitting their social connectedness (Crocker et al., 2009; Crocker & Canevello, 2008). The article also supports the assumption that digital maturity enables the use of the digital world for one's general benefit, as the increased engagement with real-life friends online enabled higher general social connectedness.

Article IV focused on the third objective, investigating how digital maturity relates to beneficial behavior for personal development in demanding situations. Contradicting the basic principles of self-determination theory, some literature suggests that individuals prefer high salary over meaningful work (Ward, 2024). We assumed that this is the case because under high difficulty and high expectation conditions individuals might prefer easy and meaningless tasks over difficult and meaningful tasks to avoid self-threat (Wicklund, 1975; Yilmaz, 2022). Especially social media communicate distorted views of others' achievements (de Lenne et al., 2020; Mills et al., 2022; Oliver et al., 2024), creating unrealistically high expectations. Hence, we proposed that digital maturity should attenuate the effect of demanding situations on the self as digital maturity incorporates the ability to master challenges in an autonomous and self-determined way, using digital technologies for personal

development. Therefore, we tested to what extent digital maturity impacted whether individuals would still opt for difficult but meaningful tasks in such conditions, perceiving them as an opportunity rather than a threat. The study was the first to examine the relation of digital maturity to behavior and showed how digital maturity can benefit a mature behavioral choice in challenging settings. With low digital maturity, high expectations caused individuals to prefer an easy and meaningless task. With higher digital maturity, individuals were less susceptible to high expectation conditions.

Overall, the studies included in this dissertation identify antecedents and outcomes of digital maturity. The in-depth investigation of the digital maturity construct in relation to potential antecedents and outcomes advances its theoretical development and provides a deeper understanding of how individuals with higher digital maturity engage with the digital world. The studies suggest that digital maturity enables the autonomous use of digital devices as tools for beneficial outcomes spanning the offline and online world, and enables mature reactions to challenging situations. Digital maturity offers an approach to address the fragmented understanding of factors which address specific use behaviors and outcomes of digital device use, providing a basis for understanding who is able to take advantage of the opportunities of the digital world, while avoiding its risks.

All studies included in this work adhere to ethical considerations and principles of good scientific practice. We made all data, analysis files and supplemental materials openly available online at the Open Science Framework. We pre-registered most studies, and all received ethical approval from either the University of Vienna Ethics Committee (reference number 00615) when the research included minors, or the Departmental Review Board (reference number 2024/S/013) for studies with adults. In all studies we asked for informed consent, treated all data anonymously and confidentially, and debriefed participants. When involving minors, we asked for informed consent from the parent and the child, as well as

final informed consent to use the data from the parent and the child at the end of the study.

The research was part of the research project ‘Digymatex’ and received funding from the Horizon 2020 research and innovation programme by the European Union, under grant agreement number 870578.

Chapter 1: Antecedents of Digital Maturity – SES, Parental Mediation, Personality

One goal of this dissertation was to understand antecedents of young people's digital maturity. Young people's environment, such as their family setting, can influence to what degree they learn to take advantage of the opportunities which the digital world presents and avoid potential risks (Livingstone et al., 2011; Mascheroni & Ólafsson, 2015). Moreover, considering the foundation of digital maturity in psychosocial maturation, personality factors are also expected to relate to young people's digital maturity level (Bleidorn, 2015; Laaber et al., 2023). Investigating these environmental and intrapersonal factors related to the first objective, which was to examine potential antecedents of digital maturity, providing first indications how young people can develop a mature use of digital technologies.

To address this objective, Article I (Koch et al., 2024) examined the relation of socioeconomic status (SES), parental mediation strategies and personality to digital maturity. We conducted a cross-sectional study with 1065 adolescent-parent dyads to test these relations. The assumption was that there can be societal differences in young people's ability to engage with digital technologies in a beneficial way, as young people from higher SES backgrounds might receive more support from their parents regarding the positive use of digital devices. Moreover, we expected that young people's personality will also affect digital maturity independently from family background because higher scores on personality traits like conscientiousness and emotional stability have been linked to lower problematic device use (Hussain et al., 2017; Sriyabhand & John, 2014). Additionally, digital maturity is associated with higher conscientiousness, agreeableness and emotional stability (Laaber et al., 2023), which is in line with increased personality maturation (Bleidorn, 2015; Roberts & Mroczek, 2008).

In today's digitized society, most young people from all socioeconomic backgrounds have access to the digital world. Hence, societal inequalities could potentially be reduced by

making opportunities for learning and development easily accessible for everyone (Moore & Blackmon, 2022). Nevertheless, we argued that although anyone can access the digital world, not everyone might be equally capable of making use of its opportunities. Rather, some might still be more vulnerable to risks which the digital world presents. If individuals from high SES backgrounds can make better use of digital opportunities, this essentially reinforces societal inequalities.

The socioeconomic environment is an influential factor regarding how young people engage with technology (Alkan et al., 2021; Faltýnková et al., 2020; Sun et al., 2021). Socioeconomic status refers to one's social standing and economic capability, which for children is impacted by their parents' income and education (Ishii, 2015; Sun et al., 2021). Previous literature found that young people from lower SES backgrounds show more maladaptive use of digital technologies (Faltýnková et al., 2020; Urbanova et al., 2019), more risky online behavior (Steinfeld, 2021) and social media addiction (Sun et al., 2021). With higher SES, young people seem to be more digitally literate (Bohnert & Gracia, 2023; Ren et al., 2022; Zilka, 2019) and use digital devices more responsibly (Wang & Xing, 2018). However, maladaptive use behavior does not necessarily preclude that individuals with low SES cannot also use digital devices in positive ways, for example to form social relations. Therefore, it needs to be examined whether SES also relates to young people's ability to use digital devices for individual growth and social integration across applications and situations (i.e., digital maturity).

We expected that with higher SES, young people are able to develop higher digital maturity. One reason for this assumption was that we expected the relation of SES to digital maturity to be explained by parents' mediation strategies regarding their child's device use. *Active parental mediation* involves parents explaining the benefits and risks of devices and applications to their child, supporting and guiding their child's use of digital devices, but also

encouraging them to explore the digital world. *Restrictive parental mediation* refers to the use of rules and time limits regarding digital device use (Alkan et al., 2021; Cricchio et al., 2022; Livingstone et al., 2011; Steinfeld, 2021). When parents engage in active parental mediation, their children are exposed to less online risks like cyberbullying or seeing sexual content, but still experience online opportunities like learning and communication, while restrictive mediation relates to both reduced risks and opportunities (Duerager & Livingstone, 2012). As active mediation helps young people to develop autonomy and learn how to effectively navigate opportunities and risks online with their parents' support (Cricchio et al., 2022; Steinfeld, 2021; Wright, 2017), we expected it to positively relate to digital maturity. Further, previous research showed that parents with higher SES typically have better digital skills (Bakó & Tőkés, 2018; Sun et al., 2021; Urbanova et al., 2019) and the necessary resources and knowledge to provide guidance to their child (Conger & Donnellan, 2007; Sohr-Preston et al., 2013). Therefore, parents with higher SES are more likely to engage in active parental mediation (Alkan et al., 2021; Bakó & Tőkés, 2018). We thus expected that active parental support would explain why young people from higher SES backgrounds can develop higher digital maturity.

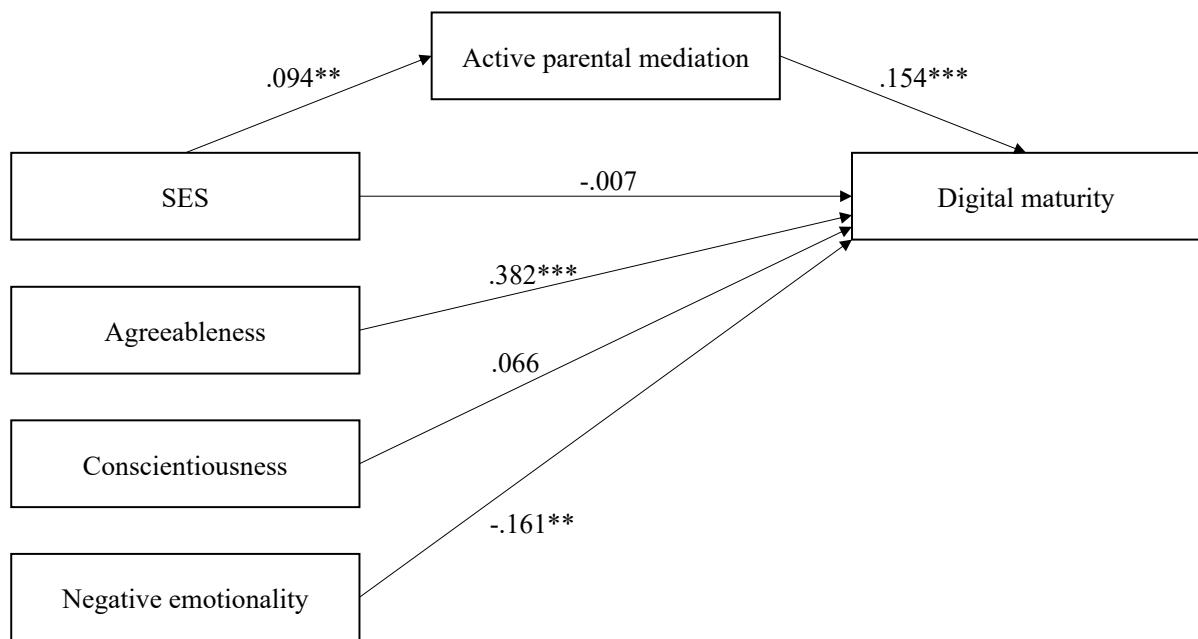
While the family background shapes young people's opportunities to develop key skills, individual personality traits have also been linked to digital use behavior (Hussain et al., 2017; Sriyabhand & John, 2014). We expected that beyond the environment, digital maturity is also influenced by personality. Personality traits like higher conscientiousness and lower negative emotionality are associated with lower problematic device use (Hussain et al., 2017; Sriyabhand & John, 2014), and Laaber et al. (2023) linked higher agreeableness and conscientiousness, and lower negative emotionality to more mature digital use. Digital maturity applies aspects relating to these personality traits specifically to the digital context, such as the regulation of negative emotions and impulses, risk awareness and respect towards

others. While personality traits predict life outcomes independently of socioeconomic status (Ayoub et al., 2018), they cannot fully mitigate the effects of a disadvantaged background (Damian et al., 2015). Therefore, both SES and personality should be considered as antecedents of digital maturity.

To test the association of SES, active parental mediation and personality to digital maturity, we employed structural equation modelling (SEM) and mediation analysis, using data from 1065 adolescent-parent dyads from Germany and Austria, with adolescents aged 12 to 18 years. The model showed a good fit for SRMR and RMSEA (SRMR = 0.071; RMSEA = 0.072; CFI = 0.782; TLI = 0.762; AIC = 89,837.715; BIC = 90,329.817), see Figure 3. The results supported that SES related positively to digital maturity, fully mediated by active parental mediation ($b = .016$, $SE = .006$, 95% CI [.006, .028]). Parents from higher SES backgrounds reported to engage in more active parental mediation strategies, which related to higher digital maturity reported by the child. When adding restrictive mediation to the model as a parallel mediator, it did not relate to SES or digital maturity. Agreeableness and conscientiousness related positively, and negative emotionality related negatively to digital maturity, as expected. Only conscientiousness did not relate to digital maturity in the full model, but was still positively correlated with digital maturity in accordance with expectations. When adding screen time as another predictor of digital maturity, it related to digital maturity but all other effects remained with a comparable model fit.

Figure 3

Structural Equation Model of Antecedents of Digital Maturity (Article I)



Note. ** $p < .01$, *** $p < .001$. $N = 1065$. Values are standardized coefficients. SRMR = 0.071; RMSEA = 0.072; CFI = 0.782; TLI = 0.762; AIC = 89,837.715; BIC = 90,329.817.

Gender and age are included as control variables on digital maturity and active parental mediation.

Discussion Chapter 1: Antecedents of Digital Maturity

In order to investigate potential antecedents of young people's digital maturity, we investigated the family environment and intrapersonal factors. The findings of Article I support that with higher SES, young people show higher digital maturity, explained by more active parental engagement in their digital device use. Societal inequalities thus seem to persist in the digital world, with young people from higher SES backgrounds showing better abilities to use the opportunities presented online. Moreover, the results showed that the personality traits agreeableness, conscientiousness and negative emotionality related to digital maturity as expected, in addition to the effect of SES and active parental mediation. Hence,

both the socioeconomic environment and personality can be antecedents of young people's digital maturity.

These results are in line with previous literature on the relation of SES and parental mediation strategies to digital device use (Livingstone et al., 2017; Ren et al., 2022; Steinfeld, 2021; Sun et al., 2021; Urbanova et al., 2019). In fact, the findings suggest that one problem in low SES families may be the low level of active mediation by parents. Thus, young people receive less guidance in how to beneficially and safely navigate the digital world, making use of its opportunities and avoiding potential risks. With higher SES, parents are more actively involved in their child's use behavior, supporting their development of digital maturity. The results support the notion of the family investment model that higher SES parents have the knowledge, abilities and resources to guide their child (Alkan et al., 2021; Nikken & Oprea, 2018; Sohr-Preston et al., 2013). While most research to date has focused on the relation of low SES to maladaptive behavior, our article adds to the small literature base which focuses on the relation of SES to positive behaviors beyond digital literacy (Ren et al., 2022; Wang & Xing, 2018).

Besides the influence of the family environment, intrapersonal factors also related to digital maturity. As would be expected based on psychosocial maturation theory (Bleidorn, 2015; Roberts & Mroczek, 2008; Staudinger & Kunzmann, 2005) and previous research on digital maturity (Laaber et al., 2023), the personality traits agreeableness, conscientiousness and negative emotionality related to digital maturity. Hence, the results provide further support for the conceptualization of digital maturity as building on psychosocial maturation. Aspects of the personality traits agreeableness, conscientiousness and negative emotionality are reflected in digital maturity's specific application to the digital context, for example in dimensions such as the regulation of emotions and impulses, or risk awareness. Moreover, the results showed that besides the environment, intraindividual factors also independently relate

to young people's ability to engage with the digital world in a mature and beneficial way (Ayoub et al., 2018; Damian et al., 2015), relating to previous literature that personality traits link to use behavior (Hussain et al., 2017; Sriyabhand & John, 2014).

The article also supports digital maturity as a measure of beneficial use behavior beyond the lack of addictive use. When including screen time in the model, it related negatively to digital maturity, but the effects of SES and active mediation remained unchanged. Hence, active mediation related rather to the quality of use, as measured by digital maturity, than solely to reduced usage time. This finding supports the notion of using digital devices as a tool, which might relate to lower, more effective use in some cases but not necessarily in others, for example, when engaging with digital devices to learn something.

A strength of the article is that information was asked directly from both the parent and adolescent. Moreover, the analyses could rely on a large sample from two countries, providing a relatively large database for the conclusions regarding socioeconomic status. Discriminant validity was confirmed, supporting that the constructs were independent (Fornell & Larcker, 1981). The article contributes to the literature as it provides further support for digital maturity as a general ability for beneficial device use, suggesting how this ability can be developed. The focus on digital maturity enables a move away from maladaptive usage behaviors, towards the opportunities of the digital world. The findings suggest that parental knowledge and mediation strategies could be addressed as a mechanism enabling young people from all socioeconomic backgrounds to take advantage of digital opportunities and avoid digital risks.

Limitations of the article include the reliance on a self-report survey which does not enable any causal conclusions. Nevertheless, the assumed directionality seems reasonable as parents' SES is a broad societal factor and is unlikely to be influenced by adolescents' digital maturity. However, to gain further insights into the development of digital maturity,

longitudinal research will be required. While not establishing causality, longitudinal research can provide further insights into the temporal link of environmental and intraindividual factors to digital maturity throughout young people's development. The present study provided first indications regarding potentially important antecedents of digital maturity, which can be built on further in the future. Moreover, future research could experimentally manipulate parental mediation to enhance young people's digital maturity, for example by instructing parents how to guide their child's device use. This would provide an interesting avenue for interventions and could provide further insight regarding the causal relations of the investigated concepts. Future studies should incorporate further factors which might also relate to young people's development of digital maturity, such as peer influence and educational settings. Including these aspects was beyond the scope of the present article, but they might equally be influential factors in young people's mature use behavior.

Overall, the article presents valuable insights into antecedents of young people's digital maturity. It suggests that despite the digital world offering a chance to reduce societal inequalities due to the easy access to information and learning opportunities, inequalities seem to persist as young people from higher SES backgrounds are better able to make use of these opportunities, benefitting from their parents' knowledge and guidance. Nevertheless, intraindividual factors also seem to relate to digital maturity levels independently from family background.

Chapter 2: Outcomes of Digital Maturity

One basic assumption of digital maturity theory is that with higher digital maturity, individuals can use the digital world for beneficial outcomes regarding personal growth and social integration (Laaber et al., 2023). However, the relation of digital maturity to outcomes of digital device use has not yet been investigated in detail. To address this, the second goal of the dissertation was to investigate outcomes of digital maturity. Across three articles, we focused on several specific aspects of digital technology use and tested to what extent digital maturity enables positive use behavior outcomes in these domains. Hence, I address the second and third objective of this dissertation.

The second objective was to examine how digital maturity relates to beneficial use behavior outcomes by using digital technologies as a tool for personal advancement and social integration. Addressing this, Article II and III investigated the relation of digital maturity to various well-being outcomes and social connectedness. We conducted several studies with adolescent-parent dyads ($N = 1214$), testing these associations and several mechanisms mediating the associations. We expected that with higher digital maturity, individuals would experience more beneficial outcomes of their digital technology use. Moreover, we examined mechanisms how individuals with high digital maturity engage with digital technology to enable this benefit. In Article II, we investigated need satisfaction, need frustration and instrumental device use as potential mechanisms. In Article III, we investigated active device use, interaction with real and virtual friends online, and compassionate goals as potential mechanisms. The studies provided insights regarding the assumption that digital maturity enables the use of digital devices as tools in an autonomous and self-determined way, in order to satisfy their needs and achieve well-being (Chen et al., 2015; Deci & Ryan, 2000). Further, they contributed to the understanding how digital

maturity relates to overall online and offline benefit by achieving positive outcomes regarding general well-being and social integration.

The third objective was to investigate how digital maturity relates to beneficial behavior for personal development in demanding situations. Addressing this, in Article IV we tested how digital maturity influences the choice of meaningful tasks in demanding settings. In an online experiment ($N = 305$), we examined how high expectations and high difficulty of a task can influence individuals' choice of a subsequent task, which is either easy and meaningless or difficult and meaningful for personal growth. Our expectation was that individuals will rather focus on an easy and meaningless task after having experienced high expectations or difficulty, but that this preference would be attenuated with higher digital maturity. This research provided insights regarding the assumption that digital maturity enables mature reactions in challenging digital situations, as individuals can adequately deal with issues such as high expectations.

Digital Maturity and Well-being

To test how digital maturity enables positive outcomes of digital device use, Article II (Laaber et al., 2024) examined the relation of digital maturity to well-being, via instrumental device use, psychological need satisfaction and frustration. We conducted two studies with a total of 641 adolescent-parent dyads. The assumption was that with higher digital maturity, young people would report higher well-being and lower ill-being, as they use digital devices as tools, achieve higher need satisfaction and lower need frustration.

Since the concept of digital maturity is based on self-determination theory, it implies that digital maturity should positively relate to well-being (Deci & Ryan, 2000). Satisfaction of basic needs relates to positive well-being outcomes like higher self-esteem (Deci & Ryan, 2000; Ryan & Deci, 2000), while frustration of needs relates to negative well-being outcomes like maladaptive functioning (Vansteenkiste & Ryan, 2013). Hence, individuals with high

digital maturity should be capable of engaging with technology in ways which enable higher satisfaction and lower frustration of the needs for autonomy, competence and relatedness (Laaber et al., 2023; Przybylski et al., 2010). This article was the first to test whether digital maturity indeed relates to these basic needs and well-being outcomes, providing a crucial contribution to the theoretical development of digital maturity. Testing this relation also sheds light on the assumption that digital maturity, which is specific to the digital context, can influence general well-being outcomes which span both offline and online domains.

The digital environment has the potential to both satisfy and frustrate needs. Previous literature showed that digital activities can satisfy needs and enhance well-being, but also hinder need satisfaction and decrease well-being (Erdmann & Dienlin, 2022; Masur et al., 2014; Przybylski et al., 2009). For example, videogames designed to support autonomy and competence can increase motivation and engagement (Peng et al., 2012). We expected that with higher digital maturity, individuals can use the digital environment as a tool to satisfy needs and achieve well-being while shielding themselves from frustrations. They can benefit from digital technologies, for example by using them as a tool to learn new skills and strengthen social relations. At the same time, they are adept in dealing with problems and are aware of risks.

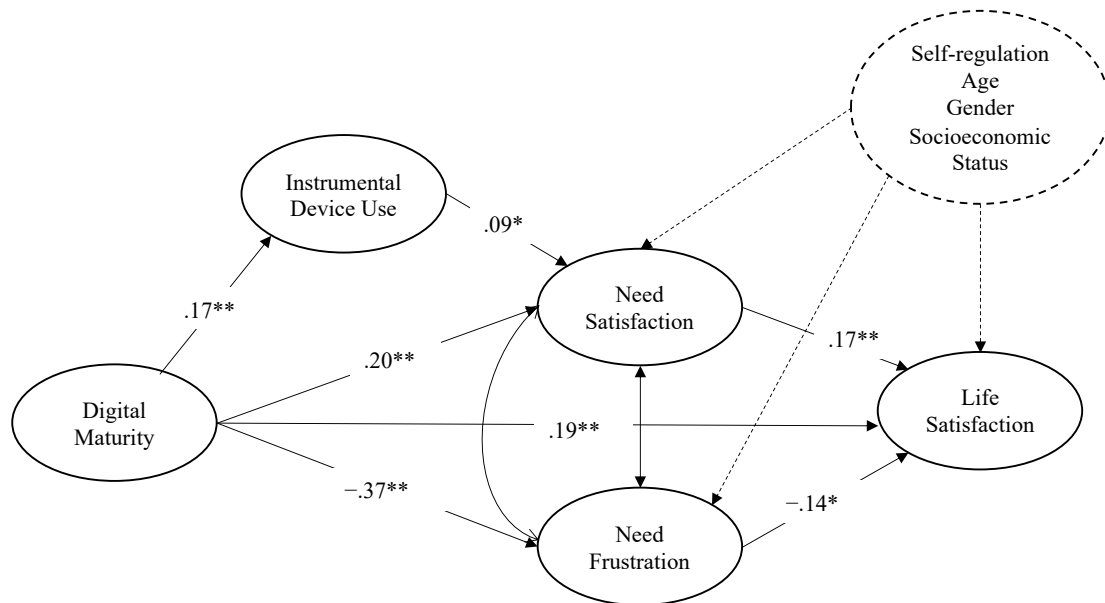
However, the process towards growth and social integration is not always straightforward and mature behavior does not always relate to higher well-being (Bauer et al., 2005; Bauer & Mcadams, 2004). Especially in the digital world, behaviors such as watching TikTok videos can increase hedonic well-being, but do not represent a mature use of digital technologies. Mature behaviors, like acquiring new programming skills, can involve frustrations and are not immediately linked to higher well-being (Oishi et al., 2021). In the long run, however, such growth experiences can increase need satisfaction and enable psychological richness. Psychological richness goes beyond a solely hedonic form of well-

being, and includes novel, complex and meaningful experiences, which can also be negative at times, but rich overall (Oishi & Westgate, 2022). Therefore, we included several well-being outcomes to capture a breadth of experiences, as we expected that while mature digital behavior might cause temporary frustrations, it will enable psychological richness overall.

Article II tested the relations between digital maturity, need fulfilment and well-being in two studies with adolescent-parent dyads in Germany and Austria. Structural equation path modelling and mediation analyses were used. In all structural equation models, we controlled for age, gender, socioeconomic status and self-regulation, as these variables can relate to technology use and well-being (Faltýnková et al., 2020; González-Carrasco et al., 2017; Koch et al., 2024; Reinecke et al., 2022; Yoon et al., 2023). In Study 1 ($N = 292$), we tested the association of digital maturity to instrumental device use, need satisfaction, need frustration and life satisfaction. The results are shown in Figure 4. The structural path model showed a good fit ($RMSEA = 0.052$; $CFI = 0.996$; $TLI = 0.951$; $SRMR = 0.013$), and supported the expected relations. With higher digital maturity, adolescents reported higher instrumental device use, need satisfaction and life satisfaction, and lower need frustration. Moreover, need satisfaction and frustration mediated the effect of digital maturity on life satisfaction. The study thus supports that digital maturity relates positively to general life satisfaction and that adolescents with higher digital maturity are more adept at using digital technologies as a tool for positive outcomes.

Figure 4

Structural Equation Path Model of Digital Maturity Predicting Life Satisfaction (Article II, Study 1)



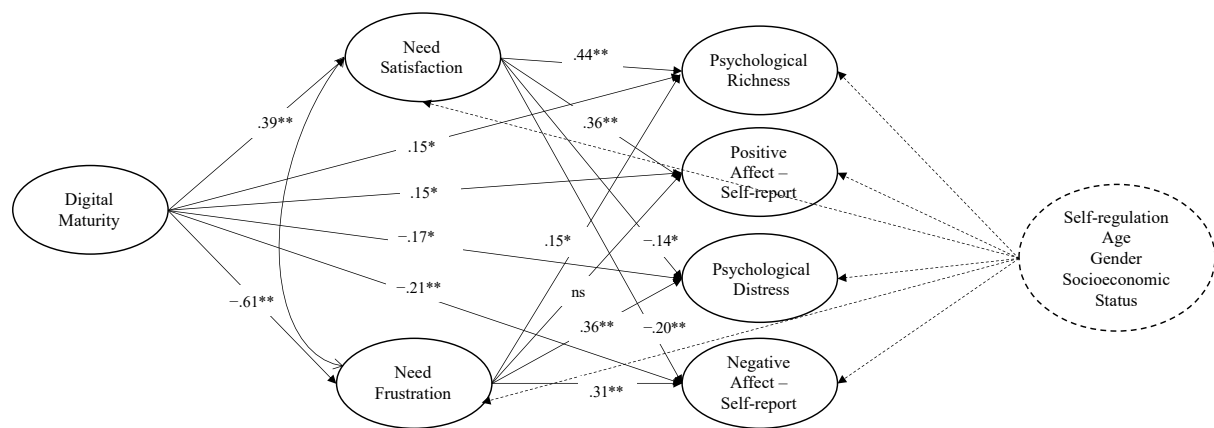
Note. $N = 292$. $*p < .05$. $**p < .01$. RMSEA = 0.052; CFI = 0.996; TLI = 0.951; SRMR = 0.013. Age, gender, self-regulation and socioeconomic status were control variables.

In Study 2 ($N = 349$), a broader array of well-being and ill-being outcomes was used, to gain a more detailed understanding of how need satisfaction and need frustration relate to these outcomes. Further, we compared adolescent-reported and parent-reported measures of the adolescents' affect, while again controlling for age, gender, self-regulation, and socioeconomic status. The model is shown in Figure 5. It showed a good fit (RMSEA = 0.071; CFI = 0.995; TLI = 0.942; SRMR = 0.008), supporting the expected findings. With higher digital maturity, adolescents reported higher need satisfaction and lower need frustration. They showed higher psychological richness and positive affect, and lower psychological distress and negative affect. Need satisfaction and frustration mediated the effect of digital maturity on psychological richness, negative affect, and psychological distress. Need satisfaction also mediated the effect of digital maturity on positive affect.

Testing the same model using the parent report of adolescents' positive and negative affect showed comparable results and a good fit as well (RMSEA = 0.053; CFI = 0.997; TLI = 0.962; SRMR = 0.012). Overall, the study supports that digital maturity indeed relates to a variety of general well-being outcomes, directly and via need satisfaction and frustration.

Figure 5

Structural Equation Path Model of Digital Maturity Predicting Several Well-Being Outcomes (Article II, Study 2)



Note. $N = 349$. $*p < .05$. $**p < .01$. RMSEA = 0.071; CFI = 0.995; TLI = 0.942; SRMR = 0.008. Age, gender, self-regulation and socioeconomic status were control variables.

Digital Maturity and Social Connectedness

Further investigating positive outcomes of digital maturity, Article III (Koch, Laaber, Arenas, & Florack, 2025) focused on the aspect of social integration and tested the relation of digital maturity to social connectedness, via active use behavior, engaging with real-life friends online and compassionate goals. We conducted a one-year longitudinal study with two waves and a cross-sectional study, with a total of 573 adolescent-parent dyads from Austria, Germany and Spain. The assumption was that with higher digital maturity, young people would report higher social connectedness. The studies tested three potential mediators of how, with whom and why individuals interact online to explain the relationship.

Social connectedness refers to a perceived sense of belonging, support and positive relationships, through active involvement with others and a sense of community (Kim et al., 2016; McIntyre et al., 2015; Ryan et al., 2017; Winstone et al., 2021). Despite the omnipresent possibility to connect with others online, it is unclear whether individuals benefit from these interactions (Kushlev et al., 2019; Ryan et al., 2017; Verduyn et al., 2017; Winstone et al., 2021). For example, emotional support on social media has been linked to higher odds of depression (Shensa et al., 2020). We argued that whether individuals benefit from the online world regarding social connectedness will depend on how they make use of these digital opportunities. With higher digital maturity, we expected young people to engage with the digital world in a way which benefits their social integration.

Previous literature identified both positive and negative associations between using social media and social connectedness. On the one hand, social media can aid individuals to interact with others and create social capital, which can be especially useful for anxious or shy persons (Allen et al., 2014; Ryan et al., 2017; Verduyn et al., 2017; Winstone et al., 2021). On the other hand, online communication has also been linked to higher isolation and loneliness (Sharabi & Margalit, 2011; Shensa et al., 2020). Overall, research emphasizes that the type of online engagement is crucial regarding the positive or negative effects for social connectedness (McIntyre et al., 2015; Pandya & Lodha, 2021; Verduyn et al., 2017). Hence, this article tested whether adolescents with higher digital maturity were more adept in using the online world to increase social connectedness. If digital maturity, as a general underlying ability, relates to whether individuals engage in online interactions in a beneficial or detrimental way, it would be a useful general predictor for social connectedness online compared to more specific factors, like passive use behavior (Frison & Eggermont, 2015).

The conceptualization of digital maturity includes the association with effective social integration (Greenberger et al., 1975; Laaber et al., 2023), but no mechanisms of how social

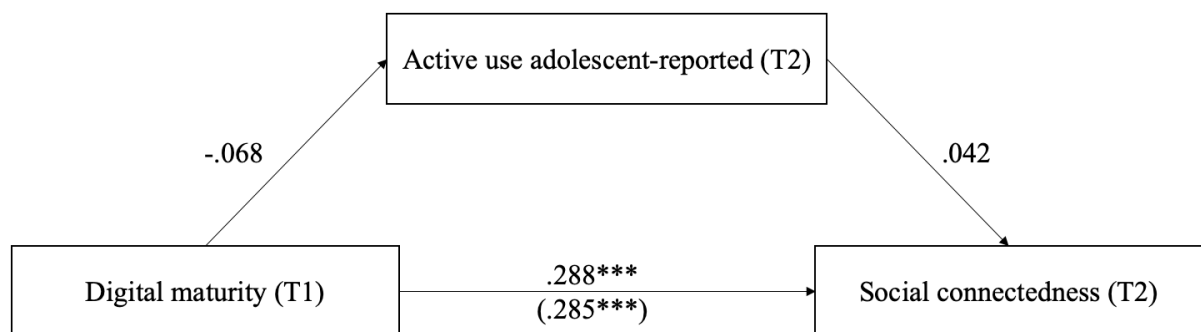
integration occurs are yet proposed in the theory. Hence, we tested three potential mechanisms: *how*, *with whom* and *why* young people engage in online social interactions. Regarding *how* young people engage with others online, we tested their active versus passive use of digital technologies. Passive use includes behaviors like scrolling through posts. It is generally evaluated as detrimental (Escobar-Viera et al., 2018; Roberts & David, 2023; Wang et al., 2018), and has been linked to increased social comparison and loneliness. Active use includes behaviors like texting with others or posting and has been linked to higher social connectedness (Deters & Mehl, 2013; Matook et al., 2015; Verduyn et al., 2017). Regarding *who* young people interact with online, we compared whether they interacted with friends they knew from real life, or with virtual-only friends. Engaging with real-life friends online can support and enhance offline social relationships (Clark et al., 2018; Winstone et al., 2021). Online communication instead of offline relations, and superficial online interactions (e.g., “likes”) do not necessarily benefit social connectedness (Burke & Kraut, 2016; Sharabi & Margalit, 2011). Regarding *why* young people engage with others online, we investigated the goals individuals hold for social interactions. Strong compassionate goals, involving a supportive and considerate approach towards others, enable social connectedness. Strong self-image goals, meaning a focus on leaving a positive impression, relate to higher loneliness (Crocker et al., 2009; Crocker & Canevello, 2008).

In Study 1 ($N = 316$), we tested the longitudinal relationship of digital maturity to social connectedness one year later and the mediating role of active device use, relying on both the adolescent- and parent-reported active use behavior of adolescents. The results supported that digital maturity related positively to social connectedness one year later. Regarding active use behavior, the results were inconclusive. While adolescent-reported active use did not relate to digital maturity, adolescents’ active use reported by parents related negatively to digital maturity, which was contrary to our expectations. The relation of digital

maturity to social connectedness was not mediated by adolescent-reported active use ($b = .003$, $SE = .006$, 95% CI $[-.017, .007]$), as can be seen in Figure 6. Using parent-reported active use, the results showed a mediation effect ($b = .018$, $SE = .011$, 95% CI $[-.044, .001]$), with a negative relation between digital maturity and active use, and a positive relation between active use and social connectedness, shown in Figure 7. Hence, the evidence for a mediation effect was rather weak and its directionality contradicted expectations. Overall, the results supported that digital maturity relates positively to social connectedness, but did not support a positive mediating effect via active use behavior.

Figure 6

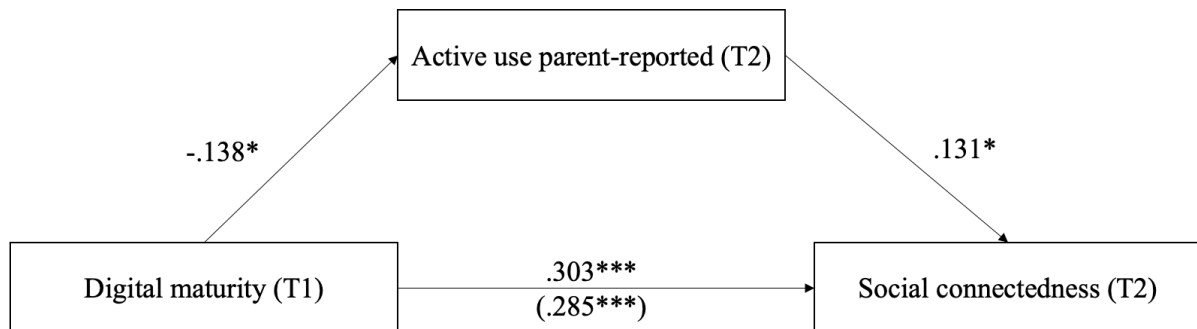
Mediation Model of Digital Maturity Predicting Social Connectedness via Adolescent-Reported Active Use (Article III, Study 1)



Note. *** $p < .001$. $N = 316$. Values are standardized.

Figure 7

Mediation Model of Digital Maturity Predicting Social Connectedness via Parent-Reported Active Use (Article III, Study I)

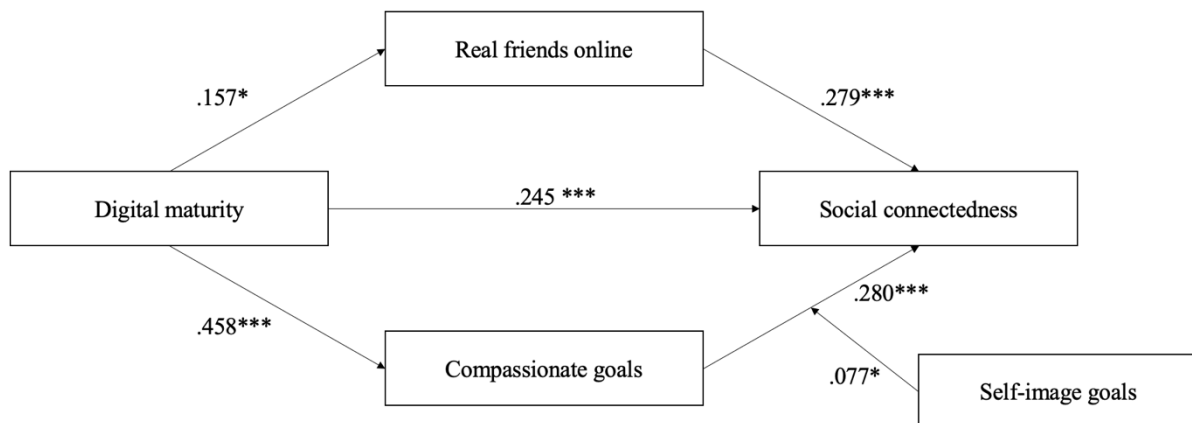


Note. $^* p < .05$, $^{***} p < .001$. $N = 316$. Values are standardized.

In Study II ($N = 257$), we set out to examine two further potential mechanisms of the relation between digital maturity and social connectedness, looking into who adolescents engage with online and the type of goals they hold for these interactions. The findings again supported the positive relation between digital maturity and social connectedness. A moderated mediation model showed the expected effects: With higher digital maturity, adolescents rather engaged with real-life than virtual friends online, benefitting their social connectedness ($b = .042$, $SE = .019$, 95% CI [.008, .083]). Also, with higher digital maturity adolescents showed higher compassionate goals, benefitting their social connectedness ($b = .099$, $SE = .031$, 95% CI [.041, .162]). Self-image goals interacted positively with compassionate goals. Thus, while it was expected that self-image goals would weaken the relation of compassionate goals to social connectedness, the opposite was indicated. The results can be seen in Figure 8. Overall, the findings indicated that both the engagement with real-life friends online and holding compassionate goals are relevant mechanisms of the positive relation between digital maturity and social connectedness.

Figure 8

Moderated Double Mediation Model of Digital Maturity Predicting Social Connectedness via Real Friends Online and Compassionate Goals, Moderated by Self-Image Goals (Article III, Study 2)



Note. * $p < .05$, *** $p < .001$. $N = 257$. Values are standardized.

Digital Maturity and Task Choice

To examine how digital maturity relates to beneficial behaviors, Article IV (Koch, Laaber, & Florack, 2025) investigated how digital maturity influences the effect of challenging situations on task choice. Our previous research tested the correlation of digital maturity with self-reported behaviors like the engagement with others online, which provided valuable insights. However, no study has yet experimentally tested how digital maturity influences choice behavior in specific situations. We conducted an online experiment with 305 adults, which measured how high vs. low expectation and difficulty levels influenced individuals' choice for an easy and meaningless, or difficult and meaningful subsequent task. The assumption was that individuals would prefer an easy and meaningless task after experiencing high difficulty or expectations, but that this tendency would be reduced with higher digital maturity.

Although self-determination theory postulates that individuals strive for personal development and want to grow and learn (Deci & Ryan, 2008; Ryan & Deci, 2000), there are trends which suggest that people avoid challenging and meaningful activities. Individuals favor high salaries over meaningful jobs (Ward, 2024), and social media trends emphasize the benefits of easy routine jobs which require little effort (Lobe, 2023; Oladele, 2023; Twenge, 2017). In today's society, especially young people perceive that expectations regarding the educational and professional standards they should meet are constantly rising, while it also becomes difficult to succeed in an increasingly uncertain world (Twenge, 2017). Moreover, idealized self-images on social media portray highly successful lives which are unrealistic to achieve, for example regarding career success (de Lenne et al., 2020; Mills et al., 2022; Oliver et al., 2024). Hence, we argued that the avoidance of meaningful, but challenging tasks stems from the prevalence of high expectations and difficulty, which cause individuals to become aware of their own shortcomings and thus prefer tasks which can easily be fulfilled successfully. However, we expected digital maturity to attenuate the effect of high difficulty and expectations, as it enables individuals to navigate the online world in a self-determined way.

According to self-awareness theory, when faced with high difficulty or high expectations, individuals' attention focuses on their own performance in order to evaluate oneself compared to ought standards (Duval et al., 1992; Yilmaz, 2022). This comparison will emphasize self-discrepancies, which are discrepancies between the actual self and standards, leading to negative self-feelings and the desire to either avoid the situation or reduce discrepancies (Duval & Lalwani, 1999; Moskalkenko & Heine, 2003; Wicklund, 1975). Therefore, when individuals experience high difficulty or high expectation situations, it increases their self-awareness and they will become aware of self-discrepancies.

Consequently, individuals might be more likely to favor easy and meaningless tasks in order to avoid challenges and self-discrepancies.

Whether individuals choose to avoid a situation or try to reduce discrepancies depends on their perception of the self-discrepancy (Csikszentmihalyi & Figurski, 1982; Duval & Lalwani, 1999; Wicklund, 1979). When a situation is perceived to threaten their self-evaluation, avoidance is likely and individuals might choose to engage with easy and meaningless tasks. However, when self-discrepancies are interpreted as feedback which can be used to learn and improve, individuals should not feel threatened and might rather choose to engage in meaningful yet difficult tasks nevertheless.

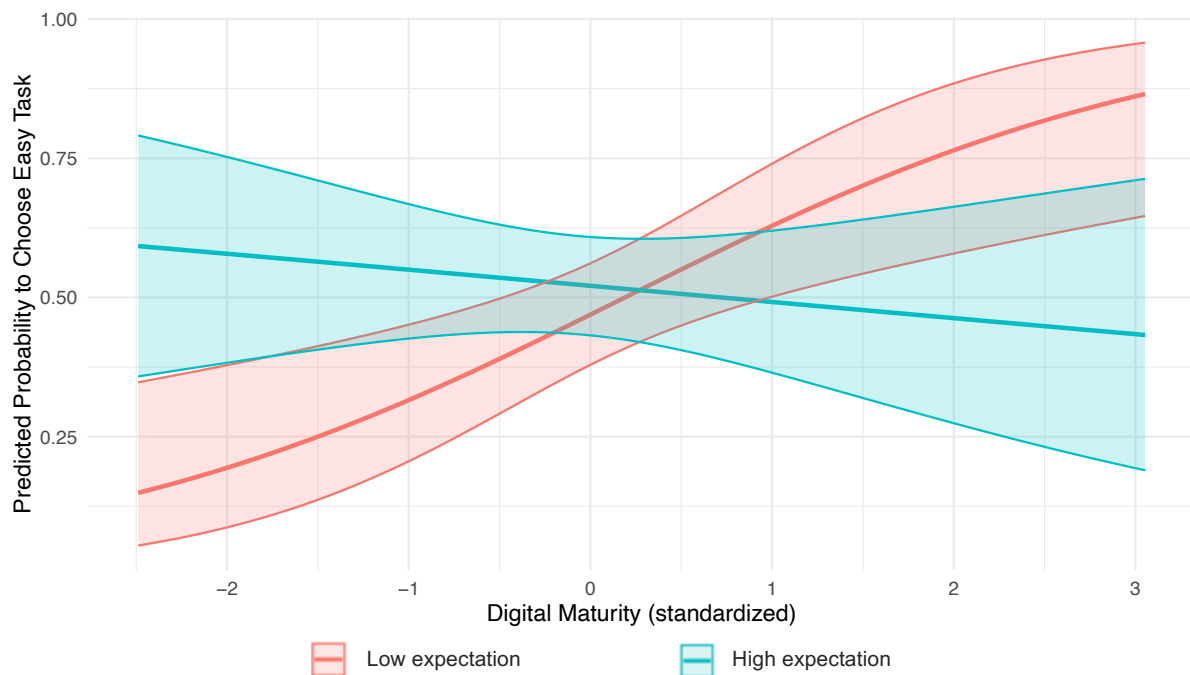
With high digital maturity, individuals should be better adept at using situations for their personal development (Laaber et al., 2023, 2024) and not being threatened by comparisons, which are especially biased and idealized in the digital world. Success and expectations portrayed online are often unrealistic and impossible to achieve (de Lenne et al., 2020, 2022; Kasperuniene & Zydziunaite, 2019; Mills et al., 2022; Oliver et al., 2024). Therefore, individuals need to be able to navigate such an environment in ways which benefit their personal growth without experiencing threat. As Article II showed a positive association of digital maturity and psychological richness, we expected that individuals with higher digital maturity might be more likely to expose themselves to challenging, but meaningful situations, seeking opportunities for growth. We expected that they would rather interpret self-discrepancies as information which they can use to improve, rather than as a source of evaluation which can threaten the self. Hence, with higher digital maturity individuals should rather engage with meaningful and difficult tasks despite having experienced high difficulty and high expectations.

We aimed to test these assumptions experimentally. Transferring the high expectations and difficulties which individuals experience in daily life into a testable

experimental setting can be challenging. In this study, we aimed to make these factors measurable, allowing us to test causal effects although creating a more artificial task setting. In the online experiment, individuals first solved several Raven matrices, which were either easy or difficult (high vs. low difficulty), and for which they were either expected to solve eight out of 10 (high expectation) or two out of 10 (low expectation). They were shown their overall score for the matrices before they could choose between two subsequent unrelated tasks, one easy and meaningless (visual search), the other difficult and meaningful (text about inflation and investment). The results of a generalized linear mixed model predicting task choice suggested a significant interaction effect of digital maturity and expectations ($b = -.766, p = .006$), but no effect of difficulty. Investigating the effect of expectation conditions at low, medium and high digital maturity levels, we found significant differences at low digital maturity. With low digital maturity, individuals chose the easy and meaningless task more often after having experienced high expectations, but chose the difficult and meaningful task more often after having experienced low expectations ($p = .012$). Individuals were not affected by the expectation conditions at medium ($p = .430$) and high digital maturity ($p = .137$). The effects can be seen in Figure 9. Overall, the results suggest that only individuals with low digital maturity were susceptible to the expectation condition, more likely choosing the easy and meaningless task after experiencing high expectations than after experiencing low expectations.

Figure 9

Probability of Choosing the Easy Task Predicted by Expectation Condition and Digital Maturity (Article IV)



Discussion Chapter 2: Outcomes of Digital Maturity

In order to examine outcomes of young people's digital maturity, we investigated how digital maturity relates to beneficial technology use for personal advancement and social integration across several studies. Although a basic assumption of digital maturity theory, the relation of digital maturity to beneficial outcomes of digital technology use had not been tested thoroughly before. Across all studies, the findings provided support for a positive association of digital maturity with beneficial outcomes of digital technology use. Digital maturity related positively to well-being outcomes and social connectedness, and weakened the detrimental effect of a challenging situation on task choice.

The findings of Article II supported that digital maturity relates positively to a wide range of well-being outcomes, and negatively to ill-being outcomes, as expected. These relations were mediated by instrumental device use, higher need satisfaction and lower need

frustration. The results supported the conceptualization of digital maturity as grounded in self-determination theory (Deci & Ryan, 2000; Laaber et al., 2023; Ryan & Deci, 2000). With higher digital maturity, young people seem more adept at satisfying their needs and avoiding need frustration, which benefits their well-being. One interesting finding was that digital maturity related positively to psychological richness, which shows that individuals with higher digital maturity seem to seek more mature and complex experiences (Bauer et al., 2005; Bauer & Mcadams, 2004). This result might indicate that with higher digital maturity, individuals rather expose themselves to psychologically rich situations, such as learning something new online, which can include both negative and positive aspects, resonating with fulfilling one's need for autonomy and competence. Crucially, with the digital environment offering possibilities for both need satisfaction and need frustration (Peng et al., 2012; Przybylski et al., 2009, 2010), the findings of Article II show that a mature use of the digital world relates to using digital devices as tools to benefit need satisfaction and well-being. Moreover, the findings indicate that digital maturity is associated with general well-being outcomes spanning the offline and online world.

In the same vein, Article III showed that digital maturity related positively to social integration both cross-sectionally and longitudinally, which supports digital maturity theory and strengthens its construct validity. Moreover, the article identified the engagement with real-life friends online and holding compassionate goals as two mechanisms how digital maturity relates to social connectedness, thus expanding the theory and providing further depth to the understanding of mature use behavior. The results support that digital maturity relates to who individuals engage with online (Burke & Kraut, 2016; Clark et al., 2018; Winstone et al., 2021), and the goals they hold for online interactions (Crocker et al., 2009; Crocker & Canevello, 2008). The study emphasized the relevance of compassionate goals in the online context, which was not thoroughly tested before (Roper & Tobin, 2022; Tobin et

al., 2020). Further research will be needed to better understand how digital maturity relates to the active use of digital devices. As digital maturity related to general social connectedness, via mechanisms focusing on the online context, the article also supports that digital maturity is associated with social integration across the online and offline world. The results suggest that individuals with higher digital maturity can effectively use the digital context as a tool to satisfy their need for relatedness (Deci & Ryan, 2000).

Further testing the relation of digital maturity to positive outcomes, Article IV showed that digital maturity moderates the effect of high expectations on subsequent task choice. We expected that high expectations and difficulty will make individuals aware of self-discrepancies, thus subsequently preferring tasks which are easy to fulfil (Duval & Lalwani, 1999; Moskalenko & Heine, 2003; Wicklund, 1975). With medium and high digital maturity, individuals were not sensitive to high expectations, suggesting that they did not feel threatened in their self-evaluation. However, individuals with low digital maturity were more likely to engage with an easy and meaningless task after high expectations than low expectations. With low digital maturity, high expectations seem to present a threat to individuals' self-evaluation, hence they avoided further potential threat and chose an easy and meaningless task over a difficult and meaningful task. The finding that the manipulation affected the choice of a subsequent, unrelated task, emphasizes the enduring effect of this self-threat. While difficulty did not affect task choice, the findings suggest that societal expectations can have strong effects on behavior. Considering the prevalence of communicated ideals and high expectations online (de Lenne et al., 2020; Oliver et al., 2024), the results indicate that such high expectations might link to recent trends to avoid challenges and prefer easy and routine jobs (Lobe, 2023; Oladele, 2023; Twenge, 2017). The study supports the assumption that digital maturity enables more mature reactions to challenges, thus enabling a beneficial use of digital technologies for personal development in demanding

situations. Using only the digital literacy dimension as a moderator instead of digital maturity, the model showed no significant effects, suggesting that digital maturity includes aspects of mature use behavior that go beyond digital literacy. Moreover, this study extends the focus of digital maturity research from young people to adults. The results suggest that digital maturity is also a relevant construct in the general population, which is equally faced with the challenges of digital technologies (Kozyreva et al., 2020).

Combining the findings of these three articles, they provide a valuable contribution to the understanding of outcomes related to digital maturity. We identified relations of digital maturity to need satisfaction and frustration, ill-being, well-being, social connectedness, and task choice. These relations of digital maturity to positive outcomes were expected based on its conceptualization, but not thoroughly tested to date. Hence, our research strengthens the theoretical foundation of digital maturity as enabling the beneficial use of digital technologies for personal development and social integration (Laaber et al., 2023).

Regarding methodological strengths, Article II statistically controlled for self-regulation and SES which were shown to relate to use behavior (Faltýnková et al., 2020; Koch et al., 2024; Reinecke et al., 2022). Moreover, in order to account for potential common method bias and halo effects due to self-report, Article II and III relied on both parent and adolescent reports, which showed similar results. Furthermore, Article IV was the first study to include digital maturity in an experimental design, extending previous correlational research by experimentally testing how digital maturity relates to a behavioral outcome.

Nevertheless, several mechanisms require further testing. Article III could not provide conclusive results regarding the relation of active use behavior to digital maturity and social connectedness. Moreover, Article IV did not explicitly test whether digital maturity relates to viewing a challenging situation as a threat or opportunity, but only focused on the behavioral outcome. Additionally, transferring high expectations from society to an artificial lab setting

only allowed to test a highly specific task. Future studies should test whether high expectations have similar effects on task choice in more natural settings like the workplace. Also, due to the correlational nature of most of the studies, the causal direction of the association of digital maturity with its outcomes remains unresolved. For instance, it is not clear whether young people with better social connectedness also develop higher digital maturity, or vice versa. While Article IV is the first to include digital maturity in an experimental design, it still cannot provide causal effects of digital maturity directly, but includes it as a moderator. The topic of causality will need to be addressed in future research, for example by using interventions which specifically address dimensions of digital maturity. In order to strengthen the conclusions which can be drawn from the mediation analyses, mediators like instrumental device use or engaging with real-life friends online could be manipulated to establish causal chains (Spencer et al., 2005).

Overall, the three articles provide useful insights into outcomes of young people's digital maturity. They support that digital maturity links to engaging with the digital world in positive ways regarding well-being, social connectedness and task choice. Furthermore, mechanisms explaining how these positive outcomes are enabled are suggested. By looking into these various aspects of digital technology use, the articles show that digital maturity relates to beneficial use outcomes, supporting its theoretical conceptualization.

General Discussion

The digital world offers both opportunities and risks, especially for young people who report very high daily usage of digital technologies (Statista, 2023). With the multitude of different applications, platforms and kinds of digital technology use, it is still unclear under what circumstances individuals will experience the positive or negative aspects of digital device use. Digital maturity aims to provide a basis for a general understanding of abilities and attitudes which enable young people to use digital technologies in a beneficial way for personal growth and social integration, not focusing on specific applications or aspects of use, but as a general ability underlying all digital technology use (Laaber et al., 2023). The aim of this dissertation was to test antecedents associated with digital maturity and to examine how digital maturity relates to positive outcomes of digital technology use.

In my dissertation, I identified environmental and intraindividual antecedents of digital maturity, enabling young people to develop a mature use of digital technologies (*Objective 1*). Regarding outcomes of digital maturity, I found that digital maturity relates to using digital technologies as a tool for personal advancement and social integration (*Objective 2*), and showed that digital maturity enables more mature behavior benefitting personal development in demanding situations (*Objective 3*).

My work contributes to the empirical validation of digital maturity theory. It identifies SES and active parental mediation as relevant antecedents of digital maturity and provides further support for the relation of agreeableness, conscientiousness and negative emotionality to digital maturity, as proposed in its original conceptualization (Laaber et al., 2023). Further, I provide support that digital maturity relates to several positive outcomes, such as well-being, social connectedness and mature task choice. While digital maturity theory postulates its relation to more beneficial use outcomes, these relations and potential mechanisms enabling positive outcomes were not tested in detail before.

Further, the presented articles add to the theoretical advancement of digital maturity. They provide insights into the mechanisms how individuals with high digital maturity use digital devices to achieve positive outcomes. These mechanisms included the satisfaction of needs and instrumental device use to achieve higher well-being, as well as the engagement with real-life friends and holding compassionate goals to benefit social connectedness. The findings fit with the conceptualization based on psychosocial maturation (Greenberger et al., 1975; Staudinger & Kunzmann, 2005) and self-determination theory (Deci & Ryan, 2008; Ryan et al., 2008). Individuals with high digital maturity strive for personal growth, by using digital devices as tools and making mature task choices. They achieve social adjustment by engaging with others online in beneficial ways, and satisfy their needs in order to achieve positive well-being.

Relying on digital maturity to understand how young people use the digital world adds new depth to the discussion of digital technologies, going beyond a fragmented understanding which focuses only on singular aspects like screen time or specific use behaviors (Bohnert & Gracia, 2021; Frison & Eggermont, 2015; Orben, 2020). Digital maturity provides a holistic understanding of who can use the opportunities of the digital world and avoid its risks, across varying platforms or functionalities. As a higher-order theory of digital technology use for personal growth and social integration, it provides a theoretical framework to test new ideas how digital maturity relates to digital device use. As digital maturity addresses a variety of aspects such as social interactions online or autonomous use, it can predict outcomes better than digital literacy alone. For example, replacing digital maturity with digital literacy in Article IV, the effect of high expectations on task choice disappears, supporting that digital maturity captures capabilities beyond digital literacy which influence behavior. Also, while we find moderate relations of digital maturity to screen time, the digital maturity framework enables the research focus to move away from

a reductionist view of how much young people use digital devices towards a more nuanced understanding of use behavior. My dissertation made a first step in this direction, testing how digital maturity relates to several antecedents, outcomes, and behavioral choice, supporting the utility of the digital maturity construct for understanding beneficial use behavior across applications and situations.

Across all articles, the findings provided support for the postulated assumptions how digital maturity enables beneficial use behavior. First, digital maturity related positively to instrumental device use, suggesting that young people with higher digital maturity rather use digital devices as tools for self-determined use. Moreover, with higher digital maturity, young people showed higher need satisfaction and well-being. Second, the studies supported that digital maturity relates to online and offline benefits as the well-being and social connectedness measures were not specific to the digital world, but general. Third, with high digital maturity, individuals exhibited mature reactions in demanding environments, showing less susceptibility to high expectations. Overall, the studies which I presented investigated several specific aspects of digital device use, which support these general assumptions of how digital maturity interacts with digital technology use.

Strengths, Limitations and Future Research

The topic of digital technologies is omnipresent in society, with the risks of digital devices often dominating discussions. One strength of this dissertation is that it addresses this topic of high societal relevance. In doing so, the aim is to move the discussion away from only the risks of digital devices, and also focus on the opportunities and how these can be leveraged. By pointing to antecedents of digital maturity and showing that high digital maturity indeed relates to beneficial outcomes of digital device use, potential ways forward are suggested.

As another strength, all studies of this dissertation were conducted with high methodological rigor. Due to the use of correlational survey studies in most of the articles, common method bias was a concern (Podsakoff et al., 2003; Tehseen et al., 2017). In order to address this issue, we tested for common method bias in several studies (Podsakoff & Organ, 1986) and used both parent and adolescent report in Article II and III to validate the findings. Moreover, Articles I, II and III used average variance extracted analyses, which supported discriminant validity (Fornell & Larcker, 1981). The variance in correlations between constructs and the null-correlations (e.g., between adolescent-reported active use and digital maturity in Article III) also suggested that common method bias did not cause the findings. Moreover, the studies relied on large samples from several countries, showing the relevance of the findings for young people across Europe.

One limitation of this dissertation is the lack of longitudinal research regarding the development of digital maturity. The findings provide indications regarding antecedents that relate to higher digital maturity, relying on cross-sectional data. In order to understand the developmental process of digital maturity better, a first step would be to investigate the influence of SES, parental mediation and personality factors on digital maturity at a later point in time. A longitudinal study could provide some temporal insights into factors that precede digital maturity changes, although it still cannot enable causal conclusions about factors affecting digital maturity.

The question of causality is an important consideration in this dissertation. Most of the studies were correlational, complemented by the experiment on task choice (Article IV). However, the experiment also did not show a causal effect of digital maturity directly, but included it as a moderator. Hence, the causality and directionality of the presented relations is not clear. For example, it is not certain whether digital maturity enables higher well-being, or whether individuals with higher well-being also develop higher digital maturity. Digital

maturity is a very broad and stable construct, which is difficult to manipulate. Due to its many dimensions, it cannot easily be manipulated and interventions will not be able to address all dimensions simultaneously. Hence, experimentally investigating digital maturity is complex. However, network analyses have shown that some digital maturity dimensions (e.g., Digital Risk Awareness, Respect Towards Others in Digital Contexts, Regulation of Impulses in Digital Contexts and Regulation of Negative Emotions in Digital Contexts) cluster more closely together than others (e.g., Digital Citizenship; Hofmans et al., 2024). Interventions could thus aim to address such clusters in order to have a relatively broad effect across several digital maturity dimensions.

Causality or directionality of effects also remains an issue in the mediation analyses. Due to the correlational nature of the data, it is not possible to rule out alternative models that could explain the relations between the variables. However, the proposed mediational mechanisms were devised based on strong theoretical reasoning, as recommended by Fiedler et al. (2018). All articles based the hypothesized mediation models on previous findings, such as the relation of need satisfaction and frustration to well-being (Deci & Ryan, 2000, 2008; Ryan et al., 2008), or the relation of parental mediation to young people's device use (Cricchio et al., 2022; Duerager & Livingstone, 2012; Steinfeld, 2021). Moreover, in Article III we tested several potential mediators of the relation between digital maturity and social connectedness, thus considering alternative mediators (Fiedler et al., 2018). In order to establish causality, mediators such as how young people engage with others online, could be experimentally manipulated in a next step (Spencer et al., 2005). Testing the mediation relations experimentally would establish causality and provide strong support for the presented models.

The difficulty of establishing causal relations between digital technology use and psychological outcomes is a general problem in the field, due to the complexity of the digital

environment. There is a seemingly indefinite range of potential influencing factors, from aspects of the social media environment, like the way platforms are designed, to behavioral, cognitive and neurobiological mechanisms (for a review, see Orben et al., 2024). Research established correlational trends over time, like relations of screen time and well-being (Orben & Przybylski, 2019; Przybylski & Weinstein, 2017), but these only show small effect sizes and can be confounded with other events. While findings are often not yet conclusive, for instance regarding the relation of social media to mental health, public recommendations and interventions are already required (Orben et al., 2024; Thorp, 2024). Based on this issue, calls for ‘fast science’ have been made, suggesting to go into the field and test interventions more quickly in order to keep up with the pace of digital technology adoption (Stegenga, 2024).

To establish causation, interventions could focus on strengthening specific clusters of digital maturity dimensions and measure the effect on outcomes such as social connectedness and well-being. Active parental mediation might provide a potential point for intervention, as such active support and guidance relates to higher digital maturity. As mentioned previously, longitudinal designs could be applied for a better understanding of digital maturity development. Such longitudinal designs could incorporate interventions to enhance active parental mediation and capture how these relate to young people’s digital maturity at a later time. Moreover, in order to understand the impact of digital maturity on behavior better, it will be promising to further follow up on the findings of the experiment in Article IV. We argued that with higher digital maturity, individuals will interpret a demanding situation as an opportunity rather than a threat. The experiment supported that with higher digital maturity, individuals’ choice was not affected by the demands of the situation. Further investigating the mechanisms behind these results and individuals’ interpretation of the situation will shed light on how digital maturity influences behavior.

Lastly, the focus of this dissertation was on the antecedents and outcomes of digital maturity as an overall score. However, digital maturity was conceptualized as a toolbox of several dimensions, which can develop individually (e.g., increase or decrease independently from each other; Laaber et al., 2023). In the supplemental analyses, Article III already tested the effect of the single digital maturity dimensions on social connectedness in the mediation model. As expected, the dimensions each drove the effect via one or both mediators but the relations to the outcome variable were not uniform across dimensions. Hence, the influence of specific dimensions should be explored further, as not all dimensions should always be expected to significantly contribute to use behavior across situations.

Overall, digital maturity provides a basis to now expand the theory and postulate theoretical models of how individuals with varying levels of digital maturity interact with the digital world. Further research will be required to understand these mechanisms of mature use in more detail. For example, it would be interesting to explore how individuals with high digital maturity engage in social comparisons online. Social comparison on social media has been identified as a potentially maladaptive use behavior with negative consequences like envy (Appel et al., 2016; Crusius & Lange, 2014; Diel et al., 2024; Fagundes et al., 2020; Verduyn et al., 2020). I argue that with higher digital maturity, individuals should act in a more self-determined way and be less prone to engage in maladaptive social comparisons. They should rather engage in comparisons of opinion, in order to learn from others, but avoid comparisons of ability, which could affect them negatively (Festinger, 1954). These and other theoretical models derived from the digital maturity framework can be systematically tested in the future, for a more holistic picture of mature digital device use and what it entails.

Practical Implications

How a positive use of digital technologies, especially by young people, can be achieved is a big societal question, which no clear answers have been presented to yet.

Digital maturity theory provides an important contribution as it outlines relevant abilities and attitudes which can help in order to benefit rather than suffer from digital device use. The dimensions of digital maturity can serve as a starting point for educators, policy-makers and parents to foster important skills for a beneficial engagement with the digital world.

Digital maturity can be used to identify differences in young people's ability to engage with digital technologies in beneficial ways. Potential risk groups can be identified and specifically addressed. The research very clearly shows that digital maturity is associated with a range of beneficial constructs like higher well-being and social connectedness. Hence, measuring digital maturity can be a useful indicator for the risk of potential negative outcomes of digital technology use. As suggested by the findings of Article I, especially young people with low socioeconomic backgrounds or who receive little active support from parents are potentially at risk to have low digital maturity, which also corresponds to previous research on the relation of low SES and maladaptive digital device use (Faltýnková et al., 2020; Mascheroni & Ólafsson, 2015). Using the digital maturity inventory, specific weaknesses can be identified and at-risk groups could then specifically be addressed and taught relevant skills like how to best interact with others online, regulate their emotions, or be aware of risks. Interventions could address parents, encouraging them to engage actively with their child's device use and explain how to effectively navigate the digital world. However, when parents lack required technological skills and understanding, this might be difficult (Bakó & Tóké, 2018; Sohr-Preston et al., 2013). Alternatively, interventions could take the form of programs substituting active parental mediation, providing young people with necessary guidance and co-use possibilities through other sources, such as youth centers or summer programs.

In the educational setting, adolescents' current digital maturity level can be measured, and teachers can be guided by the digital maturity dimensions to develop educational material

to address weaknesses. In the future, it will be crucial to collaborate with teachers in order to combine research and pedagogical expertise and develop materials to strengthen digital maturity. This is an essential step, as it is still unclear how digital maturity can be fostered, and the art of developing effective pedagogical programs goes beyond pure psychological research. In our project “BeWEEN – Be Well and Green When Digital” we already made a first step in this direction by developing several class exercises in collaboration with teachers, which aimed to strengthen digital maturity dimensions, such as emotion regulation or regulation of impulses. Further projects like this will be required in order to reap practical applications from the digital maturity concept.

However, while it is important to empower young people in their positive use of digital technologies, it is essential not to place all responsibility for beneficial use behavior with them. The question of companies’ and policy-makers’ responsibility to protect young people has recently been raised again with Australia’s ban of social media (Ritchie, 2024). Big technology and social media companies are purposely designing their applications, games and platforms in ways which undermine autonomous and self-determined use (Kozyreva et al., 2020). Online choice architectures are purposely designed against the interest of the user, in the interest of the company (Cara, 2020). It is a lot to ask of young people to defend themselves against these mechanisms. As discussed throughout this dissertation, digital environments can be positive or negative, enabling both need satisfaction and need frustration (Peng et al., 2012; Przybylski et al., 2009, 2010). Hence, the responsible companies should design platforms in ways which enable positive mechanisms of digital technology use, facilitating self-determined use behavior. This dissertation has identified several mechanisms which relate to positive use behavior outcomes: instrumental device use, need satisfaction, engaging with real-life friends online, holding compassionate goals for others. Platforms and applications should emphasize ways of using the digital environment

which focus on such mechanisms. This way, positive outcomes of digital device use might also be achieved by individuals with low digital maturity, as they are supported by the environment to engage with digital devices in beneficial ways despite lacking digital maturity.

Conclusion

In my dissertation, I set out to investigate antecedents and outcomes of digital maturity, in order to examine the positive use of digital technologies. The articles of this dissertation contribute to the theoretical advancement of digital maturity theory and provide insights how digital maturity develops and relates to the engagement with the digital world. The results identify important environmental and intraindividual antecedents of digital maturity, and support that digital maturity enables a self-determined use of digital technologies as tools for positive outcomes across offline and online domains, and mature reactions in demanding situations. As a holistic concept of abilities and attitudes which enable a positive use of digital devices, digital maturity theory can guide researchers, educators and policy-makers in identifying at-risk groups and enabling a positive digital technology use. Overall, digital maturity can aid a more general understanding of who can successfully make use of the opportunities of the digital world, while avoiding its risks.

References

- Adachi, P. J. C., & Willoughby, T. (2013). More than just fun and games: The longitudinal relationships between strategic video games, self-reported problem solving skills, and academic grades. *Journal of Youth and Adolescence*, 42(7), 1041–1052.
<https://doi.org/10.1007/s10964-013-9913-9>
- Alkan, R. Ü., Aslan, A., Turgut, Y. E., & Kurşun, E. (2021). Factors affecting parental mediation strategies in children's technology use: A systematic review. *Journal of Computer and Education Research*, 9(18), 702–723.
<https://doi.org/10.18009/jcer.925859>
- 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. *The Australian Educational and Developmental Psychologist*, 31(1), 18–31.
<https://doi.org/10.1017/edp.2014.2>
- Appel, H., Gerlach, A. L., & Crusius, J. (2016). The interplay between Facebook use, social comparison, envy, and depression. *Current Opinion in Psychology*, 9, 44–49.
<https://doi.org/10.1016/j.copsyc.2015.10.006>
- 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
- Ayoub, M., Gosling, S. D., Potter, J., Shanahan, M., & Roberts, B. W. (2018). The relations between parental socioeconomic status, personality, and life outcomes. *Social Psychological and Personality Science*, 9(3), 338–352.
<https://doi.org/10.1177/1948550617707018>
- Bakó, R. K., & Tőkés, G. (2018). Parental mediation and Romanian young children's digital practices. *Revista Română de Sociologie, Serie Nouă*, XXIX, 23–36.

- Bauer, J., & Mcadams, D. (2004). Growth goals, maturity, and well-being. *Developmental Psychology*, 40, 114–127. <https://doi.org/10.1037/0012-1649.40.1.114>
- Bauer, J., Mcadams, D., & Sakaeda, A. (2005). Interpreting the good life: Growth memories in the lives of mature, happy people. *Journal of Personality and Social Psychology*, 88, 203–217. <https://doi.org/10.1037/0022-3514.88.1.203>
- Beyens, I., Pouwels, J. L., van Driel, I. I., Keijsers, L., & Valkenburg, P. M. (2020). The effect of social media on well-being differs from adolescent to adolescent. *Scientific Reports*, 10, 10763. <https://doi.org/10.1038/s41598-020-67727-7>
- 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>
- Bohnert, M., & Gracia, P. (2021). Emerging digital generations? Impacts of child digital use on mental and socioemotional well-being across two cohorts in Ireland, 2007–2018. *Child Indicators Research*, 14(2), 629–659. <https://doi.org/10.1007/s12187-020-09767-z>
- Bohnert, M., & Gracia, P. (2023). Digital use and socioeconomic inequalities in adolescent well-being: Longitudinal evidence on socioemotional and educational outcomes. *Journal of Adolescence*, 95(6), 1179–1194. <https://doi.org/10.1002/jad.12193>
- Brautsch, L. AS., Lund, L., Andersen, M. M., Jennum, P. J., Folker, A. P., & Andersen, S. (2023). Digital media use and sleep in late adolescence and young adulthood: A systematic review. *Sleep Medicine Reviews*, 68, 101742. <https://doi.org/10.1016/j.smr.2022.101742>
- 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>

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

Cavallini, M. C., & Caravita, S. (2021). Parental strategies for limiting youths' exposure to online risks. *Media Education*, 12(2), 59–71. <https://doi.org/10.36253/me-10474>

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., Duriez, B., Lens, W., Matos, L., Mouratidis, A., Ryan, R. M., Sheldon, K. M., Soenens, B., Van Petegem, S., & Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion*, 39(2), 216–236. <https://doi.org/10.1007/s11031-014-9450-1>

Chen, L., Guo, Y., & Shi, J. (2019). Social support seeking on social media among Chinese gay men living with HIV/AIDS: The role of perceived threat. *Telemedicine and E-Health*, 25(7), 655–659. <https://doi.org/10.1089/tmj.2018.0136>

Christensen, R. N., Siddiqui, A., Valogianni, K., Florack, A., & Hubert, M. (2023). Towards a composite index for digital maturity: An unsupervised machine learning approach. *The 15th Mediterranean Conference on Information Systems (MCIS) and the 6th Middle East & North Africa Conference on Digital Information Systems (MENACIS)*, 10903. <https://easychair.org/publications/preprint/wvtx>

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>

Conger, R. D., & Donnellan, M. B. (2007). An interactionist perspective on the socioeconomic context of human development. *Annual Review of Psychology*, 58(1), 175–199. <https://doi.org/10.1146/annurev.psych.58.110405.085551>

- Cricchio, M. G. L., Palladino, B. E., Eleftheriou, A., Nocentini, A., & Menesini, E. (2022). Parental mediation strategies and their role on youths' online privacy disclosure and protection: A systematic review. *European Psychologist*, 27(2), 116–130. <https://doi.org/10.1027/1016-9040/a000450>
- 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>
- Crone, E. A., & Konijn, E. A. (2018). Media use and brain development during adolescence. *Nature Communications*, 9(1), 588. <https://doi.org/10.1038/s41467-018-03126-x>
- Crusius, J., & Lange, J. (2014). What catches the envious eye? Attentional biases within malicious and benign envy. *Journal of Experimental Social Psychology*, 55, 1–11. <https://doi.org/10.1016/j.jesp.2014.05.007>
- Csikszentmihalyi, M., & Figurski, T. J. (1982). Self-awareness and aversive experience in everyday life. *Journal of Personality*, 50(1), 15–19. <https://doi.org/10.1111/j.1467-6494.1982.tb00742.x>
- Damian, R. I., Su, R., Shanahan, M., Trautwein, U., & Roberts, B. W. (2015). Can personality traits and intelligence compensate for background disadvantage? Predicting status attainment in adulthood. *Journal of Personality and Social Psychology*, 109(3), 473–489. <https://doi.org/10.1037/pspp0000024>
- de Lenne, O., Eggermont, S., & Vandenbosch, L. (2022). Researching the malleability narrative on professional ideals: The role of internal attribution in the relations

- between media and adolescents' well-being. *Communication Studies*, 73(5–6), 527–543. <https://doi.org/10.1080/10510974.2022.2140174>
- de Lenne, O., Vandenbosch, L., Eggermont, S., Karsay, K., & Trekels, J. (2020). Picture-perfect lives on social media: A cross-national study on the role of media ideals in adolescent well-being. *Media Psychology*, 23(1), 52–78. <https://doi.org/10.1080/15213269.2018.1554494>
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01
- Deci, E. L., & Ryan, R. M. (2008). Hedonia, eudaimonia, and well-being: An introduction. *Journal of Happiness Studies*, 9(1), 1–11. <http://dx.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>
- Diel, K., Hofmann, W., Grelle, S., Boecker, L., & Friese, M. (2024). Prepare to compare: Effects of an intervention involving upward and downward social comparisons on goal pursuit in daily life. *Personality and Social Psychology Bulletin*, 1–15. <https://doi.org/10.1177/01461672231219378>
- Duerager, A., & Livingstone, S. (2012). *How can parents support children's internet safety?* EU Kids Online. <http://eprints.lse.ac.uk/42872/>
- Duval, T. S., Duval, V. H., & Mulilis, J.-P. (1992). Effects of self-focus, discrepancy between self and standard, and outcome expectancy favorability on the tendency to match self to standard or to withdraw. *Journal of Personality and Social Psychology*, 62(2), 340–348. <https://doi.org/10.1037/0022-3514.62.2.340>

- Duval, T. S., & Lalwani, N. (1999). Objective self-awareness and causal attributions for self-standard discrepancies: Changing self or changing standards of correctness. *Personality and Social Psychology Bulletin*, 25(10), 1220–1229. <https://doi.org/10.1177/0146167299258004>
- Erdmann, E., & Dienlin, T. (2022). Binge-watching, self-determination, and well-being. *Journal of Media Psychology*, 34(6), 383–394. <https://doi.org/10.1027/1864-1105/a000334>
- Erreygers, S., Vandebosch, H., Vranjes, I., Baillien, E., & De Witte, H. (2018). Development of a measure of adolescents' online prosocial behavior. *Journal of Children and Media*, 1–17. <https://doi.org/10.1080/17482798.2018.1431558>
- 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>
- Fagundes, L. S., Marot, T. A., & Natividade, J. C. (2020). Use of Instagram, social comparison, and personality as predictors of self-esteem. *Psico-USF*, 25(4), 711–724. <https://doi.org/10.1590/1413/82712020250410>
- Faltýnková, A., Blinka, L., Ševčíková, A., & Husarova, D. (2020). The associations between family-related factors and excessive internet use in adolescents. *International Journal of Environmental Research and Public Health*, 17(5), 1754. <https://doi.org/10.3390/ijerph17051754>
- Festinger, L. (1954). A theory of social comparison processes. *Human Relations*, 7(2), 117–140. <https://doi.org/10.1177/001872675400700202>

- Fiedler, K., Harris, C., & Schott, M. (2018). Unwarranted inferences from statistical mediation tests – An analysis of articles published in 2015. *Journal of Experimental Social Psychology*, 75, 95–102. <https://doi.org/10.1016/j.jesp.2017.11.008>
- 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>
- Frison, E., & Eggermont, S. (2015). Toward an integrated and differential approach to the relationships between loneliness, different types of Facebook use, and adolescents' depressed mood. *Communication Research*, 47(5), 701–728. <https://doi.org/10.1177/0093650215617506>
- González-Carrasco, M., Casas, F., Malo, S., Viñas, F., & Dinisman, T. (2017). Changes with age in subjective well-being through the adolescent years: Differences by gender. *Journal of Happiness Studies*, 18(1), 63–88. <https://doi.org/10.1007/s10902-016-9717-1>
- Green, B. M., Hribar, C. A., Hayes, S., Bhowmick, A., & Herbert, L. B. (2021). Come for information, stay for support: Harnessing the power of online health communities for social connectedness during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, 18(23), Article 23. <https://doi.org/10.3390/ijerph182312743>
- 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>
- Gretter, S., & Yadav, A. (2016). Computational thinking and media & information literacy: An integrated approach to teaching twenty-first century skills. *TechTrends*, 60(5), 510–516. <https://doi.org/10.1007/s11528-016-0098-4>

- Haddon, L., & Livingstone, S. (2017). Risks, opportunities, and risky opportunities: How children make sense of the online environment. In F. C. Blumberg, & P. J. Brooks (Eds.), *Cognitive development in digital contexts* (pp. 275–302). Elsevier.
<https://doi.org/10.1016/B978-0-12-809481-5.00014-6>
- Hawi, N. S., Samaha, M., & Griffiths, M. D. (2019). The Digital Addiction Scale for Children: Development and validation. *Cyberpsychology, Behavior, and Social Networking*, 22(12), 771–778. <https://doi.org/10.1089/cyber.2019.0132>
- Helsper, E. J., Schneider, L. S., van Deursen, A. J. A. M., & van Laar, E. (2020). *The youth Digital Skills Indicator: Report on the conceptualisation and development of the ySKILLS digital skills measure*. KU Leuven: ySKILLS.
<https://doi.org/10.5281/ZENODO.4476540>
- Hofmans, L., van der Stappen, A., & van den Bos, W. (2024). Developmental structure of digital maturity. *Computers in Human Behavior*, 157, 108239.
<https://doi.org/10.1016/j.chb.2024.108239>
- Huang, J., Kumar, S., & Hu, C. (2021). A literature review of online identity reconstruction. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.696552>
- Hussain, Z., Griffiths, M. D., & Sheffield, D. (2017). An investigation into problematic smartphone use: The role of narcissism, anxiety, and personality factors. *Journal of Behavioral Addictions*, 6(3), 378–386. <https://doi.org/10.1556/2006.6.2017.052>
- Ishii, K. (2015). Subjective socioeconomic status and cigarette smoking interact to delay discounting. *SpringerPlus*, 4(560), 1–5. <https://doi.org/10.1186/s40064-015-1361-4>
- Kasperiuniene, J., & Zydziunaite, V. (2019). A systematic literature review on professional identity construction in social media. *Sage Open*, 9(1), 1–11.
<https://doi.org/10.1177/2158244019828847>

- 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), 20160958.
<https://doi.org/10.1098/rspb.2016.0958>
- Koch, T., Laaber, F., Arenas, A., & Florack, A. (2025). Socially (dis)connected in a connected world: The role of young people's digital maturity. *Computers in Human Behavior*, 163, 108473. <https://doi.org/10.1016/j.chb.2024.108473>
- 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, 108157. <https://doi.org/10.1016/j.chb.2024.108157>
- Koch, T., Laaber, F., & Florack, A. (2025). *Digital maturity reduces the effect of expectations on task choice: An experimental study* [Manuscript submitted for publication].
- 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>
- 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, 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*, 108077. <https://doi.org/10.1016/j.chb.2023.108077>
- Liang, Q., De La Torre, J., & Law, N. (2021). Do background characteristics matter in children's mastery of digital literacy? A cognitive diagnosis model analysis. *Computers in Human Behavior, 122*, 106850. <https://doi.org/10.1016/j.chb.2021.106850>
- Lieberman, A., & Schroeder, J. (2020). Two social lives: How differences between online and offline interaction influence social outcomes. *Current Opinion in Psychology, 31*, 16–21. <https://doi.org/10.1016/j.copsyc.2019.06.022>
- 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>
- Livingstone, S., Haddon, L., Görzig, A., & Ólafsson, K. (2011). *Risks and safety on the internet: The perspective of European children: Full findings and policy implications from the EU Kids Online survey of 9-16 year olds and their parents in 25 countries* (Deliverable D4). EU Kids Online Network. <http://eprints.lse.ac.uk/33731/>
- Livingstone, S., & Helsper, E. (2010). Balancing opportunities and risks in teenagers' use of the internet: The role of online skills and internet self-efficacy. *New Media & Society, 12*(2), 309–329. <https://doi.org/10.1177/1461444809342697>
- Livingstone, S., Ólafsson, K., Helsper, E. J., Lupiáñez-Villanueva, F., Veltri, G. A., & Folkvord, F. (2017). Maximizing opportunities and minimizing risks for children online: The role of digital skills in emerging strategies of parental mediation. *Journal of Communication, 67*(1), 82–105. <https://doi.org/10.1111/jcom.12277>

- Lobe, A. (2023, September 5). Lazy-Girl-Jobs: Was hinter dem Tiktok-Trend steckt. *Der Standard*. <https://www.derstandard.at/story/3000000185038/lazy-girl-jobs-was-hinter-dem-tiktok-trend-steckt>
- Mascheroni, G., & Ólafsson, K. (2015). The mobile Internet: Access, use, opportunities and divides among European children. *New Media & Society*, 18(8), 1657–1679. <https://doi.org/10.1177/1461444814567986>
- Masur, P. K., Reinecke, L., Ziegele, M., & Quiring, O. (2014). The interplay of intrinsic need satisfaction and Facebook specific motives in explaining addictive behavior on Facebook. *Computers in Human Behavior*, 39, 376–386. <https://doi.org/10.1016/j.chb.2014.05.047>
- 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., & Saliba, A. (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>
- Mills, J. S., Minister, C., & Samson, L. (2022). Enriching sociocultural perspectives on the effects of idealized body norms: Integrating shame, positive body image, and self-compassion. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.983534>
- Moore, R. L., & Blackmon, S. J. (2022). From the learner's perspective: A systematic review of MOOC learner experiences (2008–2021). *Computers & Education*, 190, 104596. <https://doi.org/10.1016/j.compedu.2022.104596>

- Moskalenko, S., & Heine, S. J. (2003). Watching your troubles away: Television viewing as a stimulus for subjective self-awareness. *Personality and Social Psychology Bulletin*, 29(1), 76–85. <https://doi.org/10.1177/0146167202238373>
- Nebel, S., Schneider, S., Schledjewski, J., & Rey, G. D. (2017). Goal-setting in educational video games: Comparing goal-setting theory and the goal-free effect. *Simulation & Gaming*, 48(1), 98–130. <https://doi.org/10.1177/1046878116680869>
- Nikken, P., & Oprea, S. J. (2018). Guiding young children’s digital media use: SES-differences in mediation concerns and competence. *Journal of Child and Family Studies*, 27(6), 1844–1857. <https://doi.org/10.1007/s10826-018-1018-3>
- Odgers, C. L., & Jensen, M. (2020). Adolescent mental health in the digital age: Facts, fears and future directions. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 61(3), 336–348. <https://doi.org/10.1111/jcpp.13190>
- Oishi, S., Choi, H., Liu, A., & Kurtz, J. (2021). Experiences associated with psychological richness. *European Journal of Personality*, 35(5), 754–770. <https://doi.org/10.1177/0890207020962334>
- Oishi, S., & Westgate, E. C. (2022). A psychologically rich life: Beyond happiness and meaning. *Psychological Review*, 129(4), 790–811. <https://doi.org/10.1037/rev0000317>
- Oladele, B. (2023, July 26). How the “lazy girl job” took over work TikTok. *BBC*. <https://www.bbc.com/worklife/article/20230725-how-the-lazy-girl-job-took-over-work-tiktok>
- Oliver, S., Marder, B., Lavertu, L., Cowan, K., Javornik, A., & Osadchaya, E. (2024). The hustle is real: An examination of the self-related consequences of consuming idealized self-promotional content on LinkedIn. *Information Technology & People*. <https://doi.org/10.1108/ITP-02-2023-0134>

- Orben, A. (2020). Teenagers, screens and social media: A narrative review of reviews and key studies. *Social Psychiatry and Psychiatric Epidemiology*, 55(4), 407–414.
<https://doi.org/10.1007/s00127-019-01825-4>
- Orben, A., Meier, A., Dalgleish, T., & Blakemore, S.-J. (2024). Mechanisms linking social media use to adolescent mental health vulnerability. *Nature Reviews Psychology*, 3(6), 407–423. <https://doi.org/10.1038/s44159-024-00307-y>
- Orben, A., & Przybylski, A. K. (2019). Screens, teens, and psychological well-being: Evidence from three time-use-diary studies. *Psychological Science*, 30(5), 682–696.
<https://doi.org/10.1177/0956797619830329>
- 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>
- Peng, W., Lin, J.-H., Pfeiffer, K. A., & Winn, B. (2012). Need satisfaction supportive game features as motivational determinants: An experimental study of a self-determination theory guided exergame. *Media Psychology*, 15(2), 175–196.
<https://doi.org/10.1080/15213269.2012.673850>
- Podsakoff, P., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903.
<https://doi.org/10.1037/0021-9010.88.5.879>
- Podsakoff, P., & Organ, D. (1986). Self-report in organizational research: Problems and prospects. *Journal of Management*, 12(4), 531–544.
<https://doi.org/10.1177/014920638601200408>

- Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology, 14*(2), 154–166.
<https://doi.org/10.1037/a0019440>
- Przybylski, A. K., & Weinstein, N. (2017). A large-scale test of the Goldilocks hypothesis: Quantifying the relations between digital-screen use and the mental well-being of adolescents. *Psychological Science, 28*(2), 204–215.
<https://doi.org/10.1177/0956797616678438>
- Przybylski, A. K., & Weinstein, N. (2019). Digital screen time limits and young children’s psychological well-being: Evidence from a population-based study. *Child Development, 90*(1). <https://doi.org/10.1111/cdev.13007>
- Przybylski, A. K., Weinstein, N., Ryan, R. M., & Rigby, C. S. (2009). Having to versus wanting to play: Background and consequences of harmonious versus obsessive engagement in video games. *CyberPsychology & Behavior, 12*(5), 485–492.
<https://doi.org/10.1089/cpb.2009.0083>
- Pyżalski, J. (2023). Positive internet use and online civic engagement versus active involvement in selected online risks – how are both connected in adolescents from six European countries? *Psychology, Society & Education, 15*(3), 10–18.
<https://doi.org/10.21071/pse.v15i3.16093>
- Reinecke, L., Gilbert, A., & Eden, A. (2022). Self-regulation as a key boundary condition in the relationship between social media use and well-being. *Current Opinion in Psychology, 45*, 101296. <https://doi.org/10.1016/j.copsyc.2021.12.008>
- Ren, W., Zhu, X., & Yang, J. (2022). The SES-based difference of adolescents’ digital skills and usages: An explanation from family cultural capital. *Computers & Education, 177*, 104382. <https://doi.org/10.1016/j.compedu.2021.104382>

- Richardson, J., & Milovidov, E. (2019). *Digital citizenship education handbook: Being online, well-being online, and rights online*. Council of Europe.
- Ritchie, H. (2024, November 29). Australia approves social media ban on under-16s. *BBC*.
<https://www.bbc.com/news/articles/c89vjj0lxx9o>
- Roberts, B. W., & Mroczek, D. (2008). Personality trait change in adulthood. *Current Directions in Psychological Science*, 17(1), 31–35. <https://doi.org/10.1111/j.1467-8721.2008.00543.x>
- 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>
- Rothwell, J. (2023, October 13). *Teens Spend Average of 4.8 Hours on Social Media Per Day*. Gallup. <https://news.gallup.com/poll/512576/teens-spend-average-hours-social-media-per-day.aspx>
- 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>
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*.

- 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>
- 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>
- 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>
- Sohr-Preston, S. L., Scaramella, L. V., Martin, M. J., Neppl, T. K., Ontai, L., & Conger, R. (2013). Parental SES, communication and children's vocabulary development: A 3-generation test of the family investment model. *Child Development*, 84(3), 1046–1062. <https://doi.org/10.1111/cdev.12023>
- Spencer, S. J., Zanna, M. P., & Fong, G. T. (2005). Establishing a causal chain: Why experiments are often more effective than mediational analyses in examining psychological processes. *Journal of Personality and Social Psychology*, 89(6), 845–851. <https://doi.org/10.1037/0022-3514.89.6.845>

- Sriyabhand, T., & John, S. P. (2014). An empirical study about the role of personality traits in information technology adoption. *Humanities, Arts and Social Sciences Studies*, 14(2), 69–92.
- Statista. (2023, November). *Smartphone: Durchschnittliche Bildschirmzeit von Jugendlichen*. Statista.
<https://de.statista.com/statistik/daten/studie/1426928/umfrage/durchschnittliche-taegliche-bildschirmzeit-am-smartphone-bei-jugendlichen/>
- Staudinger, U. M., & Kunzmann, U. (2005). Positive adult personality development: Adjustment and/or growth? *European Psychologist*, 10(4), 320–329.
<https://doi.org/10.1027/1016-9040.10.4.320>
- Stegenga, J. (2024). Fast Science. *The British Journal for the Philosophy of Science*, 729617.
<https://doi.org/10.1086/729617>
- Steinfeld, N. (2021). Parental mediation of adolescent Internet use: Combining strategies to promote awareness, autonomy and self-regulation in preparing youth for life on the web. *Education and Information Technologies*, 26(2), 1897–1920.
<https://doi.org/10.1007/s10639-020-10342-w>
- Sun, X., Duan, C., Yao, L., Zhang, Y., Chinyani, T., & Niu, G. (2021). Socioeconomic status and social networking site addiction among children and adolescents: Examining the roles of parents' active mediation and ICT attitudes. *Computers & Education*, 173, 104292. <https://doi.org/10.1016/j.compedu.2021.104292>
- Tehseen, S., Ramayah, T., & Sajilan, S. (2017). Testing and controlling for common method variance: A review of available methods. *Journal of Management Sciences*, 4(2), 142–168. <https://doi.org/10.20547/jms.2014.1704202>
- Thorp, H. H. (2024). Unsettled science on social media. *Science*, 384(6703), 1389.
<https://doi.org/10.1126/science.adr1730>

- 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>
- Twenge, J. M. (2017). *iGen: Why today's super-connected kids are growing up less rebellious, more tolerant, less happy—and completely unprepared for adulthood—and what that means for the rest of us*. Simon and Schuster.
- Twenge, J. M., & Campbell, W. K. (2018). Associations between screen time and lower psychological well-being among children and adolescents: Evidence from a population-based study. *Preventive Medicine Reports*, 12, 271–283. <https://doi.org/10.1016/j.pmedr.2018.10.003>
- Urbanova, L. B., Holubcikova, J., Madarasova Geckova, A., Reijneveld, S. A., & van Dijk, J. P. (2019). Does life satisfaction mediate the association between socioeconomic status and excessive internet use? *International Journal of Environmental Research and Public Health*, 16(20), 3914. <https://doi.org/10.3390/ijerph16203914>
- Valkenburg, P. M., & Peter, J. (2011). Online communication among adolescents: An integrated model of its attraction, opportunities, and risks. *Journal of Adolescent Health*, 48(2), 121–127. <https://doi.org/10.1016/j.jadohealth.2010.08.020>
- Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration*, 23(3), 263–280. <https://doi.org/10.1037/a0032359>
- Verduyn, P., Gugushvili, N., Massar, K., Täht, K., & Kross, E. (2020). Social comparison on social networking sites. *Current Opinion in Psychology*, 36, 32–37. <https://doi.org/10.1016/j.copsyc.2020.04.002>

- 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>
- Vossen, H. G. M., & Valkenburg, P. M. (2016). Do social media foster or curtail adolescents' empathy? A longitudinal study. *Computers in Human Behavior*, 63, 118–124. <https://doi.org/10.1016/j.chb.2016.05.040>
- 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>
- Wang, X., & Xing, W. (2018). Exploring the influence of parental involvement and socioeconomic status on teen digital citizenship: A path modelling approach. *Educational Technology & Society*, 21(1), 186–199. <https://www.jstor.org/stable/26273879>
- Ward, S. (2024). Choosing money over meaningful work: Examining relative job preferences for high compensation versus meaningful work. *Personality and Social Psychology Bulletin*, 50(7), 1128–1148. <https://doi.org/10.1177/01461672231159781>
- Wicklund, R. A. (1975). Objective self-awareness. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 8, pp. 233–275). Academic Press.
- Wicklund, R. A. (1979). The influence of self-awareness on human behavior: The person who becomes self-aware is more likely to act consistently, be faithful to societal norms, and give accurate reports about himself. *American Scientist*, 67(2), 187–193.
- 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(1736), 1–15. <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>
- Wright, M. F. (2017). Parental mediation, cyberbullying, and cybertrolling: The role of gender. *Computers in Human Behavior*, 71, 189–195. <https://doi.org/10.1016/j.chb.2017.01.059>
- Yilmaz, H. A. (2022). Self-awareness and self-consciousness: A review from the perspective of social psychology. *Psikiyatride Güncel Yaklaşımlar*, 14(4), 437–445. <https://doi.org/10.18863/pgy.1029405>
- Yoon, Y., Eisenstadt, M., Lereya, S. T., & Deighton, J. (2023). Gender difference in the change of adolescents' mental health and subjective wellbeing trajectories. *European Child & Adolescent Psychiatry*, 32(9), 1569–1578. <https://doi.org/10.1007/s00787-022-01961-4>
- Younas, F., Naseem, M., & Mustafa, M. (2020). Patriarchy and social media: Women only Facebook groups as safe spaces for support seeking in Pakistan. *Proceedings of the 2020 International Conference on Information and Communication Technologies and Development*, 1–11. <https://doi.org/10.1145/3392561.3394639>
- Zilka, G. (2019). The digital divide: Implications for the eSafety of children and adolescents. *International Journal of Technology Enhanced Learning*, 11(1), 20–35. <https://doi.org/10.1504/IJTEL.2019.10017225>

Appendix

Credit Author Statement

The present dissertation comprises of four articles, three of which have been published, one is under review. All articles were developed in collaboration with several authors, which is why the pronoun ‘we’ is mostly used to describe the articles throughout the dissertation. Table A1 provides an overview of the articles and lists the respective contributions to each article according to the Contribution Roles Taxonomy (CRediT; <https://credit.niso.org/>).

Table A1*Articles Included in the Dissertation and Author Contributions*

Article	Contribution
Article I: Koch, T., Laaber, F., & Florack, A. (2024). Socioeconomic status and young people's digital maturity: The role of parental mediation. <i>Computers in Human Behavior</i>, 154, 108157. https://doi.org/10.1016/j.chb.2024.108157	Teresa Koch: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft & editing, Visualization. Franziska Laaber: Validation, Software, Writing - review & editing. Arnd Florack: Conceptualization, Supervision, Writing - review & editing.
Article II: 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. <i>Computers in Human Behavior</i>, 152, 108077. https://doi.org/10.1016/j.chb.2023.108077	Franziska Laaber: Conceptualization, Methodology, Writing – Original Draft, Visualization, Formal analysis. Teresa Koch: Conceptualization, Validation, Writing – Review & Editing. Marco Hubert: Conceptualization, Funding acquisition. Arnd Florack: Conceptualization, Writing – Review & Editing, Supervision.
Article III: Koch, T., Laaber, F., Arenas, A., & Florack, A. (2025). Socially (dis)connected in a connected world: The role of young people's digital maturity. <i>Computers in Human Behavior</i>, 163, 108473. https://doi.org/10.1016/j.chb.2024.108473	Teresa Koch: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft & editing, Visualization. Franziska Laaber: Validation, Software, Writing - review & editing. Alvaro Arenas: Conceptualization, Writing - review & editing. Arnd Florack: Conceptualization, Project administration, Supervision, Writing - review & editing.
Article IV: Koch, T., Laaber, F., & Florack, A. (2025). <i>Digital maturity reduces the effect of expectations on task choice: An experimental study</i> [Manuscript submitted for publication].	Teresa Koch: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft & editing, Visualization. Franziska Laaber: Conceptualization, Validation, Writing - review & editing. Arnd Florack: Conceptualization, Project administration, Supervision, Writing - review & editing, Funding acquisition.

Article I

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, 108157. <https://doi.org/10.1016/j.chb.2024.108157>



Socioeconomic status and young people's digital maturity: The role of parental mediation[☆]

Teresa Koch^{*}, Franziska Laaber, Arnd Florack

Department of Occupational, Economic, and Social Psychology, Faculty of Psychology, University of Vienna, Austria

ARTICLE INFO

Handling editor: Min Jou

Keywords:

Digital maturity (DIMI)
SES
Digital technology
Parental mediation
Personality

ABSTRACT

In a cross-sectional study conducted with 1065 parent-child dyads with adolescents aged 12 to 18, we examined the association between socioeconomic background and 'digital maturity', defined as the self-determined use of digital technologies that supports psychological growth and well-being while avoiding risks of the digital world. While previous research has focused primarily on digital addiction and the risks associated with technology use, this study takes a broader perspective that encompasses both the management of risks and the exploitation of opportunities of digital technologies for individual advancement. To understand the antecedents of digital maturity, we investigated the association of family background and personality traits with adolescents' digital maturity. Specifically, we examined whether parental influence on adolescents' usage patterns mediates the association of socioeconomic status with digital maturity. We assessed socioeconomic status (SES), active parental mediation, agreeableness, conscientiousness, negative emotionality, and digital maturity. Agreeableness and conscientiousness positively, and negative emotionality negatively predicted digital maturity. The relation of SES to digital maturity was fully mediated by active parental mediation.

Young people's use of digital technologies has reached very high levels in today's society (Bucksch et al., 2016; Crone & Konijn, 2018; Odgers & Jensen, 2020). Digital technologies provide both opportunities and risks for young people (Rodríguez-de-Dios et al., 2018). On the one hand, young people face risks such as excessive screen time, digital addiction and decreased well-being (Hawi et al., 2019; Kwon et al., 2013; Orben, 2020; Przybylski & Weinstein, 2017; Seema et al., 2022; Twenge & Campbell, 2018). On the other hand, digital technologies offer numerous opportunities (Haddon & Livingstone, 2017), including enhanced opportunities for learning and skill development (Livingstone & Helsper, 2010; Nebel et al., 2017), self-expression (Huang, Kumar, & Hu, 2021; Kim & Lee, 2010), social contact and support from others (Chen et al., 2019; Vossen & Valkenburg, 2016; Younas et al., 2020).

In principle, many opportunities of digital technologies are accessible to young people from all socioeconomic backgrounds and have the potential to reduce social inequalities, for example by making learning opportunities more affordable and accessible (Moore & Blackmon, 2022). However, it is unclear whether such opportunities are effectively exploited by individuals with lower socioeconomic status, or whether

these individuals are particularly vulnerable to the risks associated with digital innovations. In other words, it is not fully understood whether the use of digital technologies by young people from different socioeconomic backgrounds actually attenuates or perpetuates existing inequalities, and whether the influence of SES on use behavior can be offset by other factors.

Research suggests that young people from lower socioeconomic backgrounds are more likely to exhibit excessive device use (Faltýnková et al., 2020), social media addiction (Sun et al., 2021), and lower digital literacy (Ren et al., 2022). However, the presence or absence of such maladaptive use patterns does not mean that individuals are or are not also using digital technologies for their positive development or psychological growth. For example, some individuals who do not use social media might also lack social connections (González-Bailón & Lelkes, 2023; Magsamen-Conrad et al., 2014; Valkenburg et al., 2006). Moreover, individuals who use digital technologies excessively might nevertheless make useful experiences online or benefit regarding personal growth, for example by learning skills through playing video games (Adachi & Willoughby, 2013; Magsamen-Conrad et al., 2014;

[☆] Data and supplemental materials are openly available at the project's Open Science Framework page (osf.io/8kyfm/). 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 under grant agreement No 870578.

^{*} Corresponding author. Department of Occupational, Economic, and Social Psychology, University of Vienna, Universitätsstraße 7, 1010, Vienna, Austria.
E-mail address: teresa.koch@univie.ac.at (T. Koch).

<https://doi.org/10.1016/j.chb.2024.108157>

Received 16 May 2023; Received in revised form 14 November 2023; Accepted 25 January 2024

Available online 5 February 2024

0747-5632/© 2024 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Mahmoudi et al., 2015; Peng et al., 2012). Hence, it is important to study whether socioeconomic status is associated with differences in digital maturity, as an overarching concept which includes both risks and opportunities of engaging with the digital world.

While SES represents an environmental influence on adolescents' digital maturity, it is important to note that intrapersonal factors like personality might facilitate or impede the development of digital maturity. Indeed, such intrapersonal factors could compensate for differences in socioeconomic background. Previous research suggests differences in the personality traits agreeableness, conscientiousness and negative emotionality to be relevant for digital device use (Hussain et al., 2017; Laaber et al., 2023), which could affect beneficial device use beyond SES (Ayoub et al., 2018; Damian et al., 2015). Thus, for a thorough understanding of the development of digital maturity and to understand the extent of influence which the socioeconomic background exerts, personality should be considered as an additional antecedent relating to digital maturity.

While some research already suggests that socioeconomic differences in use behavior and digital literacy exist (Bohnert & Gracia, 2023; Faltýnková et al., 2020; Ren et al., 2022; Urbanova et al., 2019), the relationship between SES and young people's general ability to use digital technologies for personal development across situations and functions, as well as the potential drivers of this relationship are unclear. Moreover, the influence of intrapersonal factors which could compensate for societal disadvantages regarding mature device use are important to understand the development of digital maturity. Thus, the present study examines the relationship between young people's socioeconomic background and their digital maturity, the mediating role of parental influences, and the links of digital maturity to personality traits. We define digital maturity as the ability to use digital technologies to support individual development and integration into society. Overall, in order to better understand the antecedents of digital maturity and to address the research gap that there is little knowledge about how digital maturity develops, the main objectives of the study are to a) examine the relationship between young people's socioeconomic background and their digital maturity, b) assess the mediating role of parental influences in this relationship, and c) examine the relationships between digital maturity and personality traits, specifically agreeableness, conscientiousness, and negative emotionality. Hence, our research helps to shed light on whether young people from lower socioeconomic backgrounds can take advantage of the opportunities offered by digital technologies, or whether social inequalities persist or are reinforced in the digital domain.

1. Theoretical background

1.1. The effect of socioeconomic background on use behavior

Socioeconomic status (SES) is a multifaceted construct that, in the case of children and adolescents, broadly captures parents' education, income and occupation, and relates to the family's social standing and economic possibilities (Ishii, 2015; Sun et al., 2021). It is an important aspect of the family environment, affecting young people and their development as they grow up. According to ecological systems theory (Bronfenbrenner, 1986), individuals are embedded in environmental systems which shape their adaptation and development. The family constitutes an important environment which can also affect the use of digital devices (Alkan et al., 2021; Faltýnková et al., 2020; Sun et al., 2021). The literature supports that SES is a relevant factor regarding digital use behavior. Young people with lower SES show higher excessive internet use (Faltýnková et al., 2020; Urbanova et al., 2019), higher social networking sites addiction (Sun et al., 2021), and more risky behavior online (Steinfeld, 2021), and there are indications that societal inequalities persist in the digital domain due to differences in use behavior (Mascheroni & Ólafsson, 2015).

Interestingly, high SES might not only reduce problematic use

behavior, but it might also be associated with positive aspects of behavior in digital environments. The literature finds that adolescents from higher SES backgrounds show higher digital literacy (Bohnert & Gracia, 2023; Ren et al., 2022; Zilka, 2019). Moreover, one study suggests that with higher SES young people show higher digital citizenship, defined as "the norms of appropriate, responsible behavior with regard to technology use" (Wang & Xing, 2018, p. 186). In this study, the researchers observed a positive relation between higher SES and more responsible behavior. However, research has not investigated the positive use of digital technology for the advantage of the individual regarding personal and social aspects more broadly (Cavallini & Caravita, 2021; Erreygers et al., 2018). Hence, it remains unclear whether social inequalities are reinforced in the digital world due to young people's (in)ability to use digital opportunities for their personal development and integration in society. In the present research, we aim to fill this gap by investigating to what extent SES relates to the mature use of digital devices that includes aspects of personal and social development. We assume that higher SES provides conditions that make the development of a broad digital maturity likely.

1.2. Mature use of digital devices

Considering the prevalence of digital device use among young people, it is essential to look into the positive and mature use of these devices. Digital maturity provides a view on young people's engagement with digital devices which addresses both the risks and opportunities of digital technologies. It is a holistic concept, defined as a combination of competencies encompassing "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). Importantly, it is conceptualized as a broad ability for mature use, which should be reflected in the use of digital technologies across devices, functionalities or situations. Digital maturity relates to but goes beyond a mature personality in non-digital contexts and can predict positive use behavior outcomes, as it focuses on specific capabilities within the digital context which should enable young people to adequately deal with the opportunities and challenges in the digital world (Arenas & Yazdi, 2022; Christensen et al., 2023; Laaber et al., 2023; Laaber et al., 2024). Additionally, it encompasses but goes beyond digital literacy, as it does not only focus on the technical abilities to navigate the digital world, but equally focuses on interpersonal skills and personal growth (Laaber et al., 2023). Thus, the concept recognizes that some technical knowledge is necessary but not a sufficient condition for using technology for psychological growth. A mature use of digital technology requires the autonomous and self-determined use of digital devices, the mastering of challenges related to risk factors and a mature interaction with others in the digital world. For example, someone who wants to learn a new competence will see technology as a tool to pursue this goal and focus on digital content which aids their goal pursuit. The person may make social connections, asking others for help when difficulties arise, or providing help to others.

While previous research already provides first indications that digital maturity can capture a positive use of digital technologies (Arenas & Yazdi, 2022; Laaber et al., 2023; Laaber et al., 2024), the question arises how differences in digital maturity occur and how young people's ability to use digital devices maturely can be fostered. Based on previous research regarding more responsible and advantageous use behavior with higher socioeconomic status (Mascheroni & Ólafsson, 2015; Ren et al., 2022; Wang & Xing, 2018), we expect that socioeconomic status is positively related to digital maturity. We assume that higher SES could play a role in enabling young people to develop digital maturity, while lower SES might rather hinder mature use behavior.

H1. Higher socioeconomic status relates to higher digital maturity in young people.

1.3. Parental mediation of young people's use of digital devices

While higher socioeconomic status may be conducive to the development of digital maturity in a number of ways, we suspect that parents' attempts to manage their children's digital behavior play a critical role. Parents can engage in different strategies regarding how they influence their child's use of digital devices, referred to as parental mediation strategies. *Active parental mediation* is characterized by parents talking to the child regarding their use of digital devices and its risks and benefits, explaining media and digital content and encouraging the child to explore (Alkan et al., 2021; Cricchio et al., 2022; Livingstone et al., 2011; Steinfeld, 2021). *Active parental mediation* is closely related to *co-use*, which regards shared parent-child activities (Cricchio et al., 2022; Livingstone et al., 2011, 2017). In contrast, *restrictive parental mediation* is defined as establishing rules and limits regarding the child's allowed time and activities using digital devices (Alkan et al., 2021; Cricchio et al., 2022; Livingstone et al., 2011; Steinfeld, 2021).

While restrictive mediation can be successful in limiting screen time, it does not encourage critical thinking and limits young people's ability to make experiences, develop their digital skills, and be autonomous in their use of digital devices (Steinfeld, 2021). Studies indicate that restrictive mediation can serve to reduce risky behavior online and excessive internet use (Kalmus et al., 2015; Notten & Nikken, 2016). However, restrictive mediation is unlikely to contribute to the development of digital maturity, as it does not provide relevant learning opportunities to young people (Duerager & Livingstone, 2012; Livingstone et al., 2017; Steinfeld, 2021; Wright, 2017).

In contrast, there are several reasons to assume that the link between SES and digital maturity is mediated by active parental mediation. First, parents with higher socioeconomic status have the skills and resources necessary for active parental mediation. They are often more knowledgeable regarding digital devices (Bakó & Tóké, 2018; Sun et al., 2021; Urbanova et al., 2019), and are likely to invest their resources and knowledge into their children (Conger & Donnellan, 2007; Sohr-Preston et al., 2013). Accordingly, previous studies have found that parents with higher SES are more likely to engage in active mediation (Alkan et al., 2021; Bakó & Tóké, 2018). Second, active mediation is likely to enable autonomy and to encourage taking advantage of opportunities. Young people can engage in online activities and learn to navigate risks and opportunities with the help of their parents, thus learning to self-regulate their use effectively (Duerager & Livingstone, 2012; Steinfeld, 2021; Wright, 2017). Hence, active mediation might contribute to digital skills and a better understanding of the digital world, and thus better equip young people to deal with online content and risks (Cricchio et al., 2022). However, the focus of previous research has mostly been on the preventive effect of parental mediation on maladaptive use behaviors, such as risky behavior online (Cavallini & Caravita, 2021; Cricchio et al., 2022; Steinfeld, 2021). Instead, we focus on the relation to beneficial use of technologies for personal advancement. By investigating parental mediation, our research can provide relevant insights into how mature use behavior can be fostered. We expect the following relations.

H2. Higher socioeconomic status relates to higher active parental mediation.

H3. Higher active parental mediation relates to higher digital maturity in young people.

H4. The positive relation of socioeconomic status to digital maturity is mediated by higher active parental mediation.

1.4. The effect of personality on use behavior

While family background influences young people's opportunities to develop important skills and manage life successfully (Conger & Donnellan, 2007), individual differences in personality and their unique

influence on life outcomes are noteworthy (Damian et al., 2015). It is reasonable to assume that the ability to use technology maturely is influenced both by the social environment and individual differences in personality. Previous studies already suggest relations between personality and digital use behavior (Hussain et al., 2017; Sriyabhand & John, 2014). Laaber et al. (2023) found that digital maturity is related to personality traits linked with maturity, such as agreeableness, conscientiousness, and negative emotionality. This finding is in line with expectations regarding general personality maturation, which is reflected in increases in emotional stability, conscientiousness, and agreeableness (Bleidorn, 2015; Roberts & Mroczek, 2008).

With regard to the interplay between family background and personality in predicting the achievement of important life outcomes, research has shown that personality traits are largely independent of socioeconomic background factors, and can predict outcomes such as educational attainment independently of parental socioeconomic status (Ayoub et al., 2018; Damian et al., 2015). However, although personality traits predict life outcomes, they cannot fully compensate for disadvantaged family backgrounds (Damian et al., 2015). Thus, it is useful to take into account the influences of both the socioeconomic background and individual differences in personality when examining the development of important life skills (Damian et al., 2015; Roberts et al., 2007). We suggest that the ability of adolescents to use digital technologies in a mature way is influenced by the family background through parental influences, but also by personality traits that support digital maturity. Thus, based on Laaber et al. (2023), we examine whether agreeableness, conscientiousness and negative emotionality can explain further variance in adolescents' digital maturity beyond SES and parental mediation.

H5. Agreeableness relates positively to young people's digital maturity.

H6. Conscientiousness relates positively to young people's digital maturity.

H7. Negative emotionality relates negatively to young people's digital maturity.

In addition, we will explore whether these personality traits moderate the relationship between parental mediation and digital maturity, assuming that active parental mediation could have a stronger relation to digital maturity when adolescents score higher on agreeableness and conscientiousness, and lower on negative emotionality. While personality might not be related to SES directly (Ayoub et al., 2018; Damian et al., 2015), one can expect that personality will interact with parental strategies to influence the child. Previous research suggests that children's personality can actively influence parenting style, as parents adapt to the child's personality (Avinun & Knafo, 2014; Ayoub et al., 2019; Klahr & Burt, 2014). For instance, especially child agreeableness, conscientiousness and negative emotionality relate to parental warmth and parental stress (Ayoub et al., 2019). Therefore, the child's personality might interact with parental mediation strategies to influence digital maturity. Hence, we formulated an additional research question in order to explore the interaction of agreeableness, conscientiousness and negative emotionality with active parental mediation:

RQ: Do agreeableness, conscientiousness and negative emotionality moderate the effect of active parental mediation on digital maturity?

1.5. The present study

Overall, the main aim of the study was to examine the relation of socioeconomic status, parental influence, and personality to young people's digital maturity (Fig. 1). The first objective of this study was to test the influence of socioeconomic status on young people's digital maturity level, in order to provide novel insights regarding the relation of SES to young people's development of a general ability for beneficial digital device use. A second objective was to investigate whether the

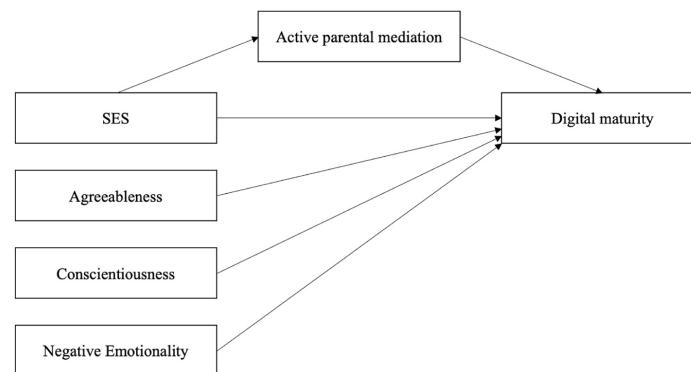


Fig. 1. Conceptual Model.

influence of SES on digital maturity is mediated by active parental mediation, which could enable young people to develop their digital maturity. A third objective was to investigate the relation of agreeableness, conscientiousness and negative emotionality to digital maturity, in order to provide insights into potential intrapersonal influences on digital maturity. A fourth objective was to explore the moderating role of personality on the relation between active parental mediation and digital maturity.

Further, we examined the associations of restrictive parental mediation and screen time with digital maturity. Moreover, adolescents' age and gender were included as control variables.

To investigate the outlined objectives, we conducted a study with parent-child dyads in which we measured SES, parental mediation, digital maturity, and personality. We recruited a sample of adolescents aged 12–18 years, reflecting an age at which young people increasingly engage in independent device use, rendering parental influence and mature use behavior especially important.

2. Method

2.1. Participants

This data was collected as part of a large multi-scale study for a research project. Participants from Germany and Austria were recruited via the *Bilendi* online panel, which recruited parents with children aged 12–18 from their available participant pool. The aim was to collect data from children aged 12–18 years and their parents, living in Germany and Austria. Using a *Qualtrics* (www.qualtrics.com) cross-sectional online survey, answers from both a parent and their child regarding the relevant constructs investigated in the study were collected. Overall, 1098 parent-child dyads completed the study, of which 27 responses were excluded, as they indicated the child to be younger than 12 years of age, which falls outside the inclusion criteria of the study. Further, six responses were excluded as participants failed both attention checks. Of the resulting 1065 responses, 50.24 % (535) of the children were male, 49.30 % (525) were female, 0.47 % (5) identified as non-binary/third gender or self-described their gender. The average age was 13.88 years ($SD = 1.44$), ranging from 12 to 18 years. Regarding the parent, 34.55 % (368) were male, 65.26 % (695) female, 2 parents identified as non-binary/third gender. Equivalently, 64.23 % (684) of parents were the child's mother, 33.52 % (357) were the father, 2.25 % (24) indicated some other relation to the child. Parents' average age was 43.60 years ($SD = 7.78$). Of the parent-child dyads, 57.00 % were recruited from Germany, 43.01 % from Austria. The study was approved by the Ethics Committee of the University of Vienna (reference number 00615).

2.2. Materials and procedure

The design of the study was a cross-sectional online survey, assessing the relevant constructs to be investigated. In the online questionnaire, parents were initially provided with information about the study and were asked to give consent for their own and the child's participation. The parent then completed questions regarding demographics and parental mediation styles. Subsequently, parents were asked to let their child answer several questions. Parents were asked to give the child privacy while doing so to allow the child to answer freely. The child was then informed about the study in simplified language and asked to provide informed assent. They then completed measures regarding their digital maturity, personality and use behavior. After the children had completed their section of the questionnaire, they were debriefed and asked to agree for their answers to be used in data analyses. They were then asked to return the online questionnaire to their parents for the parent debrief and final parental consent. Subsequently, the measures relevant to the present analysis are described.

2.2.1. Measures completed by parents

To estimate *subjective socioeconomic status*, parents were asked to rank their position on a 10-strung ladder (Adler et al., 2000; Côté et al., 2021). They were asked to imagine that the ladder represents where people stand in Germany or Austria respectively, with people with the most money, best education and jobs at the top of the ladder, and people with the least money, education and worst or no jobs at the bottom of the ladder. Parents indicated where on the ladder they would place themselves at the current moment from 1 (*lowest SES*) to 10 (*highest SES*). This measure has often been used in the literature and has shown relevant associations to psychological outcomes such as well-being (Adler et al., 2000; Ishii, 2015; Ma et al., 2011; Tan et al., 2020).

To measure *active parental mediation*, we used five items from Livingstone et al. (2011; e.g., "Do you speak with your child about what they do on their mobile phone?"), and five items assessing co-use from Cabello-Hutt et al. (2018; e.g., "Do you help your child when something is difficult to do or find?") with a 5-point scale and an 'I don't know' option (*never* (1); *maybe once or twice before* (2); *occasionally, perhaps once in a few months* (3); *often, at least every month* (4); *very often, at least every week* (5); *I don't know* (6); Steinfeld, 2021). Responses of 'I don't know' were handled as missing values. All ten items were averaged into an active mediation score (Cronbach's $\alpha = 0.881$; Cabello-Hutt et al., 2018). In the few cases of missing values, the average score was calculated with the completed items only.

To measure *restrictive parental mediation*, we used a 10-item scale by Steinfeld (2021), asking parents which activities their child was allowed

to do on a mobile device (e.g., “send and receive personal messages”). The scale ranged from 1 to 3 with an additional ‘*I don’t know*’ option (*my child is allowed to do this by themselves* (1); *my child is allowed to do this under supervision* (2); *my child is not allowed to do this* (3); *I don’t know* (4)), with ‘*I don’t know*’ responses handled as missing values (Cronbach’s $\alpha = 0.849$). In the few cases of missing values, the average score was calculated with the completed items only.

2.2.2. Measures completed by children

To measure children’s *digital maturity*, the Digital Maturity Inventory (DIMI; Laaber et al., 2023) was used. The DIMI comprises 32 items which measure digital maturity on 10 dimensions (e.g., “When using a mobile device, I learn new skills”, “When using a mobile device, I choose the content I want to see”, “When using a mobile device, I care about the feelings of others”). All dimensions were measured on 5-point scales (*not at all* (1) to *completely* (5) for the digital literacy dimension; *never* (1) to *always* (5) for all other dimensions; Cronbach’s $\alpha = 0.849$; for Cronbach’s α per dimension see Appendix A). The final digital maturity score was created according to Laaber et al. (2023).

To measure children’s *agreeableness*, *conscientiousness* and *negative emotionality*, the Big Five Inventory-2 short scale with 30 items by Soto and John (2017) was used, with 6 items per personality domain. Children were asked to assess their agreement to statements like “I am compassionate, have a soft heart” (agreeableness), “I tend to be disorganized” (conscientiousness reversed), “I worry a lot” (negative emotionality), on 5-point scales from *strongly disagree* (1) to *strongly agree* (5). Cronbach’s alpha values were 0.676 for agreeableness, 0.795 for conscientiousness and 0.780 for negative emotionality.

Further, children reported their *average use hours* of mobile devices for leisure activities on an average weekday, on a scale from 0 to 24 h. They also reported their age when they first received their own mobile phone, on a scale of bi-yearly intervals up to the age of 12, with the option *older than 12 years*, or *I do not own a mobile phone*.

2.3. Analysis method

First, correlations were used to examine the associations between SES, parental mediation, personality, digital maturity, screen time, age and gender, using SPSS (Version 28). Second, we applied structural equation modelling (SEM) to test the proposed model (Fig. 1), using the lavaan package in R (Version 4.0.5). To assess model fit, we applied the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). We relied on common recommendations that values of CFI and TLI above 0.90, with RMSEA and SRMR below 0.08, suggest a good fit (Hu & Bentler, 1999). We rely on the Akaike (AIC) and Bayesian (BIC) information criteria to compare models (Schermelleh-Engel et al., 2003). Additionally, we used the SPSS macro PROCESS (Hayes, 2017) to test indirect effects. PROCESS model number 4 was used to test a mediation model of the indirect effect of SES on digital maturity via active mediation, PROCESS model 14 was used to test moderated mediation effects (Hayes, 2017), setting 5000 bootstrap samples for 95 % percentile bootstrap confidence intervals for all models. For SEM analyses, Full Information Maximum Likelihood was used, thus no participants with missing values on the parental mediation items had to be excluded. The study data is available on the Open Science Framework (https://osf.io/8kyfm/?view_only=235bc75c04ea48c4b3787fe3fb7d0c1c).

3. Results

The average variance extracted (AVE) of all constructs ranged from 0.29 to 0.65, and all AVEs fell above the corresponding squared correlations between constructs, confirming discriminant validity (Fornell & Larcker, 1981; Table 1). Composite reliability was satisfactory (Table 1).

Table 1
Discriminant Validity Assessment for all Multi-Item Measures

Construct	CR	1	2	3	4	5	6
1. Active mediation	.83	.41					
2. Restrictive mediation	.86	.11	.47				
3. Digital maturity ^a	.85	.02	.00	.65			
4. Agreeableness	.69	.01	.00	.18	.29		
5. Conscientiousness	.80	.02	.00	.14	.17	.42	
6. Negative emotionality	.78	.00	.00	.14	.16	.19	.38

Note. CR = composite reliability. Bold italics on the diagonal show AVEs, numbers below are squared inter-construct correlations. ^aAVE and CR averaged across dimensions.

3.1. Hypothesis testing

Descriptive statistics and correlations of the main study variables are presented in Table 2. For a summary of the supported and rejected hypotheses, see Table 3. To test the proposed conceptual model, we used a structural equation model. The model estimation resulted in good fit for SRMR and RMSEA (SRMR = 0.071; RMSEA = 0.072; CFI = 0.782; TLI = 0.762; AIC = 89,837.715; BIC = 90,329.817). The results are reported in Fig. 2, with Table 4 summarizing the direct effects of the paths.

Hypothesis 1. was that socioeconomic status (SES) predicts an increase in digital maturity. The correlation of SES and digital maturity support this hypothesis. The second hypothesis was that higher socioeconomic status relates to higher active parental mediation. This hypothesis is also supported. The third hypothesis was that higher active parental mediation relates to higher digital maturity, which is also supported. The fourth hypothesis was that the relation of SES to digital maturity is mediated by higher active parental mediation. This hypothesis is supported by a test of the indirect effect using PROCESS model 4 (Hayes, 2017), $b = .016$, $SE = .006$, 95 % CI [.006, .028]. Thus, with higher SES, parents report to engage in more active parental mediation, which links to higher digital maturity. Moreover, the structural equation model indicates a full mediation of the influence of SES on digital maturity via active parental mediation (H4), hence the relation of SES to digital maturity (H1) is not significant in the model.

Regarding personality, we hypothesized that agreeableness (H5) and conscientiousness (H6) relate positively to digital maturity, and negative emotionality (H7) relates negatively to digital maturity. These hypotheses were supported by the results. Thus, adolescents who reported higher agreeableness, higher conscientiousness and lower negative emotionality, also reported higher digital maturity. However, in the full model conscientiousness did not significantly contribute to digital maturity any longer.

In a next step, restrictive mediation was added to the model as another mediator between SES and digital maturity. While the other effects remained unchanged, the paths were not significant from SES to restrictive mediation ($b = -.002$, $SE = 0.030$, $p = .936$, 95 % CI [-0.060, 0.056]) and from restrictive mediation to digital maturity ($b = -0.056$, $SE = 0.032$, $p = .081$, 95 % CI [-0.119, 0.006]). Thus, in contrast to active parental mediation, SES does not predict parents’ use of restrictive parental mediation, and there is no indirect effect on digital maturity via restrictive parental mediation. The AIC and BIC information criteria indicated the model to be worse than the initial one (SRMR = 0.078; RMSEA = 0.067; CFI = 0.760; TLI = 0.743; AIC = 107,220.746; BIC = 107,881.853). Hence, restrictive mediation was not kept in the model.

Further, screen time was included in the model as another potential predictor of digital maturity. The model showed that screen time significantly relates to digital maturity ($b = -0.069$, $SE = 0.027$, $p = .011$, 95 % CI [-0.123, -0.015]), while the other effects remain unchanged. The information criteria AIC and BIC show highly similar values to the initial model (SRMR = 0.073; RMSEA = 0.072; CFI = 0.774; TLI = 0.754; AIC = 89,833.330; BIC = 90,330.403). This suggests

Table 2
Means, Standard Deviations and Correlations of all Relevant Measures ($N = 1065$).

	Parent reported						Child reported				
	<i>M (SD)</i>	SES	Active mediation	Restrictive mediation	Age Child	Gender Child	Digital maturity	Screen time	Age first phone	Agreeableness	Conscientiousness
SES	5.94 (1.48)	1									
Active mediation	3.41 (0.84)	.110***	1								
Restrictive mediation	1.65 (0.46)	.006	.328***	1							
Age child	13.88 (1.44)	-.008	-.250***	-.407***	1						
Gender child ^a	–	.013	.046	-.031	-.042	1					
Digital maturity	363.54 (40.67)	.110***	.156***	-.019	.046	.102***	1				
Screen time (hrs)	3.74 (2.61)	-.129***	-.119***	-.226***	.165***	.006	-.173***	1			
Age first phone (yrs)	9.14 (2.32)	.033	-.015	-.049	.099**	.051	.065*	-.042	1		
Agreeableness	3.66 (0.58)	.108***	.118***	.030	-.029	.099**	.424***	-.185***	.051	1	
Conscientiousness	3.18 (0.73)	.181***	.123***	.056	.027	.116***	.375***	-.189***	.032	.417***	1
Negative emotionality	2.71 (0.70)	-.230***	-.058	-.048	.018	.112***	-.370***	.173***	-.003	-.398***	-.438***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. ^aGender is coded as: 1 = boys, 2 = girls, 3 = non-binary/third gender/prefer to self-describe.

Table 3
Results of Hypothesis Testing.

Hypothesis	Supported
1. Higher socioeconomic status relates to higher digital maturity in young people.	YES ^a
2. Higher socioeconomic status relates to higher active parental mediation.	YES
3. Higher active parental mediation relates to higher digital maturity in young people.	YES
4. The positive relation of socioeconomic status to digital maturity is mediated by higher active parental mediation.	YES ^b
5. Agreeableness relates positively to young people's digital maturity.	YES
6. Conscientiousness relates positively to young people's digital maturity.	YES ^a
7. Negative emotionality relates negatively to young people's digital maturity.	YES

Note. ^a not significant in full model. ^b confirmed by SPSS PROCESS mediation analysis.

a comparable model fit with and without screen time included.

Subsequently, we explored whether agreeableness, conscientiousness and negative emotionality moderate the relation of active parental mediation and digital maturity. To do so, we ran separate PROCESS models to test the moderating effect of each personality factor on the relation between active parental mediation and digital maturity (for a conceptual model, see Fig. 3).

The interaction of moderator and active mediation was not significant, for neither agreeableness ($b = 0.051$, $SE = 0.028$, $p = .075$, 95 % CI $[-0.005, 0.107]$), conscientiousness ($b = 0.055$, $SE = 0.029$, $p = .058$, 95 % CI $[-0.002, 0.112]$), nor negative emotionality ($b = -0.030$, $SE = 0.027$, $p = .272$, 95 % CI $[-0.082, 0.023]$), b -values are standardized coefficients. For the direct effects of all models, refer to Appendix B. However, regarding agreeableness and conscientiousness, the conditional effects of active parental mediation on digital maturity are significant at medium and high levels (mean, +1 SD) of the personality factor. Accordingly, the indirect effect of SES via active parental mediation becomes significant at medium and high agreeableness and conscientiousness levels, while not significant at low levels (Table 5). Regarding negative emotionality, there are no conditional effects, the indirect effect of SES via active parental mediation is significant at all

levels of negative emotionality.

4. Discussion

The high use of digital technologies by young people comes with several risks and opportunities (Odgers & Jensen, 2020; Twenge & Campbell, 2018; Younas et al., 2020). Although opportunities, such as easier access to skill development (Livingstone & Helsper, 2010), could potentially reduce social inequalities, previous research has provided initial evidence that young people from lower socioeconomic backgrounds are more susceptible to the risks of digital technology use, such as digital addiction (Sun et al., 2021; Urbanova et al., 2019). The present study extends previous research and investigates the relationship between SES and digital maturity, a broad concept which includes risks and opportunities of the digital world. It emphasizes that the family background relates to the beneficial use of digital technologies, adding to the doubts whether young people from different social backgrounds can equally benefit from digital opportunities regarding their positive development. Our findings suggest that with lower socioeconomic status, young people show lower digital maturity due to less active parental engagement in their digital device use. However, we also found strong links of digital maturity to intrapersonal influences independent of SES. We found that especially high agreeableness and low negative emotionality relate positively to digital maturity, supporting that personality also influences the attainment of life skills beyond SES and active parental mediation.

Our study indicates that a potential risk factor in lower SES families is related to parental involvement in supporting their children's technology use. The findings suggest that higher socioeconomic status enables higher digital maturity, due to parents' higher use of active mediation strategies. The correlational results support a direct link of SES and digital maturity, which is fully mediated by active parental mediation in the full model. Across all analyses, the mediating effect of active parental mediation persisted, emphasizing that beyond personality traits, higher SES influences beneficial device use via more active parental guidance. We argue that with higher SES, parents actively support their children's device use more, which enables them to learn more mature use behavior (Alkan et al., 2021; Wang & Xing, 2018). The observed associations complement previous research on the relation of

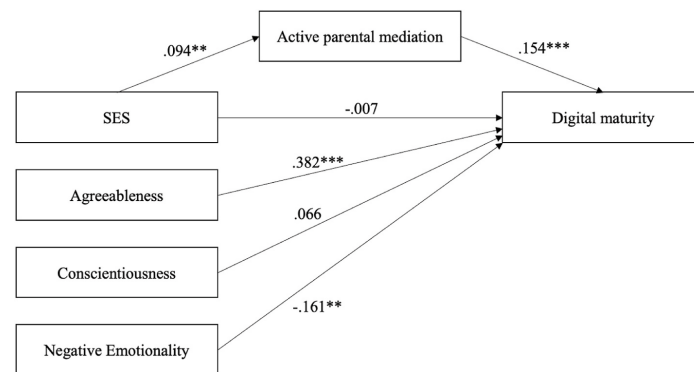


Fig. 2. SEM Testing the Hypothesized Relations.

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. $N = 1065$. Values are standardized coefficients. SRMR = 0.071; RMSEA = 0.072; CFI = 0.782; TLI = 0.762; AIC = 89,837.715; BIC = 90,329.817. Age and gender are used as control variables on active parental mediation and digital maturity during estimation.

Table 4
Direct Effects of the SEM

Path	<i>b</i>	<i>SE</i>	<i>p</i>	95 % CI
SES → digital maturity	-.007	.027	.782	[-.060, .045]
SES → active mediation	.094	.031	.002	[.033, .155]
Active mediation → digital maturity	.154	.029	<.001	[.098, .210]
Agreeableness → digital maturity	.382	.050	<.001	[.283, .480]
Conscientiousness → digital maturity	.066	.045	.141	[-.022, .155]
Negative emotionality → digital maturity	-.161	.048	.001	[-.255, -.067]
Age → digital maturity	.086	.027	.001	[.033, .138]
Age → active mediation	-.240	.030	<.001	[-.298, -.181]
Gender → digital maturity	.075	.027	.005	[.022, .127]
Gender → active mediation	.045	.031	.152	[-.016, .106]

Note. *b* = standardized coefficient. $N = 1065$.

low SES and negative use behavior, such as digital addiction and lower digital literacy (Ren et al., 2022; Sun et al., 2021; Urbanova et al., 2019). The present study extends the literature by focusing on digital maturity as a measure for the use of digital technology for personal advancement and social integration. The full mediation results highlight the importance of parents in providing learning opportunities and guidance. Our results are in line with the family investment model, which proposes that with higher SES parents have an increased capacity to guide their children's behavior (Alkan et al., 2021; Sohr-Preston et al., 2013). Due to parents' higher technology proficiency with higher SES (Alkan et al., 2021; Nikken & Oprea, 2018; Notten & Nikken, 2016), they can be more knowledgeable, but also more aware of potential risks, enabling and

motivating them to regulate their child's use and thus engage in active parental mediation (Bakó & Tökés, 2018; Livingstone et al., 2017; Steinfeld, 2021). Consequently, socioeconomic background can relate to digital use behavior through parents' active engagement and support in their child's device use, which seem to provide opportunities which enhance young people's digital maturity.

Interestingly, our findings support the necessity to distinguish between active and restrictive parental mediation. While parents engage with their child's device use by relying on multiple strategies, only active parental mediation positively predicted digital maturity. In line with previous research (Steinfeld, 2021), active and restrictive parental mediation correlated positively (see Table 1), but our findings illustrate that active and restrictive mediation are not equally linked to digital maturity. Only active parental mediation, which relates to socioeconomic status, seems to effectively enable young people to develop their digital maturity skills (Kalmus et al., 2015; Steinfeld, 2021; Wright, 2017).

Importantly, our study supports the assumption that beyond the environmental influence through parents, intraindividual differences also relate to young people's ability for beneficial device use, as the personality traits agreeableness, conscientiousness and negative emotionality correlated with young people's digital maturity. In the overall model, only agreeableness and negative emotionality contributed uniquely to the explanation of variance in digital maturity, independent from the relation of SES and parental influence. The association of conscientiousness to digital maturity was no longer significant, which could be explained by the correlations between SES and the personality traits. The relations of the personality traits to digital maturity are generally in line with previous findings on digital maturity (Laaber et al.,

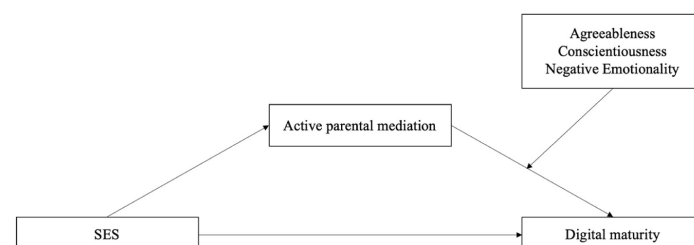


Fig. 3. Conceptual Model of Moderated Mediation Models.

Table 5
Indirect Mediation Effect at Different Levels of the Moderator.

Agreeableness level	<i>b</i>	<i>SE</i>	95 % CI
Low (−1 SD)	.005	.005	[−.004, .016]
Medium (mean)	.011	.004	[.004, .021]
High (+1 SD)	.017	.007	[.006, .032]
Conscientiousness level	<i>b</i>	<i>SE</i>	95 % CI
Low (−1 SD)	.006	.005	[−.004, .017]
Medium (mean)	.012	.005	[.004, .022]
High (+1 SD)	.018	.007	[.006, .034]
Negative emotionality level	<i>b</i>	<i>SE</i>	95 % CI
Low (−1 SD)	.018	.007	[.007, .032]
Medium (mean)	.014	.005	[.006, .026]
High (+1 SD)	.011	.006	[.002, .024]

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

2023) and general expectations regarding personality maturation (Bleidorn, 2015; Roberts & Mroczek, 2008). Thus, personality traits are suggested as one potential antecedent of digital maturity.

While agreeableness and conscientiousness also correlated with active parental mediation, the moderating influence of personality on the relation between active parental mediation and digital maturity was not significant in the present study. However, this relation could be explored further, since the conditional effects seemed to suggest that low agreeableness and low conscientiousness could hinder the positive influence of active mediation. This would correspond to research on the interaction of child personality and parenting (Ayoub et al., 2019). Potential reasons why active parental mediation might interact with agreeableness and conscientiousness include that parental strategies might be less effective with such children, or parents might engage in less active parental mediation when children score low on these traits (Avinun & Knafo, 2014; Ayoub et al., 2019; Klahr & Burt, 2014). Future research could aim to investigate this relation. In contrast, no potential reasons for negative emotionality to moderate parental mediation seem apparent.

The results provide important evidence distinguishing the mature use of digital devices from merely the absence of excessive use. Despite a significant relation of lower screen time to higher digital maturity, the effect of SES and active mediation remains with screen time included in the model, suggesting that active mediation enables a qualitatively more mature, rather than only a reduced use of digital devices. With high digital maturity, young people are assumed to effectively use digital technologies as a tool to pursue their own goals, which could lead to a more efficient, shorter use of devices in some instances, but can still come with higher screen time when using digital devices to pursue specific goals.

Previous research has focused on the negative effect of SES on digital skills due to lower access to digital resources (Ching et al., 2005; Zilka, 2019). Interestingly, we found that SES only weakly correlated with the age at which young people received their first phone, as one measure of digital access. This provides some support that the effect of SES is not solely explained by the access to resources, like digital devices. Indeed, access to the digital world is available to individuals from most social backgrounds in Western societies today (Eurostat, 2022; Pew Research Center, 2021). However, in the interpretation of this finding it has to be taken into account that our measure of digital access is quite limited and several other aspects of digital access, such as internet access and quality, should be considered, which we did not assess in this study.

Our study offers several strengths. One strength of this study lies in the use of parent-child dyads, which offers insights from both the parent and the child directly, rather than solely relying on either the parent's or child's report (Cricchio et al., 2022). Moreover, the measured constructs

showed good discriminant validity, supporting that the constructs are independent and not highly related to each other (Fornell & Larcker, 1981). Overall, the present study provides an important contribution to the literature by investigating digital maturity as a broad underlying ability of beneficial device use which benefits personal development and integration in society (Arenas & Yazdi, 2022; Laaber et al., 2023; Laaber et al., 2024). By investigating environmental and intraindividual factors which relate to digital maturity, it contributes valuable insights into the development of beneficial use behavior, which can be built upon in order to foster young people's beneficial and mature use of digital devices for personal advancement. Thereby, it extends insights regarding the influence of factors such as higher SES and active parental mediation beyond the prevention of maladaptive device use (Erreygers et al., 2018; Faltýnková et al., 2020; Urbanova et al., 2019), towards fostering mature digital behavior.

5. Limitations and future directions

An important limitation of the present research is that we relied solely on self-report measures and applied a cross-sectional design. Although no causation can be established, the directionality of the proposed relations seems reasonable, as digital maturity is unlikely to affect SES. Nevertheless, it needs to be considered that we only investigated SES and personality as one environmental and intrapersonal aspect respectively, while several other environmental and intrapersonal factors could also play a role. For instance, although parents form an important influence in their child's development, several additional environmental factors could influence digital maturity, such as peers and the school setting which also influence young people's use behavior (Huang, Lai, et al., 2021; Soh et al., 2018). Therefore, while the family environment and personality traits influence young people's digital device use, it should not be neglected that other factors also play a role.

Hence, future studies might look into additional environmental factors and individual differences which could potentially impact young people's digital maturity, such as peer influences. Moreover, to further investigate the relations found in this study, future research should aim to apply experimental interventions to expand the correlational findings. While SES is difficult to manipulate or enhance, parental influence as the mediator could be addressed to enhance young people's digital maturity and address societal disadvantages. Experiments promoting supportive behavior of parents could provide useful insights for interventions. Interventions to enhance digital maturity could encourage active mediation strategies by parents; alternatively, interventions in schools could aim to provide similar guidance in order to compensate societal inequalities.

CRedit authorship contribution statement

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

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.

Data availability

The data and supplemental materials are openly available on OSF (osf.io/8kyfm/).

Appendix A

Table 1
Reliability Analysis of the Digital Maturity Dimensions ($N = 1065$; Laaber et al., 2023).

Dimension	Number of items	Cronbach's α
Autonomous Choice to Use Mobile Devices	3	.826
Autonomy Within Digital Contexts	3	.832
Digital Literacy	3	.831
Individual Growth in Digital Contexts	3	.849
Digital Risk Awareness	3	.880
Support-Seeking Regarding Digital Problems	4	.881
Regulation of Negative Emotions in Digital Contexts	3	.882
Regulation of Impulses in Digital Contexts	3	.827
Respect Towards Others in Digital Contexts	4	.833
Digital Citizenship	3	.856
Across all items	32	.849

Appendix B

Table 1
Direct Effects of the Moderated Mediation Model - Agreeableness ($N = 1065$).

Antecedent	Dependent measure							
	Active mediation				Digital maturity			
	<i>b</i>	<i>SE</i>	<i>p</i>	95 % CI	<i>b</i>	<i>SE</i>	<i>p</i>	95 % CI
SES	.110	.031	<.001	[.050, .170]	.055	.028	.049	[.000, .110]
Active					.102	.028	<.001	[.048, .157]
Agreeableness					.405	.028	<.001	[.350, .460]
Active x Agreeableness					.051	.028	.075	[-.005, .107]
Constant	.000	.031	1.000	[-.060, .060]	-.006	.028	.830	[-.060, .048]
$R^2 = .012$					$R^2 = .197$			
$F(1, 1063) = 12.958$					$F(4, 1060) = 64.918$			
$p < .001$					$p < .001$			

Note. *b* = standardized regression coefficient.

Table 2
Direct Effects of the Moderated Mediation Model - Conscientiousness ($N = 1065$).

Antecedent	Dependent measure							
	Active mediation				Digital maturity			
	<i>b</i>	<i>SE</i>	<i>p</i>	95 % CI	<i>b</i>	<i>SE</i>	<i>p</i>	95 % CI
SES	.110	.031	<.001	[.050, .170]	.032	.029	.275	[-.025, .088]
Active					.108	.029	<.001	[.052, .163]
Conscientiousness					.353	.029	<.001	[.297, .410]
Active x Conscientiousness					.055	.029	.058	[-.002, .112]
Constant	.000	.031	1.000	[-.060, .060]	-.007	.028	.811	[-.063, .049]
$R^2 = .012$					$R^2 = .157$			
$F(1, 1063) = 12.958$					$F(4, 1060) = 49.380$			
$p < .001$					$p < .001$			

Note. *b* = standardized regression coefficient.

Table 3
Direct Effects of the Moderated Mediation Model - Negative Emotionality ($N = 1065$).

Antecedent	Dependent measure							
	Active mediation				Digital maturity			
	<i>b</i>	<i>SE</i>	<i>p</i>	95 % CI	<i>b</i>	<i>SE</i>	<i>p</i>	95 % CI
SES	.110	.031	<.001	[.050, .170]	.013	.029	.666	[-.045, .070]
Active					.131	.029	<.001	[.075, .187]
Negative emotionality					-.358	.029	<.001	[-.415, -.301]
Active x Neg. emotionality					-.030	.027	.272	[-.082, .023]
Constant	.000	.031	1.000	[-.060, .060]	-.002	.028	.952	[-.057, .054]
$R^2 = .012$					$R^2 = .156$			
$F(1, 1063) = 12.958$					$F(4, 1060) = 48.974$			
$p < .001$					$p < .001$			

Note. *b* = standardized regression coefficient.

References

- Adachi, P. J. C., & Willoughby, T. (2013). More than just fun and games: The longitudinal relationships between strategic video games, self-reported problem solving skills, and academic grades. *Journal of Youth and Adolescence*, 42(7), 1041–1052. <https://doi.org/10.1007/s10964-013-9913-9>
- Adler, N. E., Epel, E. S., Castellazzo, G., & Ickovics, J. R. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy, white women. *Health Psychology*, 19(6), 586–592. <https://doi.org/10.1037/0278-6133.19.6.586>
- Alkan, R.Ü., Aslan, A., Turgut, Y. E., & Kırşın, E. (2021). Factors affecting parental mediation strategies in children's technology use: A systematic review. *Journal of Computer and Education Research*, 9(18), 702–723. <https://doi.org/10.18009/jcer.925859>
- Arenas, A., & Yazdi, P. (2022). Towards a model of technology usage and digital maturity in children: A grounded-theory approach. In *ECIS 2022 Research Papers*. https://aiselaisnet.org/ecis2022_rp/107/
- Avinun, R., & Knafo, A. (2014). Parenting as a reaction evoked by children's genotype: A meta-analysis of children-as-twins studies. *Personality and Social Psychology Review*, 18(1), 87–102. <https://doi.org/10.1177/1088868313498308>
- Ayoub, M., Briley, D. A., Grotzinger, A., Patterson, M. W., Engelhardt, L. E., Tackett, J. L., Harden, K. P., & Tucker-Drob, E. M. (2019). Genetic and environmental associations between child personality and parenting. *Social Psychological and Personality Science*, 10(6), 711–721. <https://doi.org/10.1177/1948550618784890>
- Ayoub, M., Gosling, S. D., Potter, J., Shanahan, M., & Roberts, B. W. (2018). The relations between parental socioeconomic status, personality, and life outcomes. *Social Psychological and Personality Science*, 9(3), 338–352. <https://doi.org/10.1177/1948550617707018>
- Bakó, R. K., & Tókes, G. (2018). Parental mediation and Romanian young children's digital practices. *Revista Română de Sociologie, Serie Nouă, XXIX*, 23–36.
- 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>
- Bohnert, M., & Gracia, P. (2023). Digital use and socioeconomic inequalities in adolescent well-being: Longitudinal evidence on socioemotional and educational outcomes. *Journal of Adolescence*, 95(6), 1179–1194. <https://doi.org/10.1002/jad.12193>
- Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology*, 22(6), 723–742.
- Bucksch, J., Sigmundova, D., Hamrik, Z., Troped, P. J., Melkevik, O., Ahluwalia, N., Borraccino, A., Tynjälä, J., Kalman, M., & Inchley, J. (2016). International trends in adolescent screen-time behaviors from 2002 to 2010. *Journal of Adolescent Health*, 58(4), 417–425. <https://doi.org/10.1016/j.jadohealth.2015.11.014>
- Cabello-Hutt, T., Cabello, P., & Claro, M. (2018). Online opportunities and risks for children and adolescents: The role of digital skills, age, gender and parental mediation in Brazil. *New Media & Society*, 20(7), 2411–2431. <https://doi.org/10.1177/1461444817724168>
- Cavallini, M. C., & Caravita, S. (2021). Parental strategies for limiting youths' exposure to online risks. *Media Education*, 12(2), 59–71. <https://doi.org/10.36253/me-10474>
- Chen, L., Guo, Y., & Shi, J. (2019). Social support seeking on social media among Chinese gay men living with HIV/AIDS: The role of perceived threat. *Telemedicine and E-Health*, 25(7), 655–659. <https://doi.org/10.1089/tmj.2018.0136>
- Ching, C., Basham, J., & Jang, E. (2005). The legacy of the digital divide gender, socioeconomic status, and early exposure as predictors of full-spectrum technology use among young adults. *Urban Education*, 40, 394–411. <https://doi.org/10.1177/0042085905276389>
- 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)*, 10903 <https://easychair.org/publications/preprint/wvx>.
- Conger, R. D., & Donnellan, M. B. (2007). An interactionist perspective on the socioeconomic context of human development. *Annual Review of Psychology*, 58(1), 175–199. <https://doi.org/10.1146/annurev.psych.58.110405.085551>
- Côté, S., Stellar, J. E., Willer, R., Forbes, R. C., Martin, S. R., & Bianchi, E. C. (2021). The psychology of entrenched privilege: High socioeconomic status individuals from affluent backgrounds are uniquely high in entitlement. *Personality and Social Psychology Bulletin*, 47(1), 70–88. <https://doi.org/10.1177/0146167220916633>
- Cricchio, M. G. L., Palladino, B. E., Eleftheriou, A., Nocentini, A., & Menesini, E. (2022). Parental mediation strategies and their role on youths' online privacy disclosure and protection: A systematic review. *European Psychologist*, 27(2), 116–130. <https://doi.org/10.1027/1016-9040/a000450>
- Crone, E. A., & Konijn, E. A. (2018). Media use and brain development during adolescence. *Nature Communications*, 9(1), 588. <https://doi.org/10.1038/s41467-018-03126-x>
- Damian, R. I., Su, R., Shanahan, M., Trautwein, U., & Roberts, B. W. (2015). Can personality traits and intelligence compensate for background disadvantage? Predicting status attainment in adulthood. *Journal of Personality and Social Psychology*, 109(3), 473–489. <https://doi.org/10.1037/pspp0000024>
- Duerager, A., & Livingstone, S. (2012). *How can parents support children's internet safety? EU kids online*. <http://eprints.lse.ac.uk/42872/>.
- Erreygers, S., Vandebosch, H., Vranjes, I., Baillien, E., & De Witte, H. (2018). Development of a measure of adolescents' online prosocial behavior. *Journal of Children and Media*, 1–17. <https://doi.org/10.1080/17482798.2018.1431558>
- Eurostat. (2022). Digital economy and society statistics—Households and individuals. In *Eurostat statistics explained*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Digital_economy_and_society_statistics_-_households_and_individuals.
- Faltýnková, A., Blinka, L., Sevečková, A., & Husarova, D. (2020). The associations between family-related factors and excessive internet use in adolescents. *International Journal of Environmental Research and Public Health*, 17(5), 1754. <https://doi.org/10.3390/ijerph17051754>
- 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>
- González-Bailón, S., & Lelkes, Y. (2023). Do social media undermine social cohesion? A critical review. *Social Issues and Policy Review*, 17(1), 155–180. <https://doi.org/10.1111/sipr.12091>
- Haddon, L., & Livingstone, S. (2017). Risks, opportunities, and risky opportunities: How children make sense of the online environment. In *Cognitive development in digital contexts* (pp. 275–302). Elsevier. <https://doi.org/10.1016/B978-0-12-809481-5.00014-6>
- Hawi, N. S., Samaha, M., & Griffiths, M. D. (2019). The digital addiction scale for children: Development and validation. *Cyberpsychology, Behavior, and Social Networking*, 22(12), 771–778. <https://doi.org/10.1089/cyber.2019.0132>
- Hayes, A. F. (2017). Introduction to mediation, moderation, and conditional process analysis. In *A regression-based approach* (2nd ed.). Guilford Publications <http://ebookcentral.proquest.com/lib/univie/detail.action?docId=5109647>
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Huang, J., Kumar, S., & Hu, C. (2021). A literature review of online identity reconstruction. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.696552>
- Huang, S., Lai, X., Li, Y., Luo, Y., & Wang, Y. (2021). Understanding juveniles' problematic smartphone use and related influencing factors: A network perspective. *Journal of Behavioral Addictions*, 10(3), 811–826. <https://doi.org/10.1556/2006.2021.00048>
- Hussain, Z., Griffiths, M. D., & Sheffield, D. (2017). An investigation into problematic smartphone use: The role of narcissism, anxiety, and personality factors. *Journal of Behavioral Addictions*, 6(3), 378–386. <https://doi.org/10.1556/2006.6.2017.052>
- Ishii, K. (2015). Subjective socioeconomic status and cigarette smoking interact to delay discounting. *SpringerPlus*, 4(560), 1–5. <https://doi.org/10.1186/s40064-015-1361-4>
- Kalmus, V., Blinka, L., & Ólafsson, K. (2015). Does it matter what Mama says: Evaluating the role of parental mediation in European adolescents' excessive internet use. *Children & Society*, 29(2), 122–133. <https://doi.org/10.1111/chso.12020>
- Kim, J.-H., & Lee, J.-E. (2010). The Facebook paths to happiness: Effects of the number of Facebook friends and self-presentation on subjective well-being. *Cyberpsychology, Behavior, and Social Networking*, 14, 359–364. <https://doi.org/10.1089/cyber.2010.0374>
- Klahr, A., & Burt, S. A. (2014). Elucidating the etiology of individual differences in parenting: A meta-analysis of behavioral genetic research. *Psychological Bulletin*, 140(2), 544–586. <https://doi.org/10.1037/a0034205>
- Kwon, M., Kim, D.-J., Cho, H., & Yang, S. (2013). The Smartphone Addiction Scale: Development and validation of a short version for adolescents. *PLoS One*, 8(12), Article e83558. <https://doi.org/10.1371/journal.pone.0083558>
- 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, 108077. <https://doi.org/10.1016/j.chb.2023.108077>
- Livingstone, S., Haddon, L., Görzig, A., & Ólafsson, K. (2011). *Risks and safety on the internet: The perspective of European children: Full findings and policy implications from the EU kids Online survey of 9-16 year olds and their parents in 25 countries (Deliverable D4)*. EU Kids Online Network. <http://eprints.lse.ac.uk/33731/>.
- Livingstone, S., & Helsper, E. (2010). Balancing opportunities and risks in teenagers' use of the internet: The role of online skills and internet self-efficacy. *New Media & Society*, 12(2), 309–329. <https://doi.org/10.1177/1461444809342697>
- Livingstone, S., Ólafsson, K., Helsper, E. J., Lupiáñez-Villanueva, F., Veltri, G. A., & Folkvord, F. (2017). Maximizing opportunities and minimizing risks for children online: The role of digital skills in emerging strategies of parental mediation. *Journal of Communication*, 67(1), 82–105. <https://doi.org/10.1111/jcom.12277>
- Ma, Y., Wang, C., & Han, S. (2011). Neural responses to perceived pain in others predict real-life monetary donations in different socioeconomic contexts. *NeuroImage*, 57(3), 1273–1280. <https://doi.org/10.1016/j.neuroimage.2011.05.003>
- Magsamen-Conrad, K., Billotte-Verhoff, C., & Greene, K. (2014). Technology addiction's contribution to mental wellbeing: The positive effect of online social capital. *Computers in Human Behavior*, 40, 23–30. <https://doi.org/10.1016/j.chb.2014.07.014>
- Mahmoudi, H., Koushafar, M., Saribagloo, J. A., & Pashavi, G. (2015). The effect of computer games on speed, attention and consistency of learning mathematics among students. *Procedia - Social and Behavioral Sciences*, 176, 419–424. <https://doi.org/10.1016/j.sbspro.2015.01.491>
- Mascheroni, G., & Ólafsson, K. (2015). The mobile Internet: Access, use, opportunities and divides among European children. *New Media & Society*, 18(8), 1657–1679. <https://doi.org/10.1177/1461444814567986>

- Moore, R. L., & Blackmon, S. J. (2022). From the learner's perspective: A systematic review of MOOC learner experiences (2008–2021). *Computers & Education*, 190, Article 104596. <https://doi.org/10.1016/j.compedu.2022.104596>
- Nebel, S., Schneider, S., Schledjewski, J., & Rey, G. D. (2017). Goal-setting in educational video games: Comparing goal-setting theory and the goal-free effect. *Simulation & Gaming*, 48(1), 98–130. <https://doi.org/10.1177/1046878116680869>
- Nikken, P., & Oprea, S. J. (2018). Guiding young children's digital media use: SES-differences in mediation concerns and competence. *Journal of Child and Family Studies*, 27(6), 1844–1857. <https://doi.org/10.1007/s10826-018-1018-3>
- Notten, N., & Nikken, P. (2016). Boys and girls taking risks online: A gendered perspective on social context and adolescents' risky online behavior. *New Media & Society*, 18(6), 966–988. <https://doi.org/10.1177/1461444814552379>
- Odgers, C. L., & Jensen, M. R. (2018). Adolescent development and growing divides in the digital age. *Dialogues in Clinical Neuroscience*, 22(2), 143–149. <https://doi.org/10.31887/DCNS.2020.22.2/codgers>
- Orben, A. (2020). Teenagers, screens and social media: A narrative review of reviews and key studies. *Social Psychiatry and Psychiatric Epidemiology*, 55(4), 407–414. <https://doi.org/10.1007/s00127-019-01825-4>
- Peng, W., Lin, J.-H., Pfeiffer, K. A., & Winn, B. (2012). Need satisfaction supportive game features as motivational determinants: An experimental study of a self-determination theory guided exergame. *Media Psychology*, 15(2), 175–196. <https://doi.org/10.1080/15213269.2012.673850>
- Pew Research Center. (2021). *Mobile fact sheet. Pew research center: Internet, science & tech.* <https://www.pewresearch.org/internet/fact-sheet/mobile/>
- Przybylski, A. K., & Weinstein, N. (2017). A large-scale test of the Goldilocks hypothesis: Quantifying the relations between digital-screen use and the mental well-being of adolescents. *Psychological Science*, 28(2), 204–215. <https://doi.org/10.1177/0956797616678438>
- Ren, W., Zhu, X., & Yang, J. (2022). The SES-based difference of adolescents' digital skills and usages: An explanation from family cultural capital. *Computers & Education*, 177, Article 104382. <https://doi.org/10.1016/j.compedu.2021.104382>
- Roberts, B. W., Kuncel, N. R., Shiner, R., Caspi, A., & Goldberg, L. R. (2007). The power of personality: The comparative validity of personality traits, socioeconomic status, and cognitive ability for predicting important life outcomes. *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, 2(4), 313–345. <https://doi.org/10.1111/j.1745-6916.2007.00047.x>
- Roberts, B. W., & Mroczek, D. (2008). Personality trait change in adulthood. *Current Directions in Psychological Science*, 17(1), 31–35. <https://doi.org/10.1111/j.1467-8721.2008.00543.x>
- Rodríguez-de-Dios, I., Van Oosten, J. M. F., & Igartua, J.-J. (2018). A study of the relationship between parental mediation and adolescents' digital skills, online risks and online opportunities. *Computers in Human Behavior*, 82, 186–198. <https://doi.org/10.1016/j.chb.2018.01.012>
- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online*, 8(2), 23–74.
- 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>
- Soh, P. C.-H., Chew, K. W., Koay, K. Y., & Ang, P. H. (2018). Parents vs peers' influence on teenagers' Internet addiction and risky online activities. *Telematics and Informatics*, 35(1), 225–236. <https://doi.org/10.1016/j.tele.2017.11.003>
- Sohr-Preston, S. L., Scaramella, L. V., Martin, M. J., Neppl, T. K., Ontai, L., & Conger, R. (2013). Parental SES, communication and children's vocabulary development: A 3-generation test of the family investment model. *Child Development*, 84(3), 1046–1062. <https://doi.org/10.1111/cdev.12023>
- Soto, C. J., & John, O. P. (2017). Short and extra-short forms of the Big five inventory-2: The BFI-2-S and BFI-2-XS. *Journal of Research in Personality*, 68, 69–81. <https://doi.org/10.1016/j.jrp.2017.02.004>
- Sriyabhand, T., & John, S. P. (2014). An empirical study about the role of personality traits in information technology adoption. *Humanities, Arts and Social Sciences Studies*, 14(2), 69–92.
- Steinfeld, N. (2021). Parental mediation of adolescent Internet use: Combining strategies to promote awareness, autonomy and self-regulation in preparing youth for life on the web. *Education and Information Technologies*, 26(2), 1897–1920. <https://doi.org/10.1007/s10639-020-10342-w>
- Sun, X., Duan, C., Yao, L., Zhang, Y., Chinyani, T., & Niu, G. (2021). Socioeconomic status and social networking site addiction among children and adolescents: Examining the roles of parents' active mediation and ICT attitudes. *Computers & Education*, 173, Article 104292. <https://doi.org/10.1016/j.compedu.2021.104292>
- Tan, J. J. X., Kraus, M. W., Carpenter, N. C., & Adler, N. E. (2020). The association between objective and subjective socioeconomic status and subjective well-being: A meta-analytic review. *Psychological Bulletin*, 146, 970–1020. <https://doi.org/10.1037/bul0000258>
- Twenge, J. M., & Campbell, W. K. (2018). Associations between screen time and lower psychological well-being among children and adolescents: Evidence from a population-based study. *Preventive Medicine Reports*, 12, 271–283. <https://doi.org/10.1016/j.pmedr.2018.10.003>
- Urbanova, L. B., Holubcikova, J., Madarasova Geckova, A., Reijneveld, S. A., & van Dijk, J. P. (2019). Does life satisfaction mediate the association between socioeconomic status and excessive internet use? *International Journal of Environmental Research and Public Health*, 16(20), 3914. <https://doi.org/10.3390/ijerph16203914>
- Valkenburg, P., Peter, J., & Schouten, A. (2006). Friend networking sites and their relationship to adolescents' well-being and social self-esteem. *CyberPsychology and Behavior: The Impact of the Internet, Multimedia and Virtual Reality on Behavior and Society*, 9, 584–590. <https://doi.org/10.1089/cpb.2006.9.584>
- Vossen, H. G. M., & Valkenburg, P. M. (2016). Do social media foster or curtail adolescents' empathy? A longitudinal study. *Computers in Human Behavior*, 63, 118–124. <https://doi.org/10.1016/j.chb.2016.05.040>
- Wang, X., & Xing, W. (2018). Exploring the influence of parental involvement and socioeconomic status on teen digital citizenship: A path modelling approach. *Educational Technology & Society*, 21(1), 186–199. <https://www.jstor.org/stable/26273879>
- Wright, M. F. (2017). Parental mediation, cyberbullying, and cybertrolling: The role of gender. *Computers in Human Behavior*, 71, 189–195. <https://doi.org/10.1016/j.chb.2017.01.059>
- Younas, F., Naseem, M., & Mustafa, M. (2020). Patriarchy and social media: Women only Facebook groups as safe spaces for support seeking in Pakistan. In *Proceedings of the 2020 international conference on information and communication technologies and development* (pp. 1–11). <https://doi.org/10.1145/3392561.3394639>
- Zilkha, G. (2019). The digital divide: Implications for the eSafety of children and adolescents. *International Journal of Technology Enhanced Learning*, 11(1), 20–35. <https://doi.org/10.1504/IJTEL.2019.10017225>

Article II

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, 108077.

<https://doi.org/10.1016/j.chb.2023.108077>



Young People's digital maturity relates to different forms of well-being through basic psychological need satisfaction and frustration

Franziska Laaber^a, Teresa Koch^a, Marco Hubert^b, Arnd Florack^{a,*}

^a Department of Occupational, Economic, and Social Psychology, Faculty of Psychology, University of Vienna, Austria

^b Department of Management, Aarhus University, Denmark

ARTICLE INFO

Handling Editor: Marianna Sigala

Keywords:

Digital maturity
Information communication technology (ICT)
Self-determination theory
Psychological need satisfaction
Well-being
Adolescent

ABSTRACT

Digital maturity describes the self-determined use of digital technologies to support psychological growth and social adjustment and has been associated with reduced negative mobile device use. However, the relationships between digital maturity and a goal-directed use of technology (i.e., instrumental use) and well-being remain poorly understood. We conducted two studies ($N_{total} = 641$, age 12–18) with parent-adolescent dyads in Austria and Germany and investigated the associations of digital maturity with instrumental device use, indicators of well-being (life satisfaction, positive affect, psychological richness), and ill-being (negative affect, psychological distress), as well as the mediating role of psychological need satisfaction and frustration using structural equation modeling. The results confirmed that digital maturity is linked to instrumental device use. In addition, we found that digital maturity is positively associated with well-being and negatively with ill-being, partially mediated through psychological need satisfaction and frustration. The results indicate that a self-determined use of digital technologies (i.e., digital maturity) may support well-being while shielding against threats and dangers to well-being, and that psychological need satisfaction and frustration are important mechanisms of these relationships.

Digital technologies and services, especially social networking sites, are widely used by adolescents (Crone & Konijn, 2018; Twenge et al., 2019), which has raised concerns about whether young people's heavy use of these technologies is beneficial or harmful (Haddon & Livingstone, 2017; Livingstone et al., 2017; Livingstone & Helsper, 2010). Many of the opportunities offered by digital technologies, for example for recreation (Reinecke & Eden, 2016), learning (Gan et al., 2015), expressing oneself (Huang et al., 2021; Kim & Lee, 2011), or socializing (Koutamanis et al., 2013; Valkenburg & Peter, 2011), are offset by obvious drawbacks, including privacy risks (Shin & Kang, 2016), inappropriate online contact or content (Staksrud et al., 2013), or overuse of technologies (Paulich et al., 2021; Twenge & Campbell, 2018).

Research has provided evidence that young people can be particularly vulnerable to such powerful influences in online environments (Vandoninck et al., 2013). In studies, children repeatedly reported negative experiences of viewing disturbing content (Livingstone et al., 2014), experiencing ostracism by others online (Büttner & Rudert, 2022; Li et al., 2023), or having difficulties in reducing their screen time (Schulz van Endert, 2021). However, large-scale studies linking general digital technology use (e.g., screen time) to well-being tend to find only

weak negative (Orben & Przybylski, 2019; Twenge & Campbell, 2018), positive (Przybylski & Weinstein, 2019), or no significant relationships (Johannes et al., 2022; for a recent meta-review see Valkenburg et al., 2022).

Given the mixed evidence regarding the relationship between technology use and well-being, we argue that it is crucial to move beyond examining the correlation between screen time and well-being. Instead, we put forward that a more nuanced exploration is needed that examines the specific ways in which technology is used and its subsequent effects on well-being. Against this background, researchers have recently developed the concept of digital maturity to reflect how digital technologies are used to achieve personal goals, positive social interactions, and psychological growth (Laaber et al., 2023). This concept is rooted in self-determination theory (Deci & Ryan, 2000; Ryan & Deci, 2000) and implies that the use of technology is beneficial to an individual's well-being if the use of technology serves and does not threaten important psychological needs such as autonomy, competence, and relatedness (Horwood & Anglim, 2019; Laaber et al., 2023; Przybylski et al., 2010). However, the hypothesis that digital maturity, as a combination of the ability to use digital technology in a self-determined

* Corresponding author. Department of Occupational, Economic and Social Psychology, Faculty of Psychology, University of Vienna, Universitätsstraße 7, A-1010, Wien, Austria.

E-mail address: arnd.florack@univie.ac.at (A. Florack).

<https://doi.org/10.1016/j.chb.2023.108077>

Received 31 August 2023; Received in revised form 24 November 2023; Accepted 1 December 2023

Available online 8 December 2023

0747-5632/© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

way and the ability to cope with the challenges of digital technology, supports well-being, remains untested.

Investigating the relationship between digital maturity and well-being is critical because it is unclear whether a domain-specific capability such as digital maturity can influence well-being, understood as life satisfaction, affective experiences, and psychological richness that is not limited to one domain. In fact, research has shown that well-being is highly stable over time (Chamberlain & Zika, 1992; Eid & Diener, 2004; Lucas & Diener, 2009). Moreover, it is important to note that mature behavior is not necessarily positively related to well-being (Bauer et al., 2005; Bauer & McAdams, 2004). This may be particularly true in the digital domain because many of the activities that are considered undesirable or immature provide frequent positive hedonic experiences, such as playing video games or watching TikTok videos (Schulz van Endert, 2021). In contrast, mature behaviors, such as learning a programming language, are related to short-term frustrations. Thus, it remains unclear how digital maturity is related to mature use behaviors, well-being, which types of well-being, and what the mediators of these relationships are.

In the present research, we addressed these research gaps. We investigated the links between digital maturity, psychological need satisfaction and frustration, and well-being to better understand how mature technology use relates to overall well-being. We conducted two studies of parent-adolescent dyads to examine whether more digitally mature adolescents are more likely to satisfy their basic psychological needs, and less likely to frustrate those needs, which in turn is related to increased well-being and reduced ill-being. In addition, we examined whether digital maturity is associated with instrumental goal-directed use of mobile devices.

We found that adolescents with a higher digital maturity are more likely to use mobile devices in an instrumental, goal-directed way. Moreover, we found a positive relationship between digital maturity and need satisfaction and a negative relationship between digital maturity and need frustration, which partially mediated the relationships between digital maturity and well-being and ill-being. Our research contributes to the understanding of the mechanisms underlying the associations between digital maturity and indicators of overall well-being beyond personal and family resources, including self-regulation, age, gender, and socioeconomic status.

1. Theoretical background

1.1. Psychological need satisfaction and frustration in digital contexts

According to self-determination theory (SDT; Deci & Ryan, 2000; Ryan & Deci, 2000), people are internally motivated to grow and to develop a cohesive sense of their self through gaining mastery in overcoming challenges and seeking new experiences (Rigby & Ryan, 2016; Ryan & Deci, 2000). Satisfying the three basic psychological needs supports psychological well-being: Competence describes the need to be effective and is satisfied when people meet challenges or learn new things. Autonomy refers to the need to make voluntary decisions and perform activities and is satisfied when people support and value what one is doing, and relatedness describes the need to have authentic social relationships which is satisfied when people feel respected and valued by others (Deci & Ryan, 2000; Rigby & Ryan, 2016). In particular, the satisfaction of basic needs has been associated with well-being outcomes such as positive experiences and vitality (Ryan & Deci, 2011). On the other hand, the frustration of basic needs has been associated with negative outcomes, such as emotional distress (Vansteenkiste & Ryan, 2013).

Digital technologies provide ways to satisfy or frustrate psychological needs, sometimes simultaneously (Tamborini et al., 2010). While the satisfaction of psychological needs through digital technologies, such as while playing videogames, is associated with positive well-being outcomes (Erdmann & Dienlin, 2022; Formosa et al., 2022; Lavoie & Zheng,

2023; Peng et al., 2012; Przybylski et al., 2010), thwarted need satisfaction in digital contexts is associated with negative outcomes, such as addiction to social networking sites (Masur et al., 2014), decreased videogame enjoyment, or disordered videogame motivation (Przybylski et al., 2009). The frustration of psychological needs through digital technologies can have direct negative effects on users, but the fact that online environments can also be highly gratifying can also put some users at risk for digital overuse or addiction, especially when used as a form of escape from offline problems (Kardesfelt-Winther, 2014). Thus, digital technologies have the potential to both support and frustrate the satisfaction of psychological needs, and a mature use of technology to serve personal goals should therefore support need satisfaction.

It is important to note that need satisfaction and frustration can be different motivational forces and can have different effects on well-being. Therefore, they should be treated as related but separate constructs. For example, in their study of Facebook use, Sheldon et al. (2011) showed that people who lacked social relationships in their offline lives were able to reconnect with others through Facebook. However, although people felt more connected through Facebook, their feelings of disconnection remained (Sheldon et al., 2011). These findings illustrate that while it is possible to gain need satisfaction through digital technologies, the need may remain unmet in offline life. This is in line with research showing that need frustration is not simply the absence of need satisfaction, but a distinct construct that, for example, better predicts ill-being outcomes (e.g., negative affect) than need satisfaction (Bartholomew et al., 2011; Bradshaw et al., 2023; Longo et al., 2016; Unanue et al., 2017). Moreover, experiencing need frustration is usually accompanied by low need satisfaction, but low need satisfaction is not necessarily associated with high need frustration (Neubauer et al., 2022). Thus, we expect that a mature technology use for personal goals should not only increase need satisfaction but also decrease need frustration. We also expect increased need satisfaction due to digital maturity to be associated with increased well-being, and decreased need frustration with decreased ill-being.

1.2. Digital maturity and well-being – using technology for personal development and social adjustment

From the perspective of self-determination theory, the satisfaction of psychological needs is essential to human well-being (Ryan & Deci, 2017). In this context, it is reasonable to assume that using digital technologies maturely and in ways that satisfy psychological needs can support overall well-being. Digital maturity provides a novel and holistic view on young people's digital technology use and is defined as the self-determined use of digital technologies which supports psychological growth and social adjustment (Laaber et al., 2023). Rooted in self-determination theory and psychosocial maturity (Bleidorn, 2015; Deci & Ryan, 2000; Ryan & Deci, 2000; Wehmeyer et al., 2017), digital maturity transfers two key pillars of maturity to the use of technology: adjustment and growth (Staudinger & Kunzmann, 2005). The concept combines interpersonal skills relevant to digital contexts with aspects of individual growth with digital technologies (Arenas & Yazdi, 2022; Laaber et al., 2023). Ten dimensions of digital maturity should support using technology in an autonomous and self-determined way (i.e., *autonomous choice to use mobile devices; autonomy within digital contexts*), overcoming digital challenges and using technology to achieve goals (i.e., *digital literacy; individual growth; support-seeking regarding digital problems; digital risk awareness*), and interacting socially responsible with others in the digital world (i.e., *regulation of negative emotions; regulation of impulses; respect towards others; digital citizenship*).

The concept of digital maturity indicates that a mature use of technology can be beneficial for adolescents if they use technology as a tool to achieve own goals while preventing being harmed. In particular, the theoretical foundation of digital maturity implies that a mature use should support the experience of autonomy, mastery, and relatedness, which in turn may also support overall well-being. While there is some

evidence that higher levels of digital maturity are associated with less negative device use (Laaber et al., 2023), their relationship to need satisfaction and well-being has not been tested. Thus, it is reasonable to assume that digital maturity can support need satisfaction, while also reducing need frustrations. Young people who use digital technologies for their own positive development (e.g., learning new things), and for positive social interactions (e.g., respecting others online) may experience that technology can be a means to pursue interests, be efficient, and feel socially connected. On the other hand, digital maturity also includes autonomy in choosing digital content, technical skills to use technology, and ways to handle digital problems, which have the potential to decrease need frustrations. For example, adolescents who actively decide which content they would like to see online rather than following others, may shield themselves better from frustrating their need for autonomy. Thus, we expect that autonomy, competence, and relatedness needs can be both more satisfied and less frustrated with digital maturity.

The relationship between digital maturity and overall well-being, understood as life satisfaction, affective experiences, and psychological richness, is less obvious. In fact, digital maturity should promote using digital technology to support individual growth and social adaptation. This notion implies that digitally mature adolescents use technology in an instrumental way to achieve own goals. However, experiences that move people forward, change perspectives, and support personal development are often challenging and can elicit short-term negative effects (Oishi et al., 2021). For example, there may be initial frustration, perhaps anger, and effort needed in using technology to learn something new, such as cutting a video or learning a programming language. Yet, such novel experiences which move people forward can increase their psychological richness on a long-term perspective (Oishi et al., 2021). Psychological richness expands traditional views of the “good life” beyond happiness (i.e., hedonic well-being) and meaning in life (i.e., eudaimonic well-being; Oishi & Westgate, 2022). A psychologically rich life is driven by novel, complex, and perspective-changing experiences, and is related to but distinct from a happy or meaningful life, as it can also include negative emotions (Oishi & Westgate, 2022). In other words, while digital maturity may be associated with frustrations in the short run, in the long run, digital maturity may be associated with psychological richness by supporting the use of technology for personal and social development.

Digital technologies offer various opportunities to pursue interests, accomplish tasks and experience mastery, as well as to connect with others. However, not all adolescents can make use of digital opportunities (Verduyn et al., 2022). Therefore, it is crucial to consider how adolescents use technology and whether they are using technology to satisfy their needs for autonomy, competence, and relatedness, which can ultimately support their overall well-being.

Thus, we expect that digital maturity is positively associated with indicators of well-being and negatively associated with indicators of ill-being, and that psychological need satisfaction and frustration partially mediate these relationships beyond personal and family resources, including self-regulation, age, gender, and socioeconomic status.

2. The present research

We conducted two cross-sectional studies of parent-adolescent dyads in German-speaking countries to examine the associations between digital maturity, need satisfaction and frustration, instrumental device use, and well-being and ill-being. The first objective was to examine whether digital maturity supports an instrumental device use, as the concept suggests (Laaber et al., 2023). The active use of technology, such as connecting with others or achieving personal goals, can be empowering for individuals and more beneficial than the passive use of technology, such as scrolling through social media (Hill et al., 2015; Verduyn et al., 2017). Thus, being digitally mature and using technology in a self-determined way should also support a more instrumental device

use, which can ultimately contribute to need satisfaction and well-being (Przybylski et al., 2010; Verduyn et al., 2017).

The second objective was to explore how digital maturity relates to well-being and to which types of well-being. While literature suggests that general personality maturity is not necessarily related to well-being (Bauer et al., 2005), we suggest that digital maturity is positively related to indicators of well-being including psychological richness, and negatively related to indicators of ill-being, as a mature use of technology to achieve own goals should offer new opportunities for learning and development while also reducing negative technology uses (Laaber et al., 2023).

The third objective was to investigate whether psychological need satisfaction and frustration are mediators of the relationships between digital maturity and indicators of well-being and ill-being. Using technology in a self-determined, effective, and socially responsible way, as digital maturity implies, should increase the satisfaction of the needs for autonomy, competence, and relatedness, which in turn can support well-being (Ryan & Deci, 2011), and decrease ill-being (Vansteenkiste & Ryan, 2013).

The ethical standards for both studies (Study 1 and 2) were reviewed and approved by the Ethics Committee of the university of the first author (reference number 00615). Data, analysis scripts, the preregistration of Study 2, and supplemental materials are available on the Open Science Framework (https://osf.io/mfk4y/?view_only=f2b10fecdc514b6ebb10649c137b6dc2) (<https://osf.io/mfk4y/>).

3. Study 1

In Study 1, we examined the associations between digital maturity and instrumental, goal-directed mobile device use, life satisfaction, and psychological need satisfaction and frustration. Second, we tested our proposed model (Fig. 1) in which digital maturity predicts increased instrumental mobile device use, and increased life satisfaction, partially mediated through psychological need satisfaction and frustration, while controlling for self-regulation, age, gender, and socioeconomic status. We controlled for self-regulation to examine the unique associations between digital maturity and the dependent variables, as researchers have suggested that self-regulation skills are crucial for beneficial technology use (Reinecke et al., 2022) and a driver for psychological functioning (Chu et al., 2020; Eisenberg, 2000). We also controlled for socioeconomic status because previous research found that socioeconomic status positively predicts digital maturity through increased parental support in their technology use (Koch et al., 2023), which has the potential to influence need satisfaction, need frustration, and life satisfaction as well. In addition, we controlled for the influence of age and gender on the main outcome variables because previous research revealed declines in well-being during adolescence, especially for girls (González-Carrasco et al., 2017; Yoon et al., 2023). We assumed that digital maturity predicts an increased instrumental device use, which consequently leads to increased need satisfaction. We tested our proposed model using structural equation modeling (SEM) in Stata (Version 17.0, SE). To assess model fit, we used the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA), and the Standardised Root Mean Square Residual (SRMR). We applied common recommendations that a CFI and TLI greater than 0.90, with RMSEA and SRMR below 0.08, suggest a good fit (Hu & Bentler, 1999). In addition, to assess the indirect effects, we used the PROCESS macro for SPSS (Version 28.0) to analyze the indirect effects of the parallel mediation model using model 4 with 5,000 bootstrap samples for 95% percentile bootstrap confidence intervals (Hayes, 2017).

3.1. Method

3.1.1. Participants

A sample of 314 parent-adolescent dyads was recruited via the

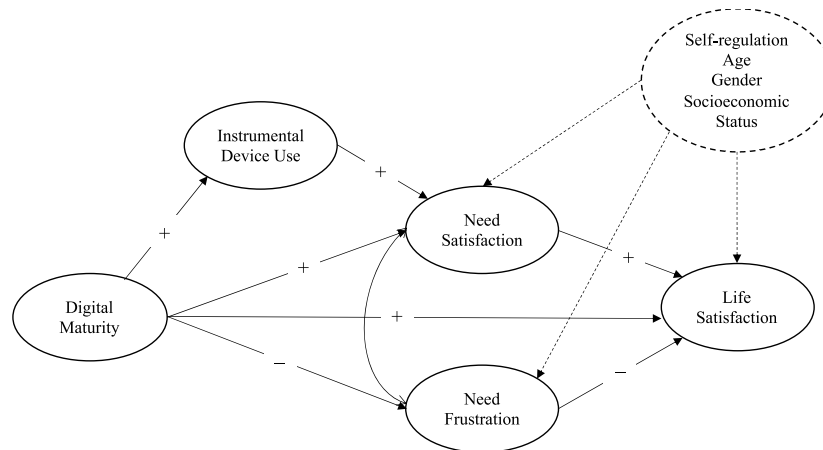


Fig. 1. Research Model in Study 1

Note. Self-regulation, age, gender, and socioeconomic status are used as control variables in the model.

parents through an access panel in Austria ("Talk"). Answers from both a parent and their child were collected. Regarding the adolescents, 12 participants failed two out of two attention check items (e.g., "Please tick 'Never' so that we know that you have read and understood this sentence"; Abbey & Meloy, 2017) and were removed from the analysis; 10 participants did not fall into the intended age range of 12–18 and were also excluded from the analysis. One person did not indicate their gender and was removed from the analysis. The final sample we used for the analyses consisted of 292 adolescents (50.7% girls, 49.3% boys) with a mean age of 14.6 years ($SD = 1.95$), and 292 parents (54.5% women; 45.5% men) with a mean age of 44.1 years ($SD = 9.4$). Regarding the parents, 54.5% (159) of parents were the child's mother, 43.8% (128) were the father, 1.7% (5) indicated some other relation to the child.

3.1.2. Measures

The Digital Maturity Inventory (DIMI). We used the Digital Maturity Inventory (DIMI; Laaber et al., 2023) to measure adolescents' digital maturity. The measure consists of 32 items which measure digital maturity on 10 dimensions. Participants were asked to think about their mobile device use (i.e., mobile, tablet, laptop) and had to complete several items for the dimensions of autonomous choice to use mobile devices (e.g., "I am online because I feel like I have to be online all the time"; reversed), autonomy within digital contexts (e.g., "I choose the content I want to see"), digital literacy (e.g., "I know how to change the privacy settings [for example, deactivate cookies]"), individual growth in digital contexts (e.g., "I learn new skills"), digital risk awareness (e.g., "I make sure to be careful"), support-seeking regarding digital problems (e.g., "I ask others for help when I have a problem"), 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"; reversed), regulation of impulses in digital contexts (e.g., "when using a mobile device and somebody insults me, I try to get back at them"; reversed), respect towards others in digital contexts (e.g., "I care about the feelings of others"), and digital citizenship (e.g., "I use the internet to support campaigns for issues like environmental protection or to spread awareness for climate change").

All dimensions were measured on 5-point scales ranging from 1 = *not at all* to 5 = *completely* for the digital literacy dimension; 1 = *never* to 5 = *always* for all other dimensions. The final digital maturity score was created according to Laaber et al. (2023), with a rescaling of the composite digital maturity score to values between 1 and 5 to improve the

interpretability of the mediation results (Cronbach's $\alpha = .84$; for Cronbach's alpha per dimension see Supplemental S1).

Life Satisfaction. We used the Cantril Ladder of Life Scale (Cantril, 1965) to measure adolescents' general life satisfaction. The measure, which has been used in studies with children (e.g., Boer et al., 2020), asks participants to rank their satisfaction with their life on a 10-strung ladder, with 10 representing the best possible life for them and 0 their worst possible life.

Basic Psychological Need Satisfaction and Frustration. To measure psychological need satisfaction and frustration, we used the German version of the 18-item General Need Satisfaction and Frustration Scale (GNSF; Neubauer et al., 2022) which has been adapted for the use with children. Participants were asked to think about what they did and how they felt during the last four weeks and indicated their autonomy satisfaction (e.g., "In the past four weeks, I could choose what I do"), autonomy frustration (e.g., "In the past four weeks, I had to do a lot of things I did not want to do"), competence satisfaction (e.g., "In the past four weeks, I was good at doing most things"), competence frustration (e.g., "In the past four weeks, there was something I did not do well"), relatedness satisfaction (e.g., "In the past four weeks, I got along well with others"), and relatedness frustration (e.g., "In the past four weeks, I had the feeling that other people do not really like me") on a 5-point scale ranging from 1 = *not true at all* to 5 = *completely true*. Items for need satisfaction were averaged into three satisfaction scores (Cronbach's alpha for autonomy satisfaction was .87, for competence satisfaction .83, for relatedness satisfaction .86) and the frustration items into three frustration scores (Cronbach's alpha for autonomy frustration was .84, for competence frustration .81, for relatedness frustration .78). Finally, we averaged all need satisfaction items into a general need satisfaction score (Cronbach's $\alpha = .85$), and all need frustration items into a general need frustration score (Cronbach's $\alpha = .85$).

Self-Regulation. To measure general self-regulation skills, we used the 7-item Self-Regulation Scale (SRS; Luszczynska et al., 2004) which focuses on assessing attentional control during goal pursuit, a key aspect of dispositional self-regulation. Participants responded to items such as "I can concentrate on one activity for a long time, if necessary", or "After an interruption, I don't have any problem resuming my concentrated style of working" on a 4-point scale from 1 = *not true* to 4 = *completely true*. We selected six items from the SRS to create the overall self-regulation score with a Cronbach's alpha of .81.

Instrumental Device Use. We created seven items to measure instrumental, goal-directed device use (“Mobile devices help me get tasks done”; “Mobile devices support me in everyday life”; “I see mobile devices as useful support”; “Mobile devices are a tool for me to accomplish tasks”; “Mobile devices are primarily a means to an end for me”; “Mobile devices are useful to achieve my goals”; “For me, mobile devices are first and foremost a useful tool”). The seven statements describe ways of using mobile devices as a tool to accomplish personal goals and tasks. Participants stated their agreement to the statements on a 11-point scale (1 = *do not agree at all*, 6 = *partly*, 11 = *strongly agree*). An exploratory factor analysis (EFA) with varimax rotation including the seven items resulted in a one-factor solution explaining 53.82% of variance. However, one item (“Mobile devices are primarily a means to an end for me”) had a low factor-item loading of .35. When repeating the EFA without this item, all items loaded on one factor explaining 60.55% of variance and their factor-item loadings all exceeded .64. Therefore, we averaged the remaining six items into a single score for instrumental device use (Cronbach’s $\alpha = .90$).

Sociodemographic Information. We collected participants’ sociodemographic data such as education, nationality, and family status through the parents at the beginning of the online questionnaire. To assess the subjective socioeconomic status, parents ranked their social status position on a 10-strung ladder, with 1 indicating the lowest status and 10 indicating the highest status compared to other people in their respective country (Adler et al., 2000; Côté et al., 2021). Adolescents indicated their age (month and year of birth) and gender at the beginning of their online survey section.

Further Measures. Participants further provided information on general mobile device use and use of social networking sites at the end of the questionnaire.

3.1.3. Procedure

At the beginning of the online survey, parents or guardians were informed about the study procedures and gave written consent. They provided sociodemographic information about themselves and their participating child. Once they completed their part, parents were informed that the adolescent’s section was about to begin and were asked to allow their child to answer the survey in private. Adolescents were informed about the study and gave written consent before participating. After an introduction and definition of mobile devices, participants indicated their age and gender and were then presented with the measures in random order. Towards the end of the survey, they were asked about their general use of mobile devices and social networking sites. Finally, both the adolescent and the parent provided their consent to submit their responses. Anonymity and data confidentiality were assured, and a debriefing was provided at the study’s conclusion.

3.2. Results

3.2.1. Associations between digital maturity, need satisfaction and frustration, life satisfaction, and instrumental device use

Table 1 summarizes the descriptive statistics and zero-order correlations of the main study variables. A discriminant validity assessment of the measures used in Study 1 revealed that all average variance extracted (AVEs) exceeded the corresponding squared inter-construct correlations (i.e., shared variances), thus establishing discriminant validity (Fornell & Larcker, 1981; Supplemental S2).

Consistent with our expectation, digital maturity had a weak, positive correlation with instrumental device use and moderate, positive correlations with life satisfaction, need satisfaction, and self-regulation. There was a negative correlation between digital maturity and need frustration. The correlations between digital maturity and these variables remained significant after controlling for self-regulation. The correlations between digital maturity and satisfaction and frustration of the individual needs (autonomy, competence, relatedness) are reported in the Supplemental Materials S3. In addition, digital maturity had weak positive correlations with age and socioeconomic status (Table 1). The results support the theoretical assumption of digital maturity that adolescents with higher levels of digital maturity are also more likely to use mobile devices in an instrumental, goal-directed way.

3.2.2. Structural model: psychological need satisfaction and frustration as mediators of the correlation between digital maturity and well-being

We hypothesized that the relationship between digital maturity and well-being could be partially explained by higher levels of psychological need satisfaction and lower levels of need frustration, while controlling for general self-regulation, age, gender, and socioeconomic status (Fig. 1). Moreover, we assumed that digital maturity would predict an increased instrumental device use, which consequently increases psychological need satisfaction (Fig. 1).

The estimation of the structural path model resulted in a good fit (RMSEA = 0.052; CFI = 0.996; TLI = 0.951; SRMR = 0.013). The results of the SEM model are reported in Fig. 2. Table 2 summarizes the direct effects of the structural paths. Digital maturity had a positive impact on instrumental device use, life satisfaction, and need satisfaction, and a negative impact on need frustration. With higher digital maturity, young people show increased instrumental device use, higher life satisfaction, need satisfaction, and lower need frustration. As expected, need satisfaction positively influenced life satisfaction, while need frustration negatively predicted life satisfaction. Moreover, instrumental device use had a small positive impact on need satisfaction. Regarding the control variables, self-regulation had significant effects on need satisfaction ($\beta = .402, p < .01$), need frustration ($\beta = -.217, p < .01$), but not on life satisfaction. Socioeconomic status was a predictor for need satisfaction ($\beta = .121, p < .01$) and life satisfaction ($\beta = .221, p < .01$), but not for need frustration. Gender had a small negative impact on need satisfaction ($\beta = -.095, p < .05$), suggesting that girls are more likely to report

Table 1
Means, Standard Deviations, and Correlations of Study Variables

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9
1. Digital Maturity	292	3.69	0.41	–								
2. Life satisfaction	292	7.08	1.61	.40**	–							
3. Need satisfaction	292	3.80	0.64	.43**	.44**	–						
4. Need frustration	292	2.64	0.80	–.48**	–.41**	–.62**	–					
5. Instrumental device use	292	8.46	1.92	.24**	.07	.24**	–.20**	–				
6. Self-regulation	292	2.97	0.53	.51**	.36**	.54**	–.41**	.19*	–			
7. Age	292	14.59	1.95	.22**	.01	.15*	–.11	.28**	.25**	–		
8. Gender ^a	292	–	–	.06	–.08	–.10	.07	.06	–.06	.06	–	
9. Socioeconomic status	292	6.12	1.50	.17*	.33**	.21**	–.15*	.03	.13*	–.02	.01	–

Note. * $p < .05$. ** $p < .01$. Mean entries of digital maturity, need satisfaction and frustration are based on a 5-point scale. Life satisfaction was measured from 0 to 10; socioeconomic status from 1 to 10; instrumental device use from 1 to 11; self-regulation on a 4-point scale.

^a Gender is coded as follows: 1 = boys, 2 = girls.

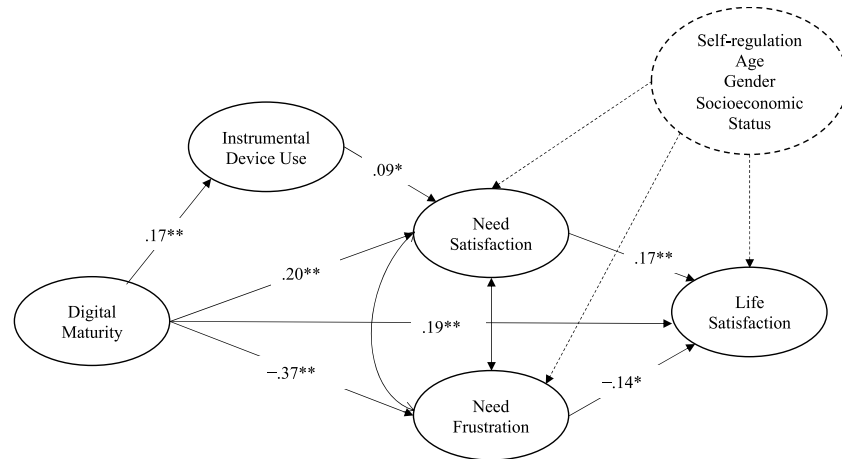


Fig. 2. SEM Results Study 1

Note. $N = 292$. * $p < .05$. ** $p < .01$. Self-regulation, age, gender, and socioeconomic status are used as control variables in the model. RMSEA = 0.052; CFI = 0.996; TLI = 0.951; SRMR = 0.013.

Table 2
Direct Effects of Structural Paths ($N = 292$)

Path	β	SE	p	95% CI
Digital maturity $\rightarrow$ instrumental device use	.166	.064	.010	[.040; .292]
Digital maturity $\rightarrow$ need satisfaction	.196	.055	<.001	[.087; .305]
Instrumental device use $\rightarrow$ need satisfaction	.089	.045	.048	[.001; .176]
Digital maturity $\rightarrow$ need frustration	-.371	.056	<.001	[-.480; -.262]
Digital maturity $\rightarrow$ life satisfaction	.187	.060	.002	[.069; .305]
Need satisfaction $\rightarrow$ life satisfaction	.174	.066	.009	[.044; .304]
Need frustration $\rightarrow$ life satisfaction	-.144	.064	.024	[-.269; -.019]

Note. β = standardized path coefficient.

less need satisfaction. Age had no impacts on the dependent variables.

We found significant indirect effects of digital maturity on life satisfaction via need satisfaction and need frustration (Table 3). With higher digital maturity, young people reported increased need satisfaction, and decreased need frustration, which linked to more life satisfaction. Hence, need satisfaction and frustration partially mediated the relationship between digital maturity and life satisfaction, while controlling for self-regulation, age, gender, and socioeconomic status.

3.3. Discussion

In Study 1, we found broad support for our hypotheses. Digital

Table 3
Indirect Effects of the Model ($N = 292$)

Path	b	SE	95% CI
Digital maturity $\rightarrow$ need satisfaction $\rightarrow$ life satisfaction	.146	.082	[.017; .332]
Digital maturity $\rightarrow$ need frustration $\rightarrow$ life satisfaction	.212	.147	[.018; .414]

Note. b = unstandardized regression coefficient; 95% percentile bootstrap confidence intervals are based on 5000 bootstrap samples. Controlling for self-regulation, age, gender, socioeconomic status.

maturity was associated with an instrumental device use, life satisfaction, psychological need satisfaction and frustration. Because digital maturity should foster an autonomous and self-determined technology use (Laaber et al., 2023), we supposed that adolescents with higher digital maturity would use technology in a more instrumental and goal-directed way. In fact, research suggests that using technology more actively, such as connecting with others, rather than passively consuming or being distracted by it, contributes to well-being (Meier & Krause, 2022; Verduyn et al., 2017). We think that using technology in a mature way, for example as a tool for personal goals, offers opportunities to experience psychological need satisfaction while reducing need frustration, ultimately contributing to overall well-being.

Controlling for self-regulation in the model enabled to assess the unique influences of digital maturity on the main outcome variables, as we found that self-regulation was indeed positively associated with digital maturity, life satisfaction, need satisfaction, and instrumental device use, and negatively associated with need frustration. In addition, the positive correlation between socioeconomic status and digital maturity supports previous research on the role of environmental factors in the development of digital maturity (Koch et al., 2023).

Study 1 provided initial support for this hypothesized model. However, a limitation of Study 1 is that well-being was measured with a one-item measure for life satisfaction due to economic restraints. This measure does not fully capture a broad range of well-being and, importantly, also ill-being, which we hypothesize to be two important, distinct aspects of well-being in the digital context, influenced by satisfaction and frustration of basic needs. Another limitation of Study 1 is that all variables were self-reported by the adolescents. Thus, the results may have been affected by method biases such as common method variance and shared evaluative biases, in which variation in the data is due to the measurement method rather than the variables of interest and can inflate correlations (Lucas et al., 1996; Podsakoff et al., 2003; Schimmack et al., 2008). Therefore, in Study 2, we extended the findings by including more holistic measures of both well-being and ill-being, while limiting the influence of common method biases.

4. Study 2

In Study 2 we tested our proposed model (Fig. 3) in which basic

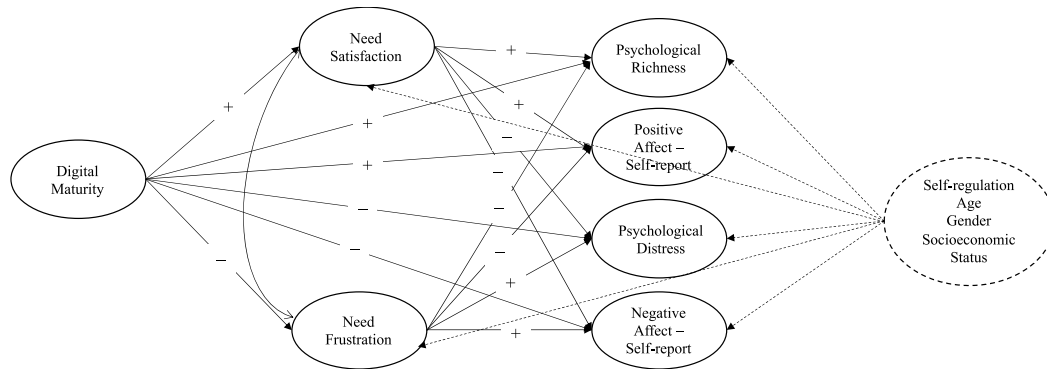


Fig. 3. Research Model A in Study 2: Prediction of Adolescents' Well Being (Self-Report Measures)

Note. Self-regulation, age, gender, and socioeconomic status are used as control variables in the model.

psychological need satisfaction and frustration are two mechanisms explaining the relationships between digital maturity, well-being, and ill-being. We assumed that adolescents with higher digital maturity are more likely to experience need satisfaction and less likely to experience need frustration, which links to increased well-being and decreased ill-being, beyond personal (self-regulation, age, gender) and family (socioeconomic status) influences. We used measures of both well-being (psychological richness, positive affect), and ill-being (psychological distress, negative affect) as dependent variables. In addition, we used a parent-report and an adolescent self-report measure of positive and negative affect to reduce the influence of common method bias. We also applied Harman's one-factor method to test for common method bias using all variables in the model (Podsakoff & Organ, 1986). We assessed two models. In Model A (Fig. 3), we used adolescent self-report measures for all variables. In Model B (Fig. 4), we assessed adolescents' positive and negative affect through their parents. In both models, we controlled for adolescent self-regulation, age, gender, and socioeconomic status. We conducted the analyses using the same software and model fit indices as in Study 1.

The study was pre-registered on As-predicted (reference no. #135943).

4.1. Method

4.1.1. Participants

A sample of 400 parent-adolescent dyads was recruited via the parents through an access panel in Germany ("Talk"). Answers from both a parent and the adolescent were collected. Following our preregistered exclusion criteria, 41 participants failed at least two out of three attention check items, and were removed from the analysis; 10 participants did not fall into the intended age range of 12 to 18 years and were also excluded from the analysis; in 12 cases, the parent and adolescent gave diverging responses regarding the adolescent's year and month of birth and were excluded from the analysis. In total, based on the criteria, we excluded 51 participants. The final sample we used for the analyses consisted of 349 adolescents (46.7% girls, 53.0% boys, 1 non-binary) with a mean age of 14.87 years ($SD = 1.72$), and 349 parents (48.7% women; 51.3% men) with a mean age of 45.49 years ($SD = 9.78$). Regarding the parents, 48.1% (168) were the child's mother, 51.3% (179) were the father, 0.6% (2) indicated some other relation to the child.

4.1.2. Measures completed by adolescents

The Digital Maturity Inventory (DIMI). As in Study 1, we used the Digital Maturity Inventory (DIMI; Laaber et al., 2023) to measure

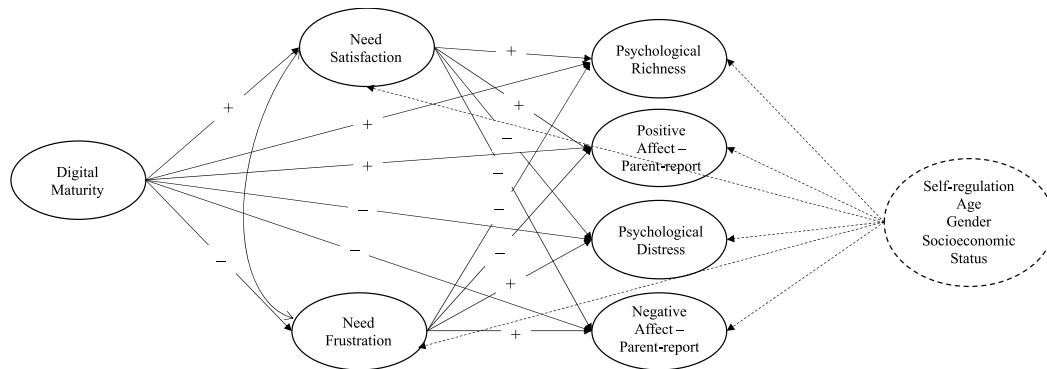


Fig. 4. Research Model B in Study 2: Prediction of Adolescents' Positive and Negative Affect (Assessed by the Parents), and Psychological Richness and Psychological Distress (Self-Report)

Note. Self-regulation, age, gender, and socioeconomic status are used as control variables in the model.

adolescents' digital maturity (Cronbach's $\alpha = .86$; for Cronbach's alpha per dimension see Supplemental S4).

Basic Psychological Need Satisfaction and Frustration. We used the German version of the 18-item General Need Satisfaction and Frustration Scale (GNSF; Neubauer et al., 2022) to measure satisfaction of the need for autonomy (Cronbach's $\alpha = .83$), competence (Cronbach's $\alpha = .80$), relatedness (Cronbach's $\alpha = .87$), and frustration of the need for autonomy (Cronbach's $\alpha = .81$), competence (Cronbach's $\alpha = .83$), and relatedness (Cronbach's $\alpha = .82$). We averaged all need satisfaction items into a general need satisfaction score (Cronbach's $\alpha = .87$), and all need frustration items into a general need frustration score (Cronbach's $\alpha = .87$).

Positive and Negative Affect. We measured adolescents' positive and negative affect using the German version by Breyer and Bluemke (2016) of the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). Participants were asked to think about what they did and how they felt during the last four weeks and indicated the extent to which they experienced 10 positive affective states (e.g., "proud"; "active"; "strong"), and 10 negative affective states (e.g., "distressed"; "guilty"; "irritable") on a 5-point scale (1 = *not at all*, 5 = *extremely*). We averaged the 10 positive affect items into a positive affect score (Cronbach's $\alpha = .90$) and the 10 negative affect items into a negative affect score (Cronbach's $\alpha = .92$).

Psychological Richness. To measure psychological richness, we selected seven items from the Psychologically Rich Life Questionnaire (Oishi et al., 2019), translated them into German, and slightly adapted some wordings for use with adolescents (e.g., using present tense). The items were: "My life is experientially rich"; "I feel many different emotions in my life. For example, sometimes I am happy, sad, excited, or scared, but it is not always the same"; "I have a lot of novel experiences"; "My life is full of diverse experiences"; "I have a lot of personal stories to tell"; "When I turn old, I am likely to say 'I had an interesting life'"; "I have a lot of interesting experiences". Participants indicated their agreement to the statements on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*). We averaged the items into one score for psychological richness (Cronbach's $\alpha = .89$).

Psychological Distress. We measured psychological distress using the German version (Giesinger et al., 2008) of the Kessler-6-item scale of mental distress (Kessler et al., 2002), which has been used in studies with adolescents (e.g., Twenge & Joiner, 2020). Participants indicated the extent to which they felt mentally distressed (e.g., "hopeless"; "restless or fidgety"; "worthless") on a 5-point scale from 1 = *never* to 5 = *always*. We summed the six items into one score for psychological distress (Cronbach's $\alpha = .92$).

Self-Regulation. As in Study 1, we measured general self-regulation skills with six items from Luszczynska et al.'s (2004) Self-Regulation Scale (SRS; Cronbach's $\alpha = .85$).

Further Measures. At the end of the questionnaire, participants provided information on general mobile device use and use of social networking sites.

Sociodemographic Information. Adolescents indicated their age (month and year of birth) and their gender at the end of the online questionnaire.

4.1.3. Measures completed by parents

Sociodemographic Information. At the beginning of the online questionnaire, parents provided basic sociodemographic information about themselves and their child, including age (month and year of birth), gender, education, nationality, and family status. As in Study 1, they reported their subjective socioeconomic status on a 10-strung ladder (Adler et al., 2000; Côté et al., 2021).

Adolescent Positive and Negative Affect. We used a parent-report version of the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) to measure adolescents' positive and negative affect. Participants were asked to indicate the extent to which their child experienced the positive affective and negative affective states on a 5-point

scale (1 = *not at all*, 5 = *extremely*). Cronbach's alpha for positive affect was .88, and .91 for negative affect.

4.1.4. Procedure

The recruitment of participants and the procedure during the online survey were identical to Study 1. Study materials were presented in German language and in random order during the online survey.

4.2. Results

4.2.1. Common method bias

Using Harman's one-factor method to test for common method bias of our measures (Podsakoff & Organ, 1986), an exploratory factor analysis including all items of all constructs revealed that the first factor accounted for only 24.64% of the variance in the unrotated factor structure, which is below the 50% cut-off recommendation of Harman's test and below the 70% bias threshold identified by Fuller et al. (2016). The result suggests that there was no general factor explaining variance in the data, and thus no major problem of common method bias in our study.

4.2.2. Associations between digital maturity, need satisfaction and frustration, well-being, and ill-being

Table 4 summarizes the descriptive statistics and zero-order correlations of the main study variables. A discriminant validity assessment of the measures used in Study 2 revealed that all AVEs exceeded the corresponding squared inter-construct correlations (i.e., shared variances) except for negative affect (self-reported) and psychological distress, which were highly correlated (Fornell & Larcker, 1981; Supplemental S5). The analysis indicates that psychological distress and negative affect map similar and highly related constructs making it difficult to distinguish between the two constructs in the interpretation of the results.

Consistent with our expectation, digital maturity had moderate, positive correlations with need satisfaction, positive affect, psychological richness, and self-regulation as well as negative correlations with need frustration, negative affect, and psychological distress (Table 4). The correlations between digital maturity and the variables remained significant after controlling for self-regulation. Further, as in Study 1, digital maturity had weak, positive correlations with age and socioeconomic status (Table 4). The correlations between digital maturity, well-being, ill-being and satisfaction and frustration of the individual needs (autonomy, competence, relatedness) are reported in the Supplemental Materials S6.

In addition, the parent-report and adolescent self-report measures for affective experience were highly correlated, both for positive affect, $r(349) = .76, p < .001$, and negative affect, $r(349) = 0.79, p < .001$, and the strengths of the correlations between digital maturity and positive, as well as negative affect, were similar for the adolescent self-report and parent-report measure.

4.2.3. Structural Models: Psychological Need Satisfaction and Frustration as Mediators for the Associations Between Digital Maturity and Well-Being and Ill-Being

Model A: Prediction of Adolescents' Well Being (Self-Report Measures). The estimation of the first structural path model (Fig. 3) including the adolescent self-reported measures resulted in a good fit (RMSEA = 0.071; CFI = 0.995; TLI = 0.942; SRMR = 0.008). The results of the SEM model are reported in Fig. 5.

Table 5 summarizes the direct effects of the structural paths. Digital maturity had positive impacts on psychological richness, positive affect, and need satisfaction. We found negative impacts of digital maturity on psychological distress, negative affect, and need frustration. With higher digital maturity, young people show higher positive affect, psychological richness, and need satisfaction, and lower negative affect, psychological distress, and need frustration. As expected, need satisfaction

Table 4
Means, Standard Deviations, and Correlations of Study Variables

Variable	n	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Digital Maturity	349	3.64	0.43	—												
2. Need satisfaction	349	3.74	0.65	.58**	—											
3. Need frustration	349	2.49	0.81	-.55**	-.49**	—										
4. Positive affect (self-report)	349	3.41	0.69	.46**	.53**	-.30**	—									
5. Positive affect (parent-report)	349	3.45	0.66	.46**	.47**	-.23**	.76**	—								
6. Negative affect (self-report)	349	1.72	0.72	-.54**	-.52**	.55**	-.30**	-.32**	—							
7. Negative affect (parent-report)	349	1.67	0.65	-.45**	-.44**	.52**	-.26**	-.32**	.79**	—						
8. Psychological richness	349	3.72	0.70	.41**	.54**	-.19**	.54**	.50**	-.33**	-.20**	—					
9. Psychological distress	349	4.63	0.89	-.52**	-.48**	.55**	-.35**	-.35**	.85**	.77**	-.29**	—				
10. Self-regulation	349	2.90	0.45	.55**	.56**	-.24**	.43**	.43**	-.36**	-.27**	.44**	-.38**	—			
11. Age	349	14.87	1.72	.13*	.12*	-.07	-.03	.01	-.14*	-.11*	.01	-.09	.08	—		
12. Gender ^a	349	—	—	.08	.07	-.02	-.01	.04	-.01	-.03	.10	.03	.09	.02	—	
13. Socioeconomic status	349	6.00	1.56	.13*	.03	-.07	-.30**	.20**	-.06	-.10	.09	-.12*	-.01	-.15*	-.14*	—

Note. * $p < .05$. ** $p < .01$. Mean entries of variables 1–9 measured on a 5-point scale; self-regulation on a 4-point scale; socioeconomic status from 1 to 10. ^aGender is coded as follows: 1 = boys, 2 = girls, 3 = non-binary.

positively influenced psychological richness and positive affect, and negatively influenced psychological distress and negative affect. Need frustration positively predicted psychological distress and negative affect. Contrary to our expectation, need frustration positively predicted psychological richness. Need frustration had no impact on positive affect. Regarding the control variables, self-regulation had significant effects on need satisfaction ($\beta = .340$, $p < .01$), positive affect ($\beta = .154$, $p < .01$), psychological richness ($\beta = .155$, $p < .01$), and psychological distress ($\beta = -.124$, $p < .05$), but had no impact on need frustration and negative affect. Age and gender had no impact on any of the variables in the model.

We found significant indirect effects of digital maturity on psychological richness, negative affect, and psychological distress via need satisfaction and need frustration. The indirect effect of digital maturity on positive affect was significant via need satisfaction, but not via need frustration (Table 6). With higher digital maturity, young people reported increased need satisfaction, which linked to more positive affect, psychological richness, and to less negative affect and distress. In addition, with higher digital maturity, young people reported decreased need frustration, which linked to more psychological richness, and less negative affect and distress. Hence, need satisfaction and frustration partially mediated the relationships between digital maturity and psychological richness, negative affect, and psychological distress. The relationship between digital maturity and positive affect was partially mediated by need satisfaction.

Model B: Prediction of Adolescents' Positive and Negative Affect (Assessed by the Parents), and Psychological Richness and Psychological Distress (Self-Report). The estimation of the second structural path model (Fig. 4) including the parent-reported measures of positive and negative affect, equivalently yielded a good fit (RMSEA = 0.053; CFI = 0.997; TLI = 0.962; SRMR = 0.012). The results of the SEM model are reported in Fig. 6. Table 7 summarizes the direct effects of the structural paths. The results of the structural paths (Table 7) and the indirect effects (Table 8) are similar to those of Model A which used adolescent self-report measures.

4.3. Discussion

The main objective of Study 2 was to test the hypothesis that digital maturity is associated with a wide range of well-being and ill-being measures mediated by need satisfaction and frustration. The results of Study 2 supported this hypothesis. Because we controlled for self-regulation, age, gender, and socioeconomic status, the results cannot be explained by differences in these variables, and especially not by differences in self-regulation. In addition, it is important to note that, in Study 2, we asked a parent to rate the positive and negative affect of the adolescents. This measure was correlated with the self-report measure, and the model including this measure yielded similar results compared to the model with the self-report measures only. Thus, it is unlikely that the observed relationships are a consequence of a halo bias at the adolescent level. However, we cannot rule out the possibility that parents may be affected by some kind of halo effect, such as the degree of self-esteem or positive mood that their children display toward them, influencing their ratings as might be the case for adolescents. Future research could use more fine-grained assessments of well-being, such as experience sampling (Conner et al., 2009), which may be less susceptible to such biases affecting an overall assessment.

The findings provide further support for the idea of distinguishing need satisfaction and need frustration as distinct but related constructs (Bortholomew et al., 2011; Bradshaw et al., 2023; Longo et al., 2016; Neubauer et al., 2022; Unanue et al., 2017). In Study 2, both measures were substantially correlated, but psychological need satisfaction was more strongly related to measures of well-being than to measures of ill-being, whereas need frustration was more strongly related to measures of ill-being than to measures of well-being. The mediation of the relationship between digital maturity and the various measures of

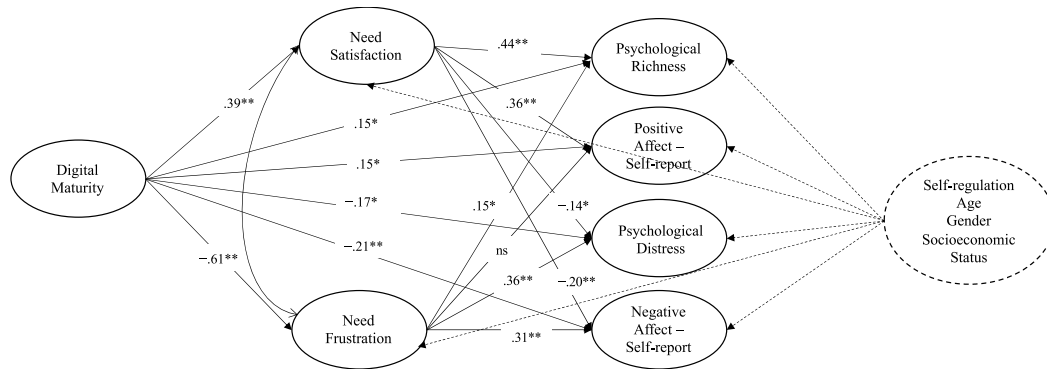


Fig. 5. SEM Results Model A: Prediction of Adolescents' Well Being (Self-Report Measures)

Note. $N = 349$. * $p < .05$. ** $p < .01$. Self-regulation, age, gender, and socioeconomic status are used as control variables in the model. RMSEA = 0.071; CFI = 0.995; TLI = 0.942; SRMR = 0.008.

Table 5
Direct Effects of Model A Structural Paths ($N = 349$)

Path	β	SE	p	95% CI
Digital maturity → psychological richness	.146	.063	.021	[.022; .269]
Digital maturity → positive affect (self-report)	.149	.060	.013	[.031; .267]
Digital maturity → psychological distress	-.172	.060	.004	[-.289; -.055]
Digital maturity → negative affect (self-report)	-.206	.059	<.001	[-.322; -.090]
Digital maturity → need satisfaction	.389	.048	<.001	[.295; .482]
Digital maturity → need frustration	-.612	.047	<.001	[-.705; -.520]
Need satisfaction → psychological richness	.440	.057	<.001	[.328; .551]
Need satisfaction → positive affect (self-report)	.362	.056	<.001	[.253; .471]
Need satisfaction → psychological distress	-.137	.057	.015	[-.248; -.026]
Need satisfaction → negative affect (self-report)	-.199	.056	<.001	[-.309; -.089]
Need frustration → psychological richness	.150	.055	.006	[.043; .258]
Need frustration → positive affect (self-report)	.011	.052	.839	[-.092; .114]
Need frustration → psychological distress	.356	.050	<.001	[.257; .455]
Need frustration → negative affect (self-report)	.314	.051	<.001	[.215; .414]

Note. β = standardized path coefficient. All measures self-reported by adolescent.

well-being and ill-being also differed in one mediation pathway. While need satisfaction partially mediated the relationships between digital maturity and all outcome measures, there was no significant mediation of the relationship between digital maturity and positive affect through need frustration. Most importantly, need satisfaction and frustration were positively associated with psychological richness, while the two variables had opposite effects in the models for the other outcome measures. This finding supports the assumption that individuals who strive for psychological richness tolerate frustrations that may occur in a psychologically rich life (Oishi et al., 2021).

5. General discussion

Young people's frequent use of digital technologies has raised public

Table 6
Indirect Effects of Model A ($N = 349$)

Path	b	SE	95% CI
Digital maturity → need satisfaction → positive affect (self-report)	.225	.052	[.131; .337]
Digital maturity → need frustration → positive affect (self-report)	-.011	.058	[-.115; .108]
Digital maturity → need satisfaction → psychological richness	.278	.053	[.179; .387]
Digital maturity → need frustration → psychological richness	-.150	.058	[-.267; -.039]
Digital maturity → need satisfaction → negative affect (self-report)	-.130	.041	[-.214; -.053]
Digital maturity → need frustration → negative affect (self-report)	-.322	.059	[-.443; -.211]
Digital maturity → need satisfaction → psychological distress	-.605	.247	[-1.121; -.154]
Digital maturity → need frustration → psychological distress	-2.469	.429	[-3.348; -1.685]

Note. b = unstandardized regression coefficient; 95% percentile bootstrap confidence intervals are based on 5000 bootstrap samples. Controlling for self-regulation, age, gender, socioeconomic status.

concern about the potential negative effects of technology use on their health and well-being (Liu et al., 2019). Recently, the novel concept of digital maturity has been developed, which shifts the focus from whether the use of technology is beneficial or harmful to adolescents to how technology is used (Laaber et al., 2023). In fact, digital maturity suggests that young people's ability to use technology for personal growth and social adjustment is important (Laaber et al., 2023), as digital technologies provide opportunities for learning (Gan et al., 2015), recreation (Reinecke & Eden, 2016), and connections with others (Koutamanis et al., 2013). Thus, the concept implies that the mature use of technology has a positive impact on the overall well-being of young people by reducing need frustration and increasing the satisfaction of needs. However, these relationships had not been tested to date.

In the current paper, we investigated whether digital maturity is associated with psychological need satisfaction and well-being for the first time. In two studies with parent-adolescent dyads, we found initial evidence for a positive relationship between digital maturity, psychological need satisfaction, and general well-being, and a negative relationship between digital maturity, need frustration, and ill-being. The finding that digital maturity is positively associated with well-being is intriguing, particularly because of the wide range of well-being measures used, including affect, satisfaction, and psychological richness,

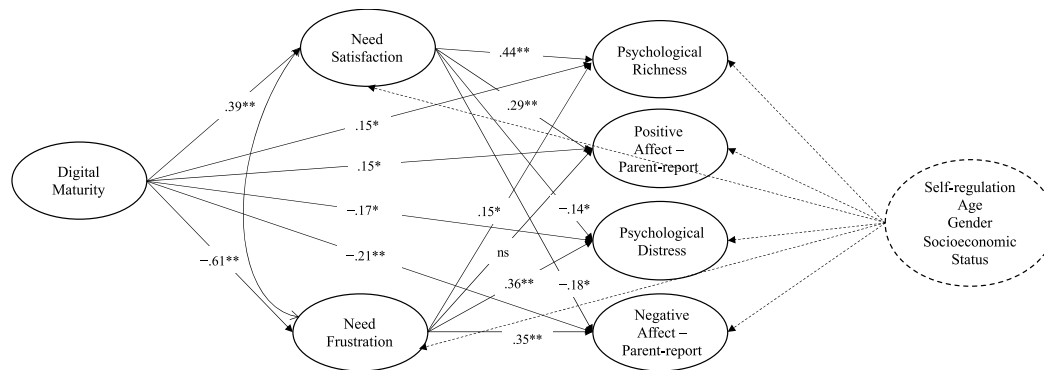


Fig. 6. SEM Results Model B: Prediction of Adolescents' Positive and Negative Affect (Assessed by the Parents), and Psychological Richness and Psychological Distress (Self-Report)

Note. $N = 349$. * $p < .05$. ** $p < .01$. Self-regulation, age, gender, and socioeconomic status are used as control variables in the model. RMSEA = 0.053; CFI = 0.997; TLI = 0.962; SRMR = 0.012.

Table 7
Direct Effects of Model B Structural Paths ($N = 349$).

Path	β	SE	p	95% CI
Digital maturity $\rightarrow$ psychological richness	.146	.063	.021	[.011; .269]
Digital maturity $\rightarrow$ positive affect (parent-report)	.206	.062	.001	[.085; .327]
Digital maturity $\rightarrow$ psychological distress	-.172	.060	.004	[-.289; -.055]
Digital maturity $\rightarrow$ negative affect (parent-report)	-.127	.064	.046	[-.252; -.002]
Digital maturity $\rightarrow$ need satisfaction	.389	.048	<.001	[.295; .482]
Digital maturity $\rightarrow$ need frustration	-.612	.047	<.001	[-.705; -.520]
Need satisfaction $\rightarrow$ psychological richness	.440	.057	<.001	[.328; .551]
Need satisfaction $\rightarrow$ positive affect (parent-report)	.291	.058	<.001	[.178; .404]
Need satisfaction $\rightarrow$ psychological distress	-.137	.057	.015	[-.248; -.026]
Need satisfaction $\rightarrow$ negative affect (parent-report)	-.181	.060	.003	[-.299; -.064]
Need frustration $\rightarrow$ psychological richness	.150	.055	.006	[.043; .258]
Need frustration $\rightarrow$ positive affect (parent-report)	.091	.054	.092	[-.015; .197]
Need frustration $\rightarrow$ psychological distress	.356	.050	<.001	[.257; .455]
Need frustration $\rightarrow$ negative affect (parent-report)	.348	.054	<.001	[.243; .453]

Note. β = standardized path coefficient. Positive and negative affect were assessed via the parents.

none of which are directly related to digital activities. It is also not trivial that some kind of mature behavior, such as using digital technologies to learn something new or to achieve own goals, is related to well-being. Indeed, mature behavior can be related to short-term frustrations just because immediate rewards are foregone (Bauer et al., 2005; Bauer & McAdams, 2004). Since we measured well-being at one point in time in a cross-sectional design, we cannot exclude that fluctuations in well-being may include more negative experiences for high digital maturity individuals. Indeed, it is plausible to assume that digital maturity can sometimes be related to frustrations and negative affect. For example, a digitally mature behavior might be muting social networking notifications to focus on schoolwork, which may initially mean fewer positive rewards from social media interactions and potentially require effort

Table 8
Indirect Effects of Model B ($N = 349$)

Path	b	SE	95% CI
Digital maturity $\rightarrow$ need satisfaction $\rightarrow$ positive affect (parent-report)	.173	.047	[.089; .271]
Digital maturity $\rightarrow$ need frustration $\rightarrow$ positive affect (parent-report)	-.085	.052	[-.184; .021]
Digital maturity $\rightarrow$ need satisfaction $\rightarrow$ psychological richness	.278	.053	[.179; .387]
Digital maturity $\rightarrow$ need frustration $\rightarrow$ psychological richness	-.150	.058	[-.267; -.039]
Digital maturity $\rightarrow$ need satisfaction $\rightarrow$ negative affect (parent-report)	-.106	.035	[-.178; -.036]
Digital maturity $\rightarrow$ need frustration $\rightarrow$ negative affect (parent-report)	-.321	.060	[-.444; -.209]
Digital maturity $\rightarrow$ need satisfaction $\rightarrow$ psychological distress	-.605	.247	[-1.121; -.154]
Digital maturity $\rightarrow$ need frustration $\rightarrow$ psychological distress	-2.469	.429	[-3.348; -1.685]

Note. b = unstandardized regression coefficient; 95% percentile bootstrap confidence intervals are based on 5000 bootstrap samples. Controlling for self-regulation, age, gender, socioeconomic status.

and persistence. However, even though a mature behavior may decrease the positive affect in the beginning, it should be likely to support positive well-being and psychological richness in the long run. Future research could explore such associations between digital maturity and well-being using experience sampling techniques.

An interesting question, however, is whether digital maturity can influence well-being, which is known to be largely determined by genetic factors and temperament, or whether the correlation is produced by the factors more deeply rooted in the personality of individuals. Indeed, Laaber et al. (2023) observed a correlation between personality and digital maturity, which may partly contribute to the positive correlation of digital maturity and well-being, but the correlation between digital maturity and personality dimensions was modest in their study. Rather, we propose that digital maturity is related to what individuals do in their daily lives and which increases satisfaction of autonomy, competence, and relationship needs. Sheldon et al. (2013) argue that a remarkable proportion of the variance in well-being, about 40%, can be modulated by the intentional activities individuals engage in as part of their daily lives. Digital maturity may influence how individuals pursue and select these intentional activities.

Against this background, it is important that we controlled for

general self-regulation skills in our studies. Hence, the observed relationship between digital maturity and well-being cannot be explained by individual differences in general self-regulation skills and is in line with the idea that digital maturity covers abilities that specifically address the challenges and opportunities of digital technologies. Also, it is unlikely that observed correlations between digital maturity and well-being are a consequence of a “halo effect” (Murphy et al., 1993), or shared evaluative biases due to self-report measures (Lucas et al., 1996; Podsakoff et al., 2003; Schimmack et al., 2008), because, in Study 2, we controlled for such effects by asking the parents to provide us with their assessment of the affective well-being of their children. The correlations of this external assessment of well-being with digital maturity were similar as for the self-report measures. Importantly, however, our results do not provide evidence of causality, although a causality is implied by the idea that digital maturity affects daily activities of individuals. Future research might study the effects of interventions to increase digital maturity to provide more insights into the causal effects of digital maturity.

In conclusion, using two samples of parent-adolescent dyads, we found that digital maturity is positively associated with well-being and negatively with ill-being via psychological need satisfaction and frustration. Our study is the first study, to our knowledge, to link digital maturity to general well-being. The findings highlight the need to support young people in becoming mature users of digital technologies, enabling them to use digital opportunities to benefit their overall well-being.

Author note

Data and supplemental materials are openly available at the project's Open Science Framework page (<https://osf.io/mfk4y/>). The work presented here has been developed in the context of the Digmatex project. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870578. We have no conflicts of interest to disclose.

CRedit authorship contribution statement

Franszka Laaber: Conceptualization, Formal analysis, Methodology, Visualization, Writing - original draft. **Teresa Koch:** Conceptualization, Validation, Writing - review & editing. **Marco Hubert:** Conceptualization, Funding acquisition. **Arnd Florack:** Conceptualization, Supervision, Writing - review & editing.

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.

Data availability

Data and supplemental materials are openly available at the project's Open Science Framework page (<https://osf.io/mfk4y/>).

Acknowledgements

This project has received funding from the European Union's Horizon 2020 research and innovation programme under 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.2023.108077>.

References

- Abbey, J. D., & Meloy, M. G. (2017). Attention by design: Using attention checks to detect inattentive respondents and improve data quality. *Journal of Operations Management*, 53(1), 63–70. <https://doi.org/10.1016/j.jom.2017.06.001>.
- Adler, N. E., Epel, E. S., Castellazzo, G., & Ickovics, J. R. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: Preliminary data in healthy, White women. *Health Psychology*, 19(6), 586–592. <https://doi.org/10.1037/0278-6133.19.6.586>.
- Arenas, A., & Yazdi, P. (2022). Towards a model of technology usage and digital maturity in children: A grounded-theory approach. *ECIS 2022 research papers*. <https://aisel.snet.org/ecis2022.r>.
- Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin*, 37(11), 1459–1473. <https://doi.org/10.1177/0146167211413125>.
- Bauer, J. J., & McAdams, D. P. (2004). Growth goals, maturity, and well-being. *Developmental Psychology*, 40(1), 114–127. <https://doi.org/10.1037/0012-1649.40.1.114>.
- Bauer, J. J., McAdams, D. P., & Sakaeda, A. R. (2005). Interpreting the good life: Growth memories in the lives of mature, happy people. *Journal of Personality and Social Psychology*, 88(1), 203–217. <https://doi.org/10.1037/0022-3514.88.1.203>.
- 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>.
- Boer, M., van den Eijnden, R. J. J. M., Boniel-Nissim, M., Wong, S., Inchley, J. C., Badury, P., et al. (2020). Adolescents' intense and problematic social media use and their well-being in 29 countries. *Journal of Adolescent Health*, 66(6), 89–99. <https://doi.org/10.1016/j.jadohealth.2020.02.014>.
- Bradshaw, E. L., DeHaan, C. R., Parker, P. D., Curren, R., Duineveld, J. J., Di Domenico, S. L., et al. (2023). The perceived conditions for living well: Positive perceptions of primary goods linked with basic psychological needs and wellness. *The Journal of Positive Psychology*, 18(1), 44–60. <https://doi.org/10.1080/17439760.2021.1991446>.
- Breyer, B., & Bluemke, M. (2016). Deutsche version der Positive and negative affect Schedule PANAS (GESIS panel). *Zusammenstellung sozialwissenschaftlicher Items und Skalen*. <https://doi.org/10.6102/zis242>.
- Büttner, C., & Rudert, S. C. (2022). Why didn't you tag me?!: Social exclusion from Instagram posts hurts, especially those with a high need to belong. *Computers in Human Behavior*, 127, Article 107062. <https://doi.org/10.1016/j.chb.2021.107062>.
- Cantril, H. (1965). *The pattern of human concerns*. Rutgers University Press.
- Chamberlain, K., & Zila, S. (1992). Stability and change in subjective well-being over short time periods. *Social Indicators Research*, 26, 101–117.
- Chu, L., Li, P. H., & Yu, M. N. (2020). The longitudinal effect of children's self-regulated learning on reading habits and well-being. *Journal of Education Research*, 104, Article 101673. <https://doi.org/10.1016/j.jer.2020.101673>.
- Conner, T. S., Tennen, H., Fleeson, W., & Barrett, L. F. (2009). Experience sampling methods: A modern idiographic approach to personality research. *Social and Personality Psychology Compass*, 3(3), 292–313. <https://doi.org/10.1111/j.1751-9004.2009.00170.x>.
- Côté, S., Stellar, J. E., Willer, R., Forbes, R. C., Martin, S. R., & Bianchi, E. C. (2021). The psychology of entrenched privilege: High socioeconomic status individuals from affluent backgrounds are uniquely high in entitlement. *Personality and Social Psychology Bulletin*, 47(1), 70–88. <https://doi.org/10.1177/0146167220916633>.
- Crone, E. A., & Konijn, E. A. (2018). Media use and brain development during adolescence. *Nature Communications*, 9(1), 588. <https://doi.org/10.1038/s41467-018-03126-x>.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01.
- Eid, M., & Diener, E. (2004). Global judgments of subjective well-being: Situational variability and long-term stability. *Social Indicators Research*, 65, 245–277.
- Eisenberg, N. (2000). Emotion, regulation, and moral development. *Annual Review of Psychology*, 51(1), 665–697. <https://doi.org/10.1146/annurev.psych.51.1.665>.
- Erdmann, E., & Dienlin, T. (2022). Binge-watching, self-determination, and well-being: A partially successful direct replication and extension of Granow et al. *Journal of Media Psychology*, 34(6). <https://doi.org/10.1027/1864-1105/a000334>, 2018.
- Formosa, J., Johnson, D., Türkay, S., & Mandryk, R. L. (2022). Need satisfaction, passion and well-being effects of videogame play prior to and during the COVID-19 pandemic. *Computers in Human Behavior*, 131, Article 107232. <https://doi.org/10.1016/j.chb.2022.107232>.
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50.
- Fuller, C. M., Simmering, M. J., Atinc, G., Atinc, Y., & Babin, B. J. (2016). Common methods variance detection in business research. *Journal of Business Research*, 69(8), 3192–3198. <https://doi.org/10.1016/j.jbusres.2015.12.008>.
- Gan, B., Menkhoff, T., & Smith, R. (2015). Enhancing students' learning process through interactive digital media: New opportunities for collaborative learning. *Computers in Human Behavior*, 51, 652–663. <https://doi.org/10.1016/j.chb.2014.12.048>.
- Giesinger, J., Rumpold, M. G., & Schüller, G. (2008). German version of the K10-Screening Scale for psychological distress. *Psychosomatik und Konsiliarpsychiatrie*, 2, 104–111. <https://doi.org/10.1007/s1800-008-0100-x>.
- González-Carrasco, M., Casas, F., Malo, S., Viñas, F., & Dinisman, T. (2017). Changes with age in subjective well-being through the adolescent years: Differences by

- gender. *Journal of Happiness Studies*, 18, 63–88. <https://doi.org/10.1007/s10902-016-9717-1>
- Haddon, L., & Livingstone, S. (2017). Risks, opportunities, and risky opportunities: How children make sense of the online environment. In *Cognitive development in digital contexts* (pp. 275–302). Academic Press. <https://doi.org/10.1016/B978-0-12-809481-5.00014-6>.
- Hayes, A. F. (2017). Introduction to mediation, moderation, and conditional process analysis. In *A regression-based approach* (2nd ed.). Guilford Publications <http://ebookcentral.proquest.com/lib/univie/detail.action?docID=5109647>.
- Hill, R., Betts, L. R., & Gardner, S. E. (2015). Older adults' experiences and perceptions of digital technology: (Dis)empowerment, wellbeing, and inclusion. *Computers in Human Behavior*, 48, 415–423. <https://doi.org/10.1016/j.chb.2015.01.062>
- Horwood, S., & Anglim, J. (2019). Problematic smartphone usage and subjective and psychological well-being. *Computers in Human Behavior*, 97, 44–50. <https://doi.org/10.1016/j.chb.2019.02.028>
- Huang, J., Kumar, S., & Hu, C. (2021). A literature review of online identity reconstruction. *Frontiers in Psychology*, 12, Article 696552. <https://doi.org/10.3389/fpsyg.2021.696552>
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Johannes, N., Dienlin, T., Bakshi, H., & Przybylski, A. K. (2022). No effect of different types of media on well-being. *Scientific Reports*, 12(1), 61. <https://doi.org/10.1038/s41598-021-03218-7>
- Kardefelt-Winther, D. (2014). The moderating role of psychosocial well-being on the relationship between escapism and excessive online gaming. *Computers in Human Behavior*, 38, 68–74. <https://doi.org/10.1016/j.chb.2014.05.020>
- Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S.-L. T., et al. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine*, 32(6), 959–976. <https://doi.org/10.1017/S0033291702006074>
- Kim, J., & Lee, J. E. R. (2011). The Facebook paths to happiness: Effects of the number of Facebook friends and self-presentation on subjective well-being. *Cyberpsychology, Behavior, and Social Networking*, 14(6), 359–364. <https://doi.org/10.1089/cyber.2010.0374>
- Koch, T., Laaber, F., & Florack, A. (2023). *Socioeconomic status and young people's digital maturity: The role of parental mediation*. Department of Occupational, Economic, and Social Psychology, University of Vienna [Unpublished manuscript].
- Koutamamis, M., Vossen, H. G., Peter, J., & Valkenburg, P. M. (2013). Practice makes perfect: The longitudinal effect of adolescents' instant messaging on their ability to initiate offline friendships. *Computers in Human Behavior*, 29(6), 2265–2272. <https://doi.org/10.1016/j.chb.2013.04.033>
- 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>
- Lavoie, R., & Zheng, Y. (2023). Smartphone use, flow and wellbeing: A case of jekyll and hyde. *Computers in Human Behavior*, 138, Article 107442. <https://doi.org/10.1016/j.chb.2022.107442>
- Liu, D., Baumeister, R. F., Yang, C. C., & Hu, B. (2019). Retracted: Digital communication media use and psychological well-being: A meta-analysis. *Journal of Computer-Mediated Communication*, 24(5), 259–273. <https://doi.org/10.1093/jcmc/zmz013>
- Livingstone, S., & Helsper, E. (2010). Balancing opportunities and risks in teenagers' use of the internet: The role of online skills and internet self-efficacy. *New Media & Society*, 12(2), 309–329. <https://doi.org/10.1177/1461444809342697>
- Livingstone, S., Kirwil, L., Ponte, C., & Staksrud, E. (2014). In their own words: What bothers children online? *European Journal of Communication*, 29(3), 271–288. <https://doi.org/10.1177/0267323114521045>
- Livingstone, S., Olafsson, K., Helsper, E. J., Lupiáñez-Villanueva, F., Veltri, G. A., & Folkvord, F. (2017). Maximizing opportunities and minimizing risks for children online: The role of digital skills in emerging strategies of parental mediation. *Journal of Communication*, 67(1), 82–105. <https://doi.org/10.1111/jcom.12277>
- Li, J., Wu, Y., & Hesketh, T. (2023). Internet use and cyberbullying: Impacts on psychosocial and psychosomatic wellbeing among Chinese adolescents. *Computers in Human Behavior*, 138, Article 107461. <https://doi.org/10.1016/j.chb.2022.107461>
- Longo, Y., Gunz, A., Curtis, G. J., & Farsides, T. (2016). Measuring need satisfaction and frustration in educational and work contexts: The Need Satisfaction and Frustration Scale (NSFS). *Journal of Happiness Studies*, 17, 295–317. <https://doi.org/10.1007/s10902-014-9595-3>
- Lucas, R. E., & Diener, E. (2009). Personality and subjective well-being. In E. Diener (Ed.), *The Science of well-being: The collected Works of ed diener* (pp. 75–102). *Social indicators research series* 37. Springer.
- Lucas, R. E., Diener, E., & Suh, E. (1996). Discriminant validity of well-being measures. *Journal of Personality and Social Psychology*, 71(3), 616–628. <https://doi.org/10.1037/0022-3514.71.3.616>
- Luszczynska, A., Diehl, M., Gutiérrez-Dona, B., Kuusinen, P., & Schwarzer, R. (2004). Measuring one component of dispositional self-regulation: Attention control in goal pursuit. *Personality and Individual Differences*, 37(3), 555–566. <https://doi.org/10.1016/j.paid.2003.09.026>
- Masur, P. K., Reinecke, L., Ziegele, M., & Quiring, O. (2014). The interplay of intrinsic need satisfaction and Facebook specific motives in explaining addictive behavior on Facebook. *Computers in Human Behavior*, 39, 376–386. <https://doi.org/10.1016/j.chb.2014.05.047>
- Meier, A., & Krause, H. V. (2022). Does passive social media use harm well-being? An adversarial review. *Journal of Media Psychology*, 35(3), 169–180. <https://doi.org/10.1027/1864-1105/a000358>
- Murphy, K. R., Jako, R. A., & Anhalt, R. L. (1993). Nature and consequences of halo error: A critical analysis. *Journal of Applied Psychology*, 78(2), 218–225. <https://doi.org/10.1037/0021-9010.78.2.218>
- Neubauer, A. B., Kramer, A. C., & Schmiedek, F. (2022). Assessing domain-general need fulfillment in children and adults: Introducing the General Need Satisfaction and Frustration scale. *Psychological Assessment*, 34(11), 1022. <https://doi.org/10.1037/pas0001169>
- Oishi, S., Choi, H., Buttrick, N., Heintzelman, S. J., Kushlev, K., Westgate, E. C., et al. (2019). The psychologically rich life questionnaire. *Journal of Research in Personality*, 81, 257–270. <https://doi.org/10.1016/j.jrp.2019.06.010>
- Oishi, S., Choi, H., Liu, A., & Kurtz, J. (2021). Experiences associated with psychological richness. *European Journal of Personality*, 35(5), 754–770. <https://doi.org/10.1177/0890207020962334>
- Oishi, S., & Westgate, E. C. (2022). A psychologically rich life: Beyond happiness and meaning. *Psychological Review*, 129(4), 790–811. <https://doi.org/10.1037/rev0000317>
- Orben, A., & Przybylski, A. K. (2019). The association between adolescent well-being and digital technology use. *Nature Human Behaviour*, 3(2), 173–182. <https://doi.org/10.1038/s41562-018-0506-1>
- Paulich, K. N., Ross, J. M., Lessem, J. M., & Hewitt, J. K. (2021). Screen time and early adolescent mental health, academic, and social outcomes in 9- and 10- year old children: Utilizing the Adolescent Brain Cognitive Development (ABCD) Study. *PLoS One*, 16(9), Article e0256591. <https://doi.org/10.1371/journal.pone.0256591>
- Peng, W., Lin, J. H., Pfeiffer, K. A., & Winn, B. (2012). Need satisfaction supportive game features as motivational determinants: An experimental study of a self-determination theory guided exergame. *Media Psychology*, 15(2), 175–196. <https://doi.org/10.1080/15213269.2012.673850>
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
- Podsakoff, P., & Organ, D. (1986). Self-report in organizational research. Problems and prospects. *Journal of Management*, 12(4), 531–544. <https://doi.org/10.1177/014920638601200408>
- Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology*, 14(2), 154–166. <https://doi.org/10.1037/a0019440>
- Przybylski, A. K., & Weinstein, N. (2019). Digital screen time limits and young children's psychological well-being: Evidence from a population-based study. *Child Development*, 90(1), e56–e65. <https://doi.org/10.1111/cdev.13007>
- Przybylski, A. K., Weinstein, N., Ryan, R. M., & Rigby, C. S. (2009). Having to versus wanting to play: Background and consequences of harmonious versus obsessive engagement in video games. *CyberPsychology and Behavior*, 12(5), 485–492. <https://doi.org/10.1089/cpb.2009.0083>
- Reinecke, L., & Eden, A. (2016). Media use and recreation: Media-induced recovery as a link between media exposure and well-being. In L. Reinecke, & M. B. Oliver (Eds.), *The routledge handbook of media use and well-being: International perspectives on theory and research on positive media effects* (pp. 106–117). Routledge.
- Reinecke, L., Gilbert, A., & Eden, A. (2022). Self-regulation as a key boundary condition in the relationship between social media use and well-being. *Current Opinion in Psychology*, 45, Article 101296. <https://doi.org/10.1016/j.copsyc.2021.12.008>
- Rigby, C. S., & Ryan, R. M. (2016). Time well-spent? Motivation for entertainment media and its eudaimonic aspects through the lens of self-determination theory. In L. Reinecke, & M. B. Oliver (Eds.), *The routledge handbook of media use and well-being: International perspectives on theory and research on positive media effects* (pp. 34–48). Routledge.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Ryan, R. M., & Deci, E. L. (2011). A self-determination theory perspective on social, institutional, cultural, and economic supports for autonomy and their importance for well-being. In V. I. Chirkov, R. M. Ryan, & K. M. Sheldon (Eds.), *Human autonomy in cross-cultural context: Perspectives on the psychology of agency, freedom, and well-being* (pp. 45–64). Springer Science + Business Media. https://doi.org/10.1007/978-90-481-9667-8_3
- Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford publications.
- Schimmack, U., Schupp, J., & Wagner, G. G. (2008). The influence of environment and personality on the affective and cognitive component of subjective well-being. *Social Indicators Research*, 89, 41–60. <https://doi.org/10.1007/s11205-007-9230-3>
- Schulz van Endert, T. (2021). Addictive use of digital devices in young children: Associations with delay discounting, self-control and academic performance. *PLoS One*, 16(6), Article e0253058. <https://doi.org/10.1371/journal.pone.0253058>
- Sheldon, K. M., Abad, N., & Hirsch, C. (2011). A two-process view of Facebook use and relatedness need satisfaction: Disconnection drives use, and connection rewards it. *Journal of Personality and Social Psychology*, 100(4), 766–775. <https://doi.org/10.1037/a0022407>
- Sheldon, K. M., Boehm, J., & Lyubomirsky, S. (2013). *Variety is the spice of happiness: The hedonic adaptation prevention model*. Oxford University Press. <https://doi.org/10.1093/oxfordhb/978019557257.013.0067>
- Shin, W., & Kang, H. (2016). Adolescents' privacy concerns and information disclosure online: The role of parents and the Internet. *Computers in Human Behavior*, 54, 114–123. <https://doi.org/10.1016/j.chb.2015.07.062>
- Staksrud, E., Olafsson, K., & Livingstone, S. (2013). Does the use of social networking sites increase children's risk of harm? *Computers in Human Behavior*, 29(1), 40–50. <https://doi.org/10.1016/j.chb.2012.05.026>

- Staudinger, U. M., & Kunzmann, U. (2005). Positive adult personality development: Adjustment and/or growth? *European Psychologist*, 10(4), 320–329.
- Tamborini, R., Bowman, N. D., Eden, A., Grizzard, M., & Organ, A. (2010). Defining media enjoyment as the satisfaction of intrinsic needs. *Journal of Communication*, 60(4), 758–777. <https://doi.org/10.1111/j.1460-2466.2010.01513.x>
- Twenge, J. M., & Campbell, W. K. (2018). Associations between screen time and lower psychological well-being among children and adolescents: Evidence from a population-based study. *Preventive Medicine Reports*, 12, 271–283. <https://doi.org/10.1016/j.pmedr.2018.10.003>
- Twenge, J. M., & Joiner, T. E. (2020). Mental distress among US adults during the COVID-19 pandemic. *Journal of Clinical Psychology*, 76(12), 2170–2182. <https://doi-org./10.1002/jclp.23064>
- Twenge, J. M., Martin, G. N., & Spitzberg, B. H. (2019). Trends in US Adolescents' media use. 1976–2016: The rise of digital media, the decline of TV, and the (near) demise of print. *Psychology of Popular Media Culture*, 8(4), 329–345. <https://doi.org/10.1037/ppm0000203>
- Unanue, W., Rempel, K., Gómez, M. E., & Van den Broeck, A. (2017). When and why does materialism relate to employees' attitudes and well-being: The mediational role of need satisfaction and need frustration. *Frontiers in Psychology*, 8, 1755. <https://doi.org/10.3389/fpsyg.2017.01755>
- Valkenburg, P. M., Meier, A., & Beyens, I. (2022). Social media use and its impact on adolescent mental health: An umbrella review of the evidence. *Current Opinion in Psychology*, 44, 58–68. <https://doi.org/10.1016/j.copsyc.2021.08.017>
- Valkenburg, P. M., & Peter, J. (2011). Online communication among adolescents: An integrated model of its attraction, opportunities, and risks. *Journal of Adolescent Health*, 48(2), 121–127. <https://doi.org/10.1016/j.jadohealth.2010.08.020>
- Vandoninck, S., d'Haenens, L., & Roe, K. (2013). Online risks: Coping strategies of less resilient children and teenagers across Europe. *Journal of Children and Media*, 7(1), 60–78. <https://doi.org/10.1080/17482798.2012.739780>
- Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration*, 23(3), 263–280. <https://doi.org/10.1037/a0032359>
- 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-/10.1177/09637214211053637>
- 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>
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070. <https://doi.org/10.1037/0022-3514.54.6.1063>
- Wehmeyer, M. L., Shogren, K. A., Little, T. D., & Lopez, S. J. (2017). *Development of self-determination through the life-course*. Springer.
- Yoon, Y., Eisenstadt, M., Lereya, S. T., & Deighton, J. (2023). Gender difference in the change of adolescents' mental health and subjective wellbeing trajectories. *European Child & Adolescent Psychiatry*, 32, 1569–1578. <https://doi.org/10.1007/s00787-022-01961-4>

Article III

Koch, T., Laaber, F., Arenas, A., & Florack, A. (2025). Socially (dis)connected in a connected world: The role of young people's digital maturity. *Computers in Human Behavior*, 163, 108473. <https://doi.org/10.1016/j.chb.2024.108473>



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's 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

0747-5632/© 2024 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

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 (Hawkey & 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
<i>Social connectedness online</i>		
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.
Winstone et al. (2021)	Interviews	- Instagram interaction only related to lower loneliness for individuals with low social comparison orientation. - 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.
<i>Active vs. passive use behavior</i>		
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.
<i>Real-life and virtual friends online</i>		
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.
Burke and Kraut (2016)	Three-wave online survey + Facebook activity log	- Social goals related negatively to loneliness, achievement goals related positively to loneliness. - 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.
<i>Compassionate and self-image goals online</i>		
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 (Bastiaenssens 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 (Detters & 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

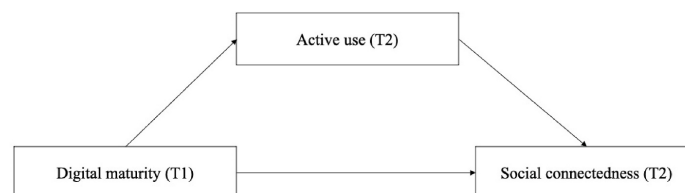


Fig. 1. Conceptual Model Tested in Study 1.

Table 2
Sample demographics Study 1.

Variable	Category	Value
Age adolescents (T2)	(range 13–18)	14.92 (<i>SD</i> = 1.42)
Gender adolescents (T2)	female	53.2 %
	male	46.5 %
	non-binary/third gender	.3 %
Age parents (T2)		46.57 (<i>SD</i> = 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 %
	primary education	0 %
	secondary education first stage	24.4 %
Degree parent* (T2)	secondary education second stage	42.4 %
*(classified according to ISCED)	short tertiary education	3.8 %
	bachelor	11.7 %
	master	15.8 %
	doctor/PhD	1.6 %
	other	.3 %
	more than 35 hrs	49.7 %
	15–34 hrs	35.1 %
	less than 15 hrs	5.7 %
Current employment parent (T1)	currently on leave	1.3 %
	currently not working	6.3 %
	other	1.9 %
	(range 1–10)	5.96 (<i>SD</i> = 1.41)
Subjective socioeconomic status parent (T2)		
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 %
	average hours	3.76 (<i>SD</i> = 2.37)
Screen time (T2)		
Age first own smartphone (T1)		9.27 (<i>SD</i> = 2.15)
Mobile devices used every day (T1)	do not own a phone	.6 %
	mobile phone/smartphone	98.7 %
	laptop/computer	44.0 %
	(games) console	22.5 %
	tablet/iPad	27.5 %
	smartwatch	8.9 %
	e-reader	1.9 %
Age first social media account (T1)	other	.6 %
	average age	12.17 (<i>SD</i> = 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, $b = -.003, SE = .006, 95\% \text{ CI } [-.017, .007]$ (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, $b = -.018, SE = .011, 95\% \text{ CI } [-.044, -.001]$ (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 (S0study 1).

	<i>M (SD)</i>	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).

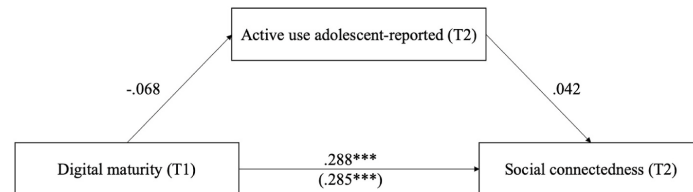


Fig. 2. Mediation Model of Digital Maturity Predicting Social Connectedness via Adolescent-Reported Active Use (Study 1)

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).

Antecedent	Dependent Measure							
	Active use adolescent-reported (T2)				Social connectedness (T2)			
	<i>b</i>	<i>SE</i>	<i>p</i>	95% CI	<i>b</i>	<i>SE</i>	<i>p</i>	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]
			$R^2 = .005$				$R^2 = .085$	
			$F(1, 314) = 1.542$				$F(2, 313) = 14.490$	
			$p = .215$				$p < .001$	

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

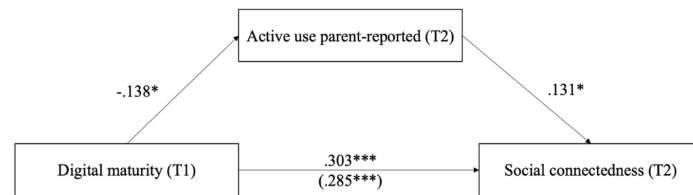


Fig. 3. Mediation Model of Digital Maturity Predicting Social Connectedness via Parent-Reported Active Use (Study 1).
 Note. * $p < .05$, *** $p < .001$. $N = 316$. Values are standardized.

Table 6

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

Antecedent	Dependent measure							
	Active use parent-reported (T2)				Social connectedness (T2)			
	<i>b</i>	<i>SE</i>	<i>p</i>	95% CI	<i>b</i>	<i>SE</i>	<i>p</i>	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]
			$R^2 = .020$				$R^2 = .100$	
			$F(1, 314) = 6.290$				$F(2, 313) = 17.304$	
			$p = .013$				$p < .001$	

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

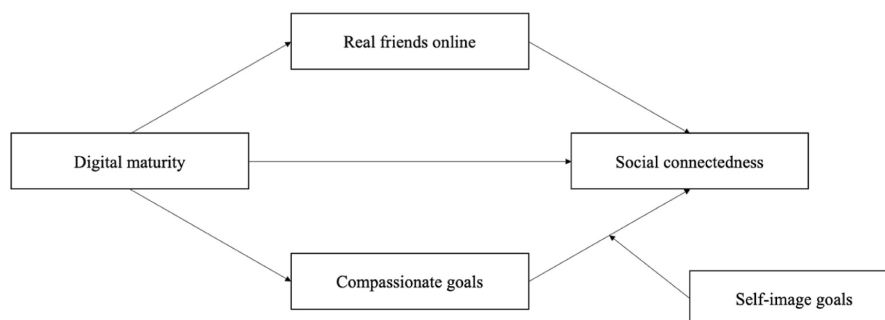


Fig. 4. Conceptual Model Tested in Study 2.

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 Canvello (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 (<i>SD</i> = 1.63)
Gender adolescents	female	49.0 %
	male	51.0 %
Age parents		47.65 (<i>SD</i> = 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 (<i>SD</i> = 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 (<i>SD</i> = 3.97)
Age first own smartphone		10.48 (<i>SD</i> = 2.65)
Mobile devices used every day	do not own a phone	4.7 %
	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 (<i>SD</i> = 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 8
Means, standard deviations, and correlations of the main study variables (Study 2).

	<i>M (SD)</i>	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. * $p < .05$, ** $p < .01$, *** $p < .001$. $N = 257$.

^a The real friends subscale and virtual friends subscale are included in the real friends online overall scale, thus no correlations are provided here.

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.

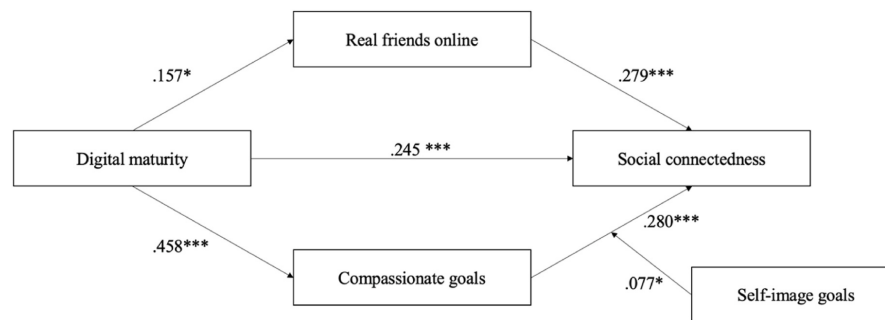


Fig. 5. Moderated Double Mediation Model of Digital Maturity Predicting Social Connectedness via Real Friends Online and Compassionate Goals, Moderated by Self-Image Goals (Study 2)

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).

Antecedent	Dependent measure											
	Real friends online				Compassionate goals				Social connectedness			
	<i>b</i>	<i>SE</i>	<i>p</i>	95% CI	<i>b</i>	<i>SE</i>	<i>p</i>	95% CI	<i>b</i>	<i>SE</i>	<i>p</i>	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	<i>b</i>	<i>SE</i>	<i>p</i>	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

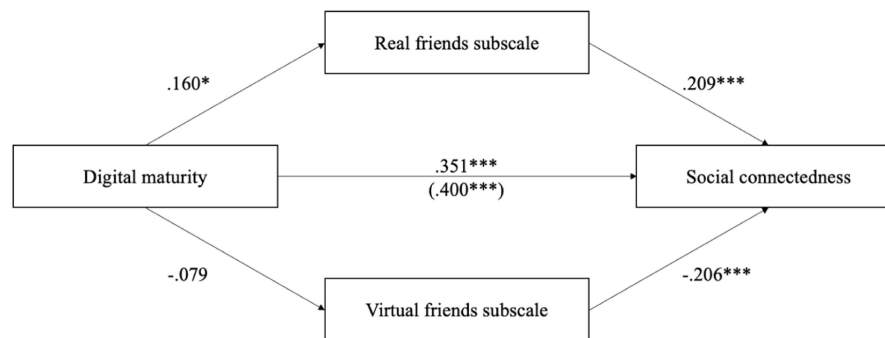


Fig. 6. Double Mediation Model Using the Real Friends and Virtual Friends Subscales as Mediators (Study 2)
Note. * $p < .05$, *** $p < .001$. $N = 257$. Values are standardized.

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, benefiting 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 from 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. ^aItem 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)

Antecedent	Dependent Measure											
	Real friends subscale				Virtual friends subscale				Social connectedness			
	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., Vandeboosch, 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>

Hawkey, 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., & Tafari, 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., Mikuska, 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., & 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., & Krömer, 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>
- Thorisdottrir, 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., Shaback, 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>

Article IV

Koch, T., Laaber, F., & Florack, A. (2025). *Digital maturity reduces the effect of expectations on task choice: An experimental study* [Manuscript submitted for publication].

Digital Maturity Reduces the Effect of Expectations on Task Choice: An Experimental Study

Teresa Koch¹, Franziska Laaber¹, Arnd Florack¹

¹ Department of Occupational, Economic, and Social Psychology, Faculty of Psychology,
University of Vienna, Austria

Author Note

Teresa Koch  [0000-0002-5301-3257](https://orcid.org/0000-0002-5301-3257)

Franziska Laaber  [0000-0003-3040-5933](https://orcid.org/0000-0003-3040-5933)

Arnd Florack  [0000-0001-9906-0043](https://orcid.org/0000-0001-9906-0043)

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].

Correspondence concerning this article should be addressed to Teresa Koch, Department of Occupational, Economic, and Social Psychology, University of Vienna, Universitätsstraße 7, 1010 Vienna, Austria. Email: teresa.koch@univie.ac.at

Abstract

Recent trends suggest that individuals increasingly prefer easy and meaningless jobs over more challenging but meaningful activities. We argue that this tendency occurs due to high difficulty and high expectation situations, leading individuals to focus on easy tasks to avoid negative self-evaluation. However, we expect that whether such challenging situations are viewed as a threat to self-evaluation depends on individuals' digital maturity, which incorporates competencies to master challenges and act in a self-determined way. In an online experiment, we found that after completing Raven matrices under high expectation conditions, individuals with low digital maturity were significantly more likely to subsequently choose an easy and meaningless task over a difficult and meaningful task, than under low expectations. Individuals with high digital maturity were not affected in their task choice. Difficulty levels did not affect task choice. The study indicates that high expectations are influential regarding the preference for easy and meaningless jobs over more meaningful but difficult jobs, and points to influential individual differences in how high expectations are appraised.

Keywords: digital maturity, meaningful work, job preferences, expectations, difficulty

Digital Maturity Reduces the Effect of Expectations on Task Choice:**An Experimental Study**

Based on the findings of applied psychology, leaders in organizations often put a lot of effort into creating challenging and meaningful work. They try to align work with intrinsic goals and aim to make tasks challenging to create an experience of meaningfulness and engagement (Lysova et al., 2019). The attempt to create meaningful work is consistent with self-determination theory, which argues that individuals have an innate need for personal development and are inherently motivated to grow, learn, and adapt (Deci & Ryan, 2000, 2008). Challenges and difficulties are not just seen as obstacles, but as nutrients that enable the experience of mastery and control. In contrast, focusing on extrinsic rewards, such as money, undermines these basic human needs (Deci & Ryan, 2000).

Given these basic tenets of self-determination theory, it is surprising that individuals seem less and less willing to expose themselves to challenging but meaningful tasks. Instead, many people seem to prefer meaningless jobs with high salaries. In eight studies with more than 4000 participants, Ward (2024) found that most participants prioritize salary over meaningfulness in jobs. Moreover, recent trends in social media focus on the benefits of easy, meaningless jobs (Lobe, 2023; Oladele, 2023), and young people report to prefer jobs which pay enough but do not require too much effort (Twenge, 2017).

One explanation for this trend could be that individuals seek meaning outside of work (Ward, 2024). However, given that people still spend a large portion of their lives at work, the question remains whether other processes also contribute to this avoidance of challenges at work. One possibility is that the prevalence of high expectations and difficult tasks may drive avoidance. High expectations and difficult tasks may lead individuals to view themselves as objects of evaluation, and the resulting awareness of discrepancies between their actual self and societal norms may trigger negative affect (Duval & Lalwani, 1999;

Moskalenko & Heine, 2003; Wicklund, 1975). Such experiences could discourage individuals from engaging in future challenging tasks in order to avoid self-evaluation. In the present research, we therefore investigated whether confronting individuals with high expectations and task difficulties in one context might influence their subsequent preferences between easy, meaningless and difficult but meaningful tasks in another context.

Our idea was inspired by research showing that many young people today feel that expectations for them are rising (Twenge, 2017). Moreover, social media platforms often provide a distorted view of reality, with users portraying idealized self-images of themselves and their success (de Lenne et al., 2020; Mills et al., 2022; Oliver et al., 2024), creating unrealistic comparisons for others. Therefore, we hypothesized that a general capacity for self-determination in the digital world, where individuals are constantly exposed to biased information and more frequent social comparisons than in their offline lives, might moderate the effects of high expectations and task difficulty.

To measure the ability to remain self-determined in a digital world, we relied on the concept of digital maturity (Laaber et al., 2023). This concept is derived from self-determination theory and includes the ability to use the opportunities of the digital world for psychological growth. We assume that individuals with high digital maturity are less affected by the negative influence of high expectations and task difficulty because they experience a non-evaluative self-awareness: Rather than focusing on self-discrepancies as a threatening evaluation of themselves, it helps them to self-regulate their behavior and they see it as an opportunity for development. Hence, these processes related to the capacity for digital maturity should affect how individuals perceive a challenging task: Less as a social threat and more as a nutrient to experience mastery and growth.

1 Theoretical Background

1.1 The Preference for Meaningless Tasks

A focus on easy and meaningless tasks avoids falling short of high expectations and demands. When being confronted with difficult situations or high expectations, individuals' attention is drawn to their own performance and ought expectations for themselves (Wicklund, 1975). This increased focus on oneself enables the engagement in self-regulatory processes to amend the situation (Silvia & Phillips, 2013). Self-awareness theory states that a focus on the self will emphasize personal shortcomings, resulting in negative self-feelings and the desire to avoid this situation or reduce discrepancies: When individuals experience high self-awareness, they will engage in self-evaluation (Duval et al., 1992; Yilmaz, 2022). Linking to self-discrepancy theory, individuals then compare their actual self to the ought self, norms and expectations they should adhere to (Higgins, 1987, 1989). Mostly, such comparison will result in perceived discrepancies, which is uncomfortable and leads to negative self-feelings (Duval & Lalwani, 1999; Moskalkenko & Heine, 2003; Wicklund, 1975). Hence, engaging with difficult tasks and high expectations can lead to perceiving self-discrepancies which individuals might tend to avoid, despite a task feeling meaningful to them.

When experiencing self-discrepancies, individuals either want to avoid this state of self-awareness, or reduce the discrepancy by aligning the actual self closer with standards, if possible (Csikszentmihalyi & Figurski, 1982; Duval & Lalwani, 1999; Wicklund, 1979). For instance, Moskalkenko and Heine (2003) found that when individuals received negative performance feedback compared to the average performance, they then watched TV for longer, which let them direct awareness away from oneself. Hence, after negative performance feedback which showed self-discrepancies to the ought performance level, individuals rather wanted to avoid self-focus. However, if individuals perceive a high

likelihood to meet standards, they will work to reduce self-discrepancies (Duval et al., 1992; Wicklund, 1975). Adjusting behavior to deal with a difficult task or high expectations can eliminate negative affect (Wicklund, 1975). Thus, when experiencing high difficulty or high expectations situations, individuals will focus on their self-discrepancies and can either regulate their behavior to avoid the situation (e.g., stop an activity), or reduce the discrepancy (e.g., mobilize resources to improve performance).

Therefore, we expect that when individuals are confronted with high difficulty or high expectations situations, this will lead to a heightened focus on the self, making individuals aware of their discrepancies to these standards. They will then be motivated to reduce the discrepancy in order to meet standards, or reduce their focus on the self. Hence, they might be more likely to prefer easy, albeit more meaningless tasks over more difficult but meaningful tasks, because the easy task lets them avoid self-focus and having to experience self-discrepancies. Their choice of an easy task can thus be seen as a means of regulating one's behavior to reduce uncomfortable self-awareness.

We therefore postulated the following hypotheses:

H1: Individuals will rather choose an easy and meaningless subsequent task after completing a difficult task compared to an easy task.

H2: Individuals will rather choose an easy and meaningless subsequent task after completing a task with high expectations compared to low expectations.

Importantly, whether individuals decide to reduce discrepancies or avoid a situation will depend on their evaluation of the self-discrepancy (Csikszentmihalyi & Figurski, 1982; Duval & Lalwani, 1999; Wicklund, 1979). We argue that when individuals interpret self-discrepancies as a threat to their self-evaluation, avoidance – and hence a focus on easily fulfilled yet meaningless tasks – is likely. However, when self-discrepancies are interpreted as performance feedback which is an opportunity for personal growth, then individuals will

be more likely to engage in difficult and meaningful tasks despite discrepancies. We expect that whether individuals see difficulty and expectations as an opportunity for mastery or a threat relates to their digital maturity levels.

1.2 Maturely Navigating High Demands

Especially the digital world is prone to portray high expectations and accomplishments which are difficult to achieve, due to the idealized and distorted view of reality displayed therein (de Lenne et al., 2020, 2022; Kasperuniene & Zydziunaite, 2019; Mills et al., 2022). For example, viewing idealized LinkedIn posts was shown to lead to higher negative self-discrepancies regarding career success, compared to viewing neutral LinkedIn posts (Oliver et al., 2024). Hence, it is crucial that individuals navigate such an environment in an autonomous and self-determined way, using it for their personal benefit and as an opportunity for growth, but not being threatened by biased comparisons.

We expect that digital maturity will attenuate the effect of high difficulty and high expectation situations on task choice, as digital maturity includes the competence to master challenges in digital contexts with a high level of self-determination. Digital maturity is defined as “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 regarding individuals’ use of digital technologies, theoretically grounded in psychosocial maturation principles and self-determination theory (Bleidorn, 2015; Deci & Ryan, 2000; Greenberger et al., 1975). With high digital maturity, individuals are capable of using digital opportunities in ways which support their personal growth and social adjustment (Staudinger & Kunzmann, 2005), and satisfy their psychological needs for autonomy, competence and relatedness (Deci & Ryan, 2000; Laaber et al., 2023, 2024).

Digital maturity encompasses several abilities and attitudes addressing the challenges of the digital world (Laaber et al., 2023), including the ability to make self-determined choices, and using digital opportunities for personal growth. Laaber et al. (2024) showed that with higher digital maturity, individuals are more likely to experience psychological richness (Oishi et al., 2021), suggesting that they more often expose themselves to demanding, yet valuable situations. Hence, individuals with high digital maturity might seek out opportunities for personal growth online, like learning a new skill, and find these activities rewarding. Such situations might come with difficulties and experiences of failure, but can enable growth and mastery experiences. We argue that with high digital maturity, individuals see negative experiences as feedback for improvement rather than a threat to their self. Moreover, as they seem more prone to expose themselves to psychologically rich experiences, they will have learned that negative experiences can still lead to positive outcomes. On the other hand, individuals with low digital maturity might only focus on quick and easy rewards which can easily be achieved online, and will not learn to see a challenging task as rewarding, but see it as a threat. Thus, with high digital maturity, individuals should be more inclined to persevere with difficult yet meaningful tasks, rather than perceiving difficulty and expectations as a threat causing uncomfortable states of self-awareness.

Hence, we assumed that digital maturity can moderate the effect of high difficulty and high expectation on task choice:

H3: The predicted effect of task difficulty (H1) will be reduced with increasing digital maturity.

H4: The predicted effect of expectation (H2) will be reduced with increasing digital maturity.

In the present study, we transferred the assumptions discussed above to the laboratory setting to test them empirically. We manipulated the expectation (high vs. low) and difficulty

(high vs. low) of an experimental task, and tested whether this affects if individuals engage in an easy and meaningless or difficult and meaningful subsequent task. Importantly, we expected the difficulty and expectation manipulations to affect choice of a subsequent task, which is not itself subject to high expectations. This would show that the increased self-discrepancy experienced then affects subsequent behavior on other tasks.

2 The Present Study

The main question investigated in this study is the influence of high difficulty and high expectation situations on individuals' subsequent task choice. We assume that when experiencing high task difficulty and high expectations of fulfillment, individuals will be more inclined to subsequently prefer an easy and meaningless task over a difficult but meaningful task. We expect this to occur because high difficulty and expectations pose a threat to individuals' self-evaluation, as they draw one's awareness to discrepancies between one's performance and standards. However, we expect that with high digital maturity, individuals are less prone to view high difficulty and expectation as a threat, but as an opportunity for development. They should thus be more likely to engage with meaningful yet difficult tasks. Hence, we independently manipulate both task difficulty and expectation in a 2x2 design and measure individual's digital maturity, to test the effect on subsequent task choice. The study obtained ethics approval from the Departmental Review Board of the Department of Occupational, Economic, and Social Psychology at the University of Vienna (reference number 2024/S/013).

3 Method

3.1 Design

The study was designed as an online experiment. First, participants completed survey measures, then they were forwarded to the experiment. Participants had to complete five Raven matrices (Kratzmeier & Horn, 1987) for which they were randomly assigned to one of

four conditions in the 2 (high vs. low difficulty) x 2 (high vs. low expectation) design. Hence, participants experienced a situation of high vs. low expectations crossed with high vs. low difficulty. Then, participants had to complete a subsequent task for which they could choose between an easy and meaningless and a difficult and meaningful task.

3.2 Participants

Participants aged 18 years or older and living in Germany were recruited to participate in the online experiment using *Prolific*. Participants who did not use a macOS or Windows computer to answer the study were screened out for technical reasons. Assuming a small to medium effect size, we aimed for a minimum sample size of 277, to achieve 80% power. The final sample consisted of 305 participants, with a mean age of 31.43 ($SD = 9.45$), 32.5% female, 65.9% male, 1.3% non-binary/third gender, 0.3% preferred not to disclose.

3.3 Measures

Digital maturity. The Digital Maturity Inventory was used (DIMI, Laaber et al., 2023), which measures the 10 dimensions of digital maturity using 32 items, on 5-point scales from *not at all true of me* (1) to *very true of me* (5) for the digital literacy dimension, and *never* (1) to *always* (5) for the other dimensions. Example items include “When using a mobile device, I have the feeling that it is controlling my life” (autonomous choice to use mobile devices, reverse coded), “When using a mobile device, I decide what I do” (autonomy within digital contexts), “When using a mobile device, I learn something useful” (individual growth in digital contexts) (Cronbach’s $\alpha = .776$; for α per dimension see Appendix A).

Preference for the easy task. Participants were asked which task they preferred to work on, measured on a slider from 0 (*prefer finance text*) to 100 (*prefer visual search*).

Financial knowledge. Participants were asked how much they have engaged with such financial topics until now, on a scale from 1 (*very little*) to 5 (*very much*).

3.4 Procedure

Participants first provided informed consent, completed socio-demographic questions and the Digital Maturity Inventory. Then, participants were forwarded to the online experiment using *Inquisit 6*. Therein, participants were initially presented with two easy Raven matrices (Kratzmeier & Horn, 1987) to solve. They were then informed that the next matrices had been adapted to their performance on the initial matrices, so that they should get 2 out of 10 (low expectation condition) or 8 out of 10 (high expectation condition) correct on average. The following three matrices were either easy (low difficulty condition) or difficult (high difficulty condition). The expectation conditions and difficulty conditions were randomly allocated. After completing the three matrices, participants received overall performance feedback (out of 25 points, 5 points per correctly solved matrix). Next, participants were given a choice between two subsequent tasks: a visual search task or reading a text about financial knowledge. Participants were informed that they could freely choose which task to do as both were valuable to research, and that they would have the possibility to switch between tasks. The visual search task was a very easy and meaningless task, where individuals repeatedly had to identify the differently colored square out of a 4x4 matrix of squares. In contrast, the reading task was more difficult, but also meaningful, as participants were required to read a text about inflation and investment, rating their understanding of the text. The societal and personal relevance of this topic was emphasized in the task description. The matrices and the financial text were pre-tested (see Appendix B). For the detailed instructions, refer to Appendix C.

Every two minutes participants could choose between the tasks again, giving them the choice to either continue with the task they were working on or switching task. Overall, this second part took six minutes and participants chose between the tasks three times (initial choice, 2 further choices). After six minutes, the task ended irrespective of how much of the

text participants had read or how many visual searches they had completed (detailed study materials are provided on

https://osf.io/sfvz5/?view_only=0a9bcde522624dd685da00b78386ed42). Participants then rated their task preference and financial knowledge, and were debriefed.

3.5 Analysis Method

The relationships between the relevant constructs were initially investigated using correlations. It was preregistered that the hypotheses would be tested using a two-way ANOVA in SPSS, with difficulty and expectation as the independent variables, and the sum of choices for the easy task and the preference for the easy task as the dependent variables (https://aspredicted.org/YHY_GWX). However, both dependent variables and the ANOVA standardized residuals were not normally distributed. Therefore, for the behavioral choice between the two tasks we instead used a generalized linear mixed model of the three binary choices, predicted by difficulty, expectation and digital maturity. The ANOVA results and all further pre-registered analyses can be found in the Online Appendices on OSF, along with the data (https://osf.io/sfvz5/?view_only=0a9bcde522624dd685da00b78386ed42).

4 Results

4.1 Preliminary Analysis

Correlations of the relevant constructs are shown in Table 1. As would be expected, the difficulty of the matrices correlated negatively with the score participants obtained in the matrices task. There was a significant difference in scores between the low difficulty group ($M = 20.38$, $SD = 6.90$) and the high difficulty group ($M = 14.62$, $SD = 7.73$), $t(303) = 6.87$, $p < .001$, *Cohen's d* = .79. Digital maturity did not correlate with the score. The number of times participants chose the easy visual search task highly correlated with their preference for the easy task. Moreover, financial knowledge correlated negatively with the choice of and

preference for the easy task. Hence, with higher financial knowledge participants rather chose and preferred the difficult financial reading task.

Table 1*Means, Standard Deviations, and Correlations of the Main Study Variables*

	<i>M (SD)</i>	Difficulty	Expectation	Digital maturity	Sum of choices for the easy task	Task preference for the easy task	Score on matrices
Difficulty	-	1					
Expectation	-	-	1				
Digital maturity	364.62 (32.42)	.015	-.054	1			
Sum of choices for the easy task	1.52 (1.15)	-.032	.027	.089	1		
Task preference for the easy task	56.50 (40.22)	.016	.035	.103	.810***	1	
Score on matrices	17.62 (7.84)	-.367***	-.030	-.063	-.034	-.090	1
Financial knowledge	3.40 (1.08)	-.026	-.030	.017	-.333***	-.400***	.040

Note. *** $p < .001$. $N = 305$.

4.2 Hypothesis Testing

The hypotheses were tested using a generalized linear mixed model of the three binary choices between the two tasks, predicted by difficulty, expectation and digital maturity. The results showed a significant interaction effect of expectation with digital maturity ($b = -.766$, $p = .006$). In contrast, the hypothesized interaction of difficulty with digital maturity was not significant ($b = .072$, $p = .796$). Moreover, neither the hypothesized effect of difficulty on task choice ($b = -.303$, $p = .422$), nor the hypothesized effect of expectation on task choice ($b = .130$, $p = .718$) were significant. The effects are presented in Table 3.

Table 3

Generalized Linear Mixed Model Predicting the Choice for the Easy Task (3 Trials)

Antecedent	Choices for the easy task			
	b	SE	p	95% CI
Difficulty	-.303	.377	.422	[-1.012, 0.412]
Expectation	.130	.362	.718	[-0.560, 0.813]
Digital maturity	.614	.235	.009	[0.156, 1.077]
Difficulty x expectation	.153	.525	.770	[-0.851, 1.173]
Difficulty x digital maturity	.072	.276	.796	[-0.457, 0.601]
Expectation x digital maturity	-.766	.277	.006	[-1.309, -0.239]
Intercept	.028	.241	.908	[-0.450, 0.488]

Note. $N = 305$. 95% CI were created using 5000 bootstrap samples.

To examine the significant interaction between expectation and digital maturity, we conducted contrasts at low (-1 SD), medium (mean) and high ($+1$ SD) digital maturity per expectation condition. We expected that the effect of the expectation condition will be reduced at higher digital maturity levels, as individuals with high digital maturity are not threatened by high expectations. Indeed, comparing the expectation conditions at low, medium and high digital maturity, individuals with low digital maturity were less likely to

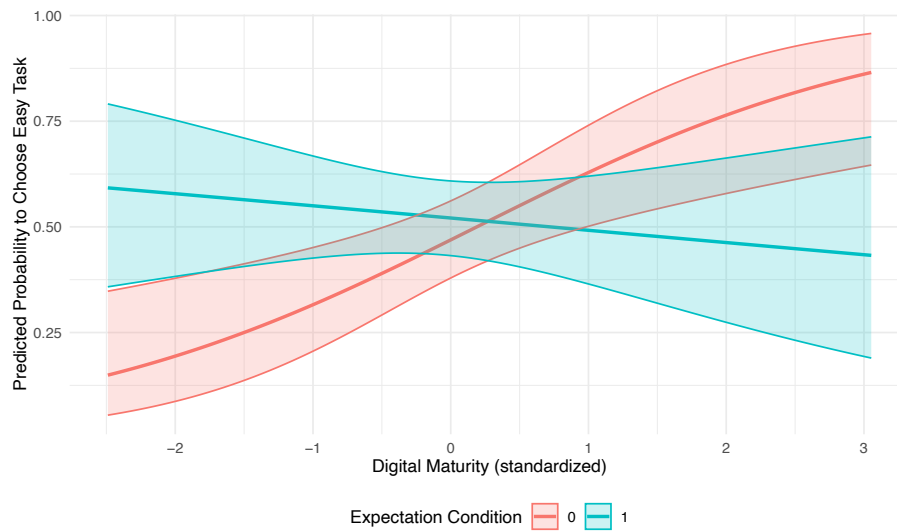
choose the easy task under low expectations than high expectations ($p = .012$). There were no differences between expectation conditions at medium ($p = .430$) or high digital maturity ($p = .137$). Table 4 shows the probability of choosing the easy task at each level. Figure 1 displays the effects.

Table 4

Choices for the easy task			
Low digital maturity	<i>probability</i>	<i>SE</i>	95% CI
High expectation	.550	.063	[.426, .668]
Low expectation	.316	.064	[.206, .451]
Medium digital maturity			
High expectation	.521	.046	[.432, .609]
Low expectation	.469	.047	[.379, .561]
High digital maturity			
High expectation	.492	.067	[.365, .620]
Low expectation	.629	.062	[.501, .740]

Figure 1

Estimated Marginal Means of the Probability to Choose the Easy Task Predicted by Digital Maturity and Expectation Condition



Note. Expectation coded as 0 = low expectation, 1 = high expectation.

Hence, with low digital maturity participants were more likely to choose the difficult task when they had experienced low expectations. After high expectations, they chose the easy task at a similar rate like participants with medium and high digital maturity. There were no differences due to low or high expectation at medium or high digital maturity levels. With medium and high digital maturity, participants were not affected by the expectation condition, while with low digital maturity individuals were sensitive to the expectation.

5 Discussion

The aim of this study was to test the effect of high difficulty and high expectations on individuals' preference for an easy and meaningless task over a difficult and meaningful task. Moreover, we assumed that with increasing digital maturity individuals would be less affected by high difficulty and expectations, because they perceive challenging situations not

as a threat but as an opportunity to grow. The results support that the effect of high vs. low expectations on task preference depend on individuals' digital maturity level as expected. Contrary to expectations, high vs. low difficulty did not affect subsequent task choice.

While individuals with medium and high digital maturity were not affected by the expectation manipulation, individuals with low digital maturity were susceptible to expectation effects. After having experienced low expectations, they were significantly more likely to engage with the difficult and meaningful task than after having experienced high expectations. These results support that after high expectations, individuals with low digital maturity prefer to engage in an easy and meaningless task, suggesting a preference to avoid a potential threat to self-evaluation. The finding is in line with research on self-awareness, stating that individuals will strive to avoid situations which make them aware of self-discrepancies to standards (Duval & Lalwani, 1999; Moskalenko & Heine, 2003; Wicklund, 1975). It emphasizes the importance of societal standards or expectations for self-awareness and self-evaluation, as setting a simple standard of how many matrices individuals were expected to solve still influenced their choice of a subsequent, unrelated task. This continued effect across tasks shows the persevering influence of self-evaluation on other activities.

Moreover, the study supports that the preference for the easy and meaningless task is moderated by digital maturity, which captures the competence to master challenges and use digital opportunities for personal growth (Laaber et al., 2023, 2024). As expected, it seems that with higher digital maturity, individuals are not threatened by high expectations and thus not impacted in their task choice. This corresponds to previous research which showed a positive relation of digital maturity to psychological richness (Laaber et al., 2024), suggesting that with higher digital maturity individuals rather expose themselves to complex situations, which can be positive and negative and overall enriching (Oishi et al., 2021). However, with low digital maturity, individuals were significantly affected by the set expectations. The

results support the assumption that with low digital maturity, individuals felt threatened by high expectations, thus rather avoiding the difficult and meaningful task.

Contrary to the hypotheses, high difficulty did not impact subsequent task choice. This was unexpected as the easy matrices should have posed no threat to self-evaluation, while the difficult matrices could have posed a threat. Participants' scores on the matrices task show that the difficult condition was in fact more difficult to solve than the easy condition, both in the pretest and the main experiment. Hence, the lack of a significant effect was not due to the difficulty manipulation. Rather, the results seem to suggest that while comparing oneself to expectations triggers self-awareness and threat, and leads to avoidance of a subsequent difficult task, experiencing difficulty per se does not. Crucially, this points to the potential threats of expectations to self-evaluation exacerbated by the online world, which offers constant comparison to the achievements of others, setting expectations of what one should strive for and creating negative self-discrepancies (Oliver et al., 2024).

One core strength of this study is that it experimentally tests the effect of high expectations and difficulty on behavior, showing a causal effect of expectations and difficulty on subsequent task choice. Moreover, the study is the first to test the influence of digital maturity on behavior in an experimental setting, as previous studies have solely tested correlational associations of digital maturity to outcomes (Koch et al., 2025; Laaber et al., 2023, 2024). The generated insights emphasize that high expectations set at the workplace or by unrealistic portrayals on social media can lead individuals to avoid challenging situations and prefer easy and meaningless activities, in which they experience no threat to their self-evaluation.

Moreover, the study contributes to the advancement of digital maturity theory. The findings provide interesting insights how digital maturity influences behavior, suggesting potential mechanisms how digital maturity can enable a beneficial use of the digital world.

The study validates the conceptualization of digital maturity as grounded in self-determination theory as it suggests that with higher digital maturity individuals act in a more self-determined and autonomous way in the face of adversities, such as they are often encountered in the digital context. However, while previous research has shown that digital maturity goes beyond measures of personality or self-regulation (Koch et al., 2024; Laaber, 2024; Laaber et al., 2023), we cannot yet fully differentiate the digital maturity concept from pure self-determination measures in this study. The relevance of digital maturity in this context, as opposed to general self-determination, should become evident when focusing on the expectations communicated on social media, as a specifically digital context.

5.1 Limitations and Future Directions

Crucially, we propose that individuals with high digital maturity see high expectations as an opportunity for development rather than as a threat to their self-evaluation, as an explanation why digital maturity moderates the effect of expectations on task choice. However, this mechanism is not tested in the present experiment. While it offers a theoretical explanation why digital maturity interacts with expectations, empirical validation is still required. Potentially, individuals with higher digital maturity might see high expectation situations as an opportunity to develop because they feel more capable of overcoming challenges and accomplishing their goals, which would also be in line with self-awareness research on when individuals choose to avoid a situation or actively reduce self-discrepancies (Csikszentmihalyi & Figurski, 1982; Duval & Lalwani, 1999; Wicklund, 1979). Investigating these mechanisms would provide additional depth to the understanding of digital maturity and behavior in challenging situations. Future studies should aim to test these mechanisms, exploring whether individuals with higher digital maturity rather view negative discrepancies to expectations or societal standards as feedback and an opportunity to grow, or as a threat to the self.

Another limitation is that the experiment only tested a very specific task within an online setting. While the online experiment allowed causal testing of the effects of interest, future research should explore whether similar avoidance of difficult and meaningful tasks after having experienced high expectations also persists in more natural settings, such as school or the workplace, and how the expectations generated by social media influence task choice.

To conclude, meaningful work is not always appreciated as would be suggested by self-determination theory (Deci & Ryan, 2000; Lysova et al., 2019; Ryan et al., 2008). When individuals are exposed to high expectations, they might react either with avoidance or attempts to improve, depending on individuals' ability to master challenges in a self-determined way. The results emphasize that high expectations, as they are often portrayed on social media, might fuel the tendency to prefer easy, routine jobs, which are easily accomplished yet meaningless.

6 References

- 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>
- Csikszentmihalyi, M., & Figurski, T. J. (1982). Self-awareness and aversive experience in everyday life. *Journal of Personality*, 50(1), 15–19. <https://doi.org/10.1111/j.1467-6494.1982.tb00742.x>
- de Lenne, O., Eggermont, S., & Vandenbosch, L. (2022). Researching the malleability narrative on professional ideals: The role of internal attribution in the relations between media and adolescents' well-being. *Communication Studies*, 73(5–6), 527–543. <https://doi.org/10.1080/10510974.2022.2140174>
- de Lenne, O., Vandenbosch, L., Eggermont, S., Karsay, K., & Trekels, J. (2020). Picture-perfect lives on social media: A cross-national study on the role of media ideals in adolescent well-being. *Media Psychology*, 23(1), 52–78.
<https://doi.org/10.1080/15213269.2018.1554494>
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268.
https://doi.org/10.1207/S15327965PLI1104_01
- Deci, E. L., & Ryan, R. M. (2008). Hedonia, eudaimonia, and well-being: An introduction. *Journal of Happiness Studies*, 9(1), 1–11. <http://dx.doi.org/10.1007/s10902-006-9018-1>
- Duval, T. S., Duval, V. H., & Mulilis, J.-P. (1992). Effects of self-focus, discrepancy between self and standard, and outcome expectancy favorability on the tendency to match self to standard or to withdraw. *Journal of Personality and Social Psychology*, 62(2), 340–348. <https://doi.org/10.1037/0022-3514.62.2.340>

- Duval, T. S., & Lalwani, N. (1999). Objective self-awareness and causal attributions for self-standard discrepancies: Changing self or changing standards of correctness. *Personality and Social Psychology Bulletin*, 25(10), 1220–1229.
<https://doi.org/10.1177/0146167299258004>
- 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>
- Kasperuniene, J., & Zydziunaite, V. (2019). A systematic literature review on professional identity construction in social media. *Sage Open*, 9(1), 2158244019828847.
<https://doi.org/10.1177/2158244019828847>
- Koch, T., Laaber, F., Arenas, A., & Florack, A. (2025). Socially (dis)connected in a connected world: The role of young people's digital maturity. *Computers in Human Behavior*, 163, 108473. <https://doi.org/10.1016/j.chb.2024.108473>
- 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, 108157. <https://doi.org/10.1016/j.chb.2024.108157>
- Kratzmeier, H., & Horn, R. (1987). *Raven-Matrizen-Test: Standard progressive matrices; Manual* (2nd ed.). Beltz Test.
- Laaber, F. (2024). *A psychological perspective on self-determined digital technology use: Conceptualizing, measuring, and understanding young people's digital maturity* [Doctoral Dissertation]. University of Vienna.
- 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, 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, 108077. <https://doi.org/10.1016/j.chb.2023.108077>
- Lobe, A. (2023, September 5). Lazy-Girl-Jobs: Was hinter dem Tiktok-Trend steckt. *Der Standard*. <https://www.derstandard.at/story/3000000185038/lazy-girl-jobs-was-hinter-dem-tiktok-trend-steckt>
- Lysova, E. I., Allan, B. A., Dik, B. J., Duffy, R. D., & Steger, M. F. (2019). Fostering meaningful work in organizations: A multi-level review and integration. *Journal of Vocational Behavior*, 110, 374–389. <https://doi.org/10.1016/j.jvb.2018.07.004>
- Mills, J. S., Minister, C., & Samson, L. (2022). Enriching sociocultural perspectives on the effects of idealized body norms: Integrating shame, positive body image, and self-compassion. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.983534>
- Moskalenko, S., & Heine, S. J. (2003). Watching your troubles away: Television viewing as a stimulus for subjective self-awareness. *Personality and Social Psychology Bulletin*, 29(1), 76–85. <https://doi.org/10.1177/0146167202238373>
- Oishi, S., Choi, H., Liu, A., & Kurtz, J. (2021). Experiences associated with psychological richness. *European Journal of Personality*, 35(5), 754–770. <https://doi.org/10.1177/0890207020962334>
- Oladele, B. (2023, July 26). How the “lazy girl job” took over work TikTok. *BBC*. <https://www.bbc.com/worklife/article/20230725-how-the-lazy-girl-job-took-over-work-tiktok>
- Oliver, S., Marder, B., Lavertu, L., Cowan, K., Javornik, A., & Osadchaya, E. (2024). The hustle is real: An examination of the self-related consequences of consuming

- idealized self-promotional content on LinkedIn. *Information Technology & People*.
<https://doi.org/10.1108/ITP-02-2023-0134>
- 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>
- Silvia, P. J., & Phillips, A. G. (2013). Self-awareness without awareness? Implicit self-focused attention and behavioral self-regulation. *Self and Identity: The Journal of the International Society for Self and Identity*, 12(2), 114–127.
<https://doi.org/10.1080/15298868.2011.639550>
- Staudinger, U. M., & Kunzmann, U. (2005). Positive adult personality development: Adjustment and/or growth? *European Psychologist*, 10(4), 320–329.
<https://doi.org/10.1027/1016-9040.10.4.320>
- Twenge, J. M. (2017). *iGen: Why today's super-connected kids are growing up less rebellious, more tolerant, less happy—and completely unprepared for adulthood—and what that means for the rest of us*. Simon and Schuster.
- Ward, S. (2024). Choosing money over meaningful work: Examining relative job preferences for high compensation versus meaningful work. *Personality and Social Psychology Bulletin*, 50(7), 1128–1148. <https://doi.org/10.1177/01461672231159781>
- Wicklund, R. A. (1975). Objective self-awareness. In *Advances in experimental social psychology* (Vol. 8, pp. 233–275). Academic Press.
- Wicklund, R. A. (1979). The influence of self-awareness on human behavior: The person who becomes self-aware is more likely to act consistently, be faithful to societal norms, and give accurate reports about himself. *American Scientist*, 67(2), 187–193.

Yilmaz, H. A. (2022). Self-awareness and self-consciousness: A review from the perspective of social psychology. *Psikiyatride Güncel Yaklaşımlar*, 14(4), 437–445.
<https://doi.org/10.18863/pgy.1029405>

Appendix A – Digital Maturity Dimensions*Reliability Analysis of the Digital Maturity Dimensions (N = 305)*

Dimension	Number of items	Cronbach's α
Autonomous Choice to Use Mobile Devices	3	.779
Autonomy Within Digital Contexts	3	.739
Digital Literacy	3	.714
Individual Growth in Digital Contexts	3	.787
Digital Risk Awareness	3	.856
Support-Seeking Regarding Digital Problems	4	.855
Regulation of Negative Emotions in Digital Contexts	3	.848
Regulation of Impulses in Digital Contexts	3	.809
Respect Towards Others in Digital Contexts	4	.776
Digital Citizenship	3	.806
Across all items	32	.776

Appendix B - Pre-test of Raven Matrices

For the pre-test, 37 psychology students completed a test of the matrices in a computer lab at the university. Participants average age was 22.30 ($SD = 3.83$), with a gender distribution of 83.8% females, 13.5% males, and 2.7% non-binary / third gender.

Mirroring the manipulation in the main study, all participants saw the first two easy matrices (matrix E3 and E4 from Kratzmeier and Horn, 1987). They were then informed that the next matrices had been adapted to their performance on the initial matrices, so that they should get 8 out of 10 correct on average. Then participants were randomly allocated to see either three easy (E5, E6, E7) or three difficulty matrices (E10, E11, E12). There were 19 participants in the easy condition and 18 participants in the difficult condition.

As expected, in the difficult condition participants perceived that they met the expectations regarding their performance significantly worse ($M = 2.67$, $SD = 1.41$) than in the easy condition ($M = 4.00$, $SD = 1.37$) on a scale from 1-5, $t(35) = 2.91$, $p = .006$, *Cohen's* $d = .957$. Similarly, in the difficult condition participants perceived that they met the demands of the task significantly worse ($M = 2.94$, $SD = 1.31$) than in the easy condition ($M = 4.11$, $SD = 1.24$) on a scale from 1-5, $t(35) = 2.77$, $p = .009$, *Cohen's* $d = .912$. Moreover, in the difficult condition participants perceived that the matrices as significantly more exhausting ($M = 64.28$, $SD = 19.12$) than in the easy condition ($M = 27.32$, $SD = 17.44$) on a scale from 0-100, $t(35) = -6.150$, $p < .001$, *Cohen's* $d = -2.02$. Lastly, in the difficult condition participants received a significantly lower score ($M = 15.00$, $SD = 7.67$) than in the easy condition ($M = 21.05$, $SD = 6.79$) from 0 to 25 points (5 per correctly solved matrix), $t(35) = 2.546$, $p < .015$, *Cohen's* $d = .837$.

The results supported that the two sets of matrices had differential effects on how participants perceived their performance and how easy the matrices were to solve.

After completing the matrices and evaluating their own performance on them, all participants were asked to read the financial text which formed the difficult and meaningful task in the main study. Participants reported low liking of the text ($M = 39.00$, $SD = 25.14$, on a scale from 0-100), but rated it as rather useful ($M = 58.92$, $SD = 24.37$, on a scale from 0-100), that they learned something useful ($M = 63.03$, $SD = 25.62$, on a scale from 0-100) and learned something new ($M = 67.92$, $SD = 23.02$, on a scale from 0-100). Hence, the results suggested that the financial text provided a meaningful yet difficult task, as participants reported low enjoyment but high utility of engaging with it.

Appendix C – Instructions

First set of two matrices:

You will see a pattern with a gap on each of the following pages. Choose which of the individual pieces below correctly completes the pattern.

Which piece is just right to complete the pattern? Select the correct number.

Second set of three matrices:

Very good! You now have 3 more patterns to solve.

We have adjusted these **to your ability** based on your previous performance, so you should have an average of **8 (2) out of 10 patterns correct**.

After matrices:

You have now completed this task.

You achieved a total of **X out of 25 points!**

Instructions subsequent task:

Now the next part will start.

You can choose between two possible tasks. Both tasks are important for our research. All participants can choose which task they prefer to work on.

You can also switch between the tasks in between. This part takes 6 minutes in total.

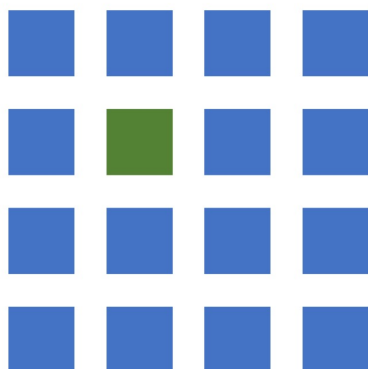
Task A: This task is about search images. The color perception on the screen is examined at different contrasts.

Task B: This task is about financial understanding. To better understand the handling of finances in society, you will see practical help for financial protection against inflation. We are interested in your understanding and reasons for your decisions. This is an important topic that is particularly relevant for people in your age group.

Task choice:

Which task do you want to do?

- Task A (search images)
- Task B (financial understanding)

Example of the Visual Search Task:

Which shape does not match?

The numbers in the response options describe the squares. The first number describes the column, the second number describes the row, starting at the top left.

For example, (1, 3) means the first column and the third row.

Participants were then asked to choose the correct one of six sets of coordinates, e.g. (3, 2), (2, 2).