Original article

The impact of digital technology use on adolescent well-being

Tobias Dienlin, PhD; Niklas Johannes, PhD

This review provides an overview of the literature regarding digital technology use and adolescent well-being. Overall, findings imply that the general effects are on the negative end of the spectrum but very small. Effects differ depending on the type of use: whereas procrastination and passive use are related to more negative effects, social and active use are related to more positive effects. Digital technology use has stronger effects on short-term markers of hedonic well-being (eg, negative affect) than long-term measures of eudaimonic well-being (eg, life satisfaction). Although adolescents are more vulnerable, effects are comparable for both adolescents and adults. It appears that both low and excessive use are related to decreased well-being, whereas moderate use is related to increased well-being. The current research still has many limitations: High-quality studies with large-scale samples, objective measures of digital technology use, and experience sampling of well-being are missing.

With each new technology come concerns about its potential impact on (young) people's well-being.[1] In recent years, both scholars and the public have voiced concerns about the rise of digital technology, with a focus on smartphones and social media.[2] To ascertain whether or not these concerns are justified, this review provides an overview of the literature regarding digital technology use and adolescent well-being.

Digital technology use and well-being are broad and complex concepts. To understand how technology use might affect well-being, we first define and describe both concepts. Furthermore, adolescence is a distinct stage of life. To obtain a better picture of the context in which potential effects unfold, we then examine the psychological development of adolescents. Afterward, we present current empirical findings about the relation between digital technology use and adolescent well-being. Because the empirical evidence is mixed, we then formulate six implications in order to provide some general guidelines, and end with a brief conclusion.

Digital technology use

Digital technology use is an umbrella term that encompasses various devices, services, and types of use. Most adolescent digital technology use nowadays takes place on mobile devices.[3,4] Offering the functions and affordances of several other media, smartphones play a pivotal role in adolescent media use and are thus considered a "metamedium."[5] Smartphones and other digital devices can host a vast range of different services. A representative survey of teens in the US showed that the most commonly used digital services are YouTube (85%), closely followed by the social media Instagram (72%), and Snapchat (69%). Notably, there exist

Author affiliations: School of Communication, University of Hohenheim, Germany (Tobias Dienlin); Institute of Neuroscience and Psychology, University of Glasgow, UK (Niklas Johannes). **Address for correspondence:** Tobias Dienlin, School of Communication (540F), University of Hohenheim, 70599 Stuttgart, Germany (email: tobias.dienlin@uni-hohenheim.de)

two different types of social media: *social networking sites* such as Instagram or TikTok and *instant messengers* such as WhatsApp or Signal.

All devices and services offer different functionalities and affordances, which result in different *types of use*.[6] When on social media, adolescents can chat with others, post, like, or share. Such uses are generally considered *active*. In contrast, adolescents can also engage in *passive* use, merely lurking and watching the content of others. The binary distinction between active and passive use does not yet address whether behavior is considered as procrastination or goal-directed.[7,8] For example, chatting with others can be considered procrastination if it means delaying work on a more important task. Observing, but not interacting with others' content can be considered to be goal-directed if the goal is to stay up to date with the lives of friends. Finally, there is another important distinction between different types of use: whether use is social or nonsocial.[9] Social use captures all kinds of active interpersonal communication, such as chatting and texting, but also liking photos or sharing posts. Nonsocial use includes (specific types of) reading and playing, but also listening to music or watching videos.

When conceptualizing and measuring these different types of digital technology use, there are several challenges. Collapsing all digital behaviors into a single predictor of well-being will inevitably decrease precision, both conceptually and empirically. Conceptually, subsuming all these activities and types of use under one umbrella term fails to acknowledge that they serve different functions and show different effects.[10] Understanding digital technology use as a general behavior neglects the many forms such behavior can take. Therefore, when asking about the impact of digital technology use on adolescent well-being, we need to be aware that digital technology use is not a monolithic concept.

Empirically, a lack of validated measures of technology use adds to this imprecision.[11] Most work relies on self-reports of technology use. Self-reports, however, have been shown to be imprecise and of low validity because they correlate poorly with objective measures of technology use.[12] In the case of smartphones, self-reported duration of use correlated moderately, at best, with objectively logged use.[13] These findings are mirrored when comparing self-reports of general internet use with objectively measured use.[14] Taken

together, in addition to losing precision by subsuming all types of technology use under one behavioral category, the measurement of this category contributes to a lack of precision. To gain precision, it is necessary that we look at effects for different types of use, ideally objectively measured.

Well-being

Well-being is a subcategory of mental health. Mental health is generally considered to consist of two parts: negative and positive mental health.[15] Negative mental health includes subclinical negative mental health, such as stress or negative affect, and psychopathology, such as depression or schizophrenia.[16] Positive mental health is a synonym for well-being; it comprises hedonic well-being and eudaimonic well-being.[17] Whereas hedonic well-being is affective, focusing on emotions, pleasure, or need satisfaction, eudaimonic well-being is cognitive, addressing meaning, self-esteem, or fulfillment.

Somewhat surprisingly, worldwide mental health problems have not increased in recent decades.[18] Similarly, levels of general life satisfaction remained stable during the last 20 years.[19,20] Worth noting, the increase in mental health problems that has been reported[21] could merely reflect increased awareness of psychosocial problems.[22,23] In other words, an increase in diagnoses might not mean an increase in psychopathology.

Which part of mental health is the most likely to be affected by digital technology use? Empirically, eudaimonic well-being, such as life satisfaction, is stable. Although some researchers maintain that 40% of happiness is volatile and therefore malleable,[24] more recent investigations argued that the influences of potentially stabilizing factors such as genes and life circumstances are substantially larger.[25] These results are aligned with the so-called set-point hypothesis, which posits that life satisfaction varies around a fixed level, showing much interpersonal but little intrapersonal variance.[26] The hypothesis has repeatedly found support in empirical studies, which demonstrate the stability of life satisfaction measures.[27,28] Consequently, digital technology use is not likely to be a strong predictor of eudaimonic well-being. In contrast, hedonic well-being such as positive and negative affect is volatile and subject to substantial fluctuations.[17] Therefore, digital technology use might well be a driver of hedonic well-being: Watching entertaining content

Original article

can make us laugh and raise our spirits, while reading hostile comments makes us angry and causes bad mood. In sum, life satisfaction is stable, and technology use is more likely to affect temporary measures of hedonic well-being instead of more robust eudaimonic well-being. If this is the case, we should expect small to medium-sized effects on short-term affect, but small to negligible effects on both long-term affect and life satisfaction.

Adolescents

Adolescence is defined as "the time between puberty and adult independence,"[29] during which adolescents actively develop their personalities. Compared with adults, adolescents are more open-minded, more social-oriented, less agreeable, and less conscientious[30]; more impulsive and less capable of inhibiting behavior[31]; more risk-taking and sensation seeking[29]; and derive larger parts of their well-being and life satisfaction from other peers.[32] During adolescence, general levels of life satisfaction and self-esteem drop and are often at their all-time lowest.[33,34] At the same time, media use increases and reaches a first peak in late adolescence.[3] Analyzing the development of several well-being-related variables across the last two decades, the answers of 46 817 European adolescents and young adults show that, whereas overall internet use has risen strongly, both life satisfaction and health problems remained stable.[19] Hence, although adolescence is a critical life stage with substantial intrapersonal fluctuations related to well-being, the current generation does not seem to do better or worse than those before.

Does adolescent development make them particularly susceptible to the influence of digital technology? Several scholars argue that combining the naturally occurring trends of low self-esteem, a spike in technology use, and higher suggestibility into a causal narrative can take the form of a foregone conclusion.[35] For one, although adolescents are in a phase of development, there might be more similarities between adolescents and adults than differences.[30] Concerns about the effects of a new technology on an allegedly vulnerable group has historically often taken the form of paternalization.[36] For example, and maybe in contrast to popular opinion, adolescents already possess much media literacy or privacy literacy.[3]

This has two implications. First, asking *what technology does to adolescents* ascribes an unduly passive role to

adolescents, putting them in the place of simply responding to technology stimuli. Recent theoretical developments challenge such a one-directional perspective and advise to rather ask *what adolescents do with digital technology*, including their type of use.[37] Second, in order to understand the effects of digital technology use on well-being, it might not be necessary to focus on adolescents. It is likely that similar effects can be found for both adolescents and adults. True, in light of the generally decreased life satisfaction and the generally increased suggestibility, results might be more pronounced for adolescents; however, it seems implausible that they are fundamentally different. When assessing how technology might affect adolescents compared with adults, we can think of adolescents as "canaries in the coalmine."[38] If digital technology is indeed harmful, it will affect people from all ages, but adolescents are potentially more vulnerable.

Effects

What is the effect of digital technology use on well-being? If we ask US adolescents directly, 31% are of the opinion that the effects are mostly positive, 45% estimate the effects to be neither positive nor negative, and 24% believe that effects are mostly negative.[4] Teens who considered the effects to be positive stated that social media help (i) connect with friend; (ii) obtain information; and (c) find like-minded people.[4] Those who considered the effects to be negative explained that social media increase the risks of (i) bullying; (ii) neglecting face-to-face contacts; (iii) obtaining unrealistic impressions of other people's lives.[4]

Myriad studies lend empirical support to adolescents' mixed feelings, reporting a wide range of positive,[39] neutral,[40] or negative[41] relations between specific measures of digital technology use and well-being. Aligned with these mixed results of individual studies, several meta-analyses support the lack of a clear effect.[42] In an analysis of 43 studies on the effects of online technology use on adolescent mental well-being, Best et al[43] found that "[t]he majority of studies reported either mixed or no effect(s) of online social technologies on adolescent wellbeing." Analyzing eleven studies on the relation between social media use and depressive symptoms, McCrae et al[44] report a small positive relationship. Similarly, Lissak[45] reports positive relations between excessive screen time and insufficient sleep, physiological stress, mind wandering, attention deficit-hyperactivity disorder

(ADHD)-related behavior, nonadaptive/negative thinking styles, decreased life satisfaction, and potential health risks in adulthood. On the basis of 12 articles, Wu et al[46] find that "the use of [i]nternet technology leads to an increased sense of connectedness to friend[s] and school, while at the same time increasing levels of anxiety and loneliness among adolescents." Relatedly, meta-analyses on the relation between social media use and adolescent academic performance find no or negligible effects.[47]

It is important to note that the overall quality of the literature these meta-analyses rely upon has been criticized.[48] This is problematic because low quality of individual studies biases meta-analyses.[49] To achieve higher quality, scholars have called for more large-scale studies using longitudinal designs, objective measures of digital technology use that differentiate types of use, experience sampling measures of well-being (ie, in-the-moment measures of well-being; also known as ambulant assessment or in situ assessment), and a statistical separation of between-person variance and within-person variance.[50] In addition, much research cannot be reproduced because the data and the analysis scripts are not shared.[51] In what follows, we look at studies that implemented some of these suggestions.

Longitudinal studies generally find a complex pattern of effects. In an 8 year study of 500 adolescents in the US, time spent on social media was positively related to anxiety and depression on the between-person level.[52] At the within-person level, these relationships disappeared. The study concludes that those who use social media more often might also be those with lower mental health; however, there does not seem to be a causal link between the two. A study on 1157 Croatians in late adolescence supports these findings. Over a period of 3 years, changes in social media use and life satisfaction were unrelated, speaking to the stability of life satisfaction.[40] In a sample of 1749 Australian adolescents, Houghton et al[53] distinguished between screen activities (eg, web browsing or gaming) and found overall low within-person relations between total screen time and depressive symptoms. Out of all activities, only web surfing was a significant within-person predictor of depressive symptoms. However, the authors argue that this effect might not survive

> No screen time is created equal; different uses will lead to different effects

corrections for multiple testing. Combining a longitudinal design with experience sampling in a sample of 388 US adolescents, Jensen et al[54] did not find a between-person association between baseline technology use and mental health. Interestingly, they only observed few and small within-person effects. Heffer et al[55] found no relation between screen use and depressive symptoms in 594 Canadian adolescents over 2 years. These results emphasize the growing need for more robust and transparent methods and analysis. In large adolescent samples from the UK and the US, a specification curve analysis, which provides an overview of many different plausible analyses, found small, negligible relations between screen use and well-being, both cross-sectionally and longitudinally.[56] Employing a similar analytical approach, Orben, Dienlin, and Przybylski[57] found small negative between-person relations between social media use and life satisfaction in a large UK sample of adolescents over 7 years. However, there was no robust within-person effect. Similarly, negligible effect sizes between adolescent screen use and well-being are found in cross-sectional data sets representative of the population in the UK and US.[58] In analyzing the potential effects of social media abstinence on well-being, two large-scale studies using adult samples found small positive effects of abstinence on well-being.[59,60] Two studies with smaller and mostly student samples instead found mixed[61] or no effects of abstinence on well-being.[62]

The aforementioned studies often relied on composite measures of screen use, possibly explaining the overall small effects. In contrast, work distinguishing between different types of use shows that active use likely has different effects than passive use. Specifically, active use may contribute to making meaningful social connections, whereas passive use does not.[9] For example, meaningful social interactions have been shown to increase social gratification in adults,[63,64] whereas passive media use or media use as procrastination has been negatively related to well-being.[6,8] This distinction should also apply to adolescents.[6] The first evidence for this proposition already exists. In a large sample of Icelandic adolescents, passive social media use was positively related to anxiety and depressive symptoms; the opposite was the case for active use.[65]

Furthermore, longitudinal work so far relies on self-reports of media use. Self-reported media use has been shown to be inaccurate compared with objectively measured use.[14] Unfortunately, there is little work employing objective measures to test whether the results of longitudinal studies using self-reports hold up when objective use is examined. The limited existing evidence suggests that effects remain small. In a convenience sample of adults, only phone use at night negatively predicted well-being.[66] Another study that combined objective measures of social smartphone applications with experience sampling in young adults found a weak negative relation between objective use and well-being.[67]

Effects might also not be linear. Whereas both low and high levels of internet use have been shown to be associated with slightly decreased life satisfaction, moderate use has been shown to be related to slightly increased life satisfaction.[10,35,68] However, evidence for this position is mixed; other empirical studies did not find this pattern of effects.[53,54]

Taken together, do the positive or the negative effects prevail? The literature implies that the relationship between technology use and adolescent well-being is more complicated than an overall negative linear effect. In line with meta-analyses on adults, effects of digital technology use in general are mostly neutral to small. In their meta-review of 34 meta-analyses and systematic reviews, Meier and Reinecke[42] summarize that "[f]indings suggest an overall (very) small negative association between using SNS [social networking sites], the most researched CMC [computer mediated communication] application, and mental health." In conclusion, the current literature is mostly ambivalent, although slightly emphasizing the negative effects of digital tech use.

Implications

Although there are several conflicting positions and research findings, some general implications emerge:

1. The general effects of digital technology use on well-being are likely in the negative spectrum, but very small—potentially too small to matter.
2. No screen time is created equal; different uses will lead to different effects.
3. Digital technology use is more likely to affect short-term positive or negative affect than long-term life satisfaction.
4. The dose makes the poison; it appears that both low and excessive use are related to decreased well-being, whereas moderate use is related to increased well-being.
5. Adolescents are likely more vulnerable to effects of digital technology use on well-being, but it is important not to patronize adolescents—effects are comparable and adolescents not powerless.
6. The current empirical research has several limitations: high-quality studies with large-scale samples, objective measures of digital technology use, and experience sampling of well-being are still missing.

Conclusion

Despite almost 30 years of research on digital technology, there is still no coherent empirical evidence as to whether digital technology hampers or fosters well-being. Most likely, general effects are small at best and probably in the negative spectrum. As soon as we take other factors into account, this conclusion does not hold up. Active use that aims to establish meaningful social connections can have positive effects. Passive use likely has negative effects. Both might follow a nonlinear trend. However, research showing causal effects of general digital technology use on well-being is scarce. In light of these limitations, several scholars argue that technology use has a mediating role[69]: already existing problems increase maladapted technology use, which then decreases life satisfaction. Extreme digital technology use is more likely to be a symptom of an underlying sociopsychological problem than vice versa. In sum, when assessing the effects of technology use on adolescent well-being, one of the best answers is that it's complicated.

This lack of evidence is not surprising, because there is no consensus on central definitions, measures, and methods.[42] Specifically, digital technology use is an umbrella term that encompasses many different behaviors. Furthermore, it is theoretically unclear as to why adolescents in particular should be susceptible to the effects of technology and what forms of well-being are candidates for effects. At the same time, little research adopts longitudinal designs, differentiates different types of technology use, or measures technology use objectively. Much work in the field has also been criticized for a lack of transparency and rigor.[51] Last, research (including this review) is strongly biased toward a Western perspective. In other cultures, adolescents use markedly different services (such as WeChat or Renren,

etc). Although we assume most effects to be comparable, problems seem to differ somewhat. For example, online gaming addiction is more prevalent in Asian than Western cultures.[70]

Adults have always criticized the younger generation, and media (novels, rock music, comic books, or computer games) have often been one of the culprits.[1] Media panics are cyclical, and we should refrain from simply blaming the unknown and the novel.[1] In view of the public debate, we should rather emphasize that digital technology is not good or bad per se. Digital technology does not "happen" to individuals. Individuals, instead, actively use technology, often with much competence.[3] The current evidence suggests that typical digital technology use will not harm a typical adolescent. That is not to say there are no individual cases and scenarios in which effects might be negative and large. Let's be wary, but not alarmist. ∎

References

1. Orben A. The Sisyphean cycle of technology panics. *Perspect Psychol Sci*. Preprint doi:10.31234/osf.io/dqmju.

2. Carr N. *The Shallows - How the Internet Is Changing the Way We Think, Read and Remember*. London, UK: Atlantic Books; 2011.

3. Livingstone S. EU Kids Online: Findings, methods, recommendations. 2014. http://eprints.lse.ac.uk/60512/1/EU%20Kids%20onlinie%20III%20.pdf.

4. Pew Research Center. Teens, Social Media & Technology 2018. *Pew Res Cent Internet Sci Tech*. https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology-2018/. Published May 31, 2018. Accessed December 12, 2019.

5. Humphreys L, Karnowski V, von Pape T. Smartphones as metamedia: a framework for identifying the niches structuring smartphone use. *Int J Commun*. 2018;12:2793-2809.

6. Verduyn P, Ybarra O, Résibois M, Jonides J, Kross E. Do social network sites enhance or undermine subjective well-being?: A critical review. *Soc Issues Policy Rev*. 2017;11(1):274-302. doi:10.1111/sipr.12033.

7. Meier A, Reinecke L, Meltzer CE. "Facebocrastination"? Predictors of using Facebook for procrastination and its effects on students' well-being. *Comput Hum Behav*. 2016;64:65-76. doi:10.1016/j.chb.2016.06.011.

8. Reinecke L, Meier A, Beutel ME, et al. The relationship between trait procrastination, Internet use, and psychological functioning: results from a community sample of German adolescents. *Front Psychol*. 2018;9:913. doi:10.3389/fpsyg.2018.00913.

9. Clark JL, Algoe SB, Green MC. Social network sites and well-being: the role of social connection. *Curr Dir Psychol Sci*. 2018;27(1):32-37. doi:10.1177/0963721417730833.

10. Przybylski AK, Orben A, Weinstein N. How much is too much? Examining the relationship between digital screen engagement and psychosocial functioning in a confirmatory cohort study. *J Am Acad Child Adolesc Psychiatry*. 2019. doi:10.1016/j.jaac.2019.06.017. In press.

11. Ellis DA. Are smartphones really that bad? Improving the psychological measurement of technology-related behaviors. *Comput Hum Behav*. 2019;97:60-66. doi:10.1016/j.chb.2019.03.006.

12. Ellis DA, Davidson BI, Shaw H, Geyer K. Do smartphone usage scales predict behavior? *Int J Hum-Comput Stud*. 2019;130:86-92. doi:10.1016/j.ijhcs.2019.05.004.

13. Boase J, Ling R. Measuring mobile phone use: self-report versus log data. *J Comput-Mediat Commun*. 2013;18(4):508-519.

14. Scharkow M. The accuracy of self-reported internet use—a validation study using client log data. *Commun Methods Meas*. 2016;10(1):13-27. doi:10.1080/19312458.2015.1118446.

15. Greenspoon PJ, Saklofske DH. Toward an integration of subjective well-being and psychopathology. *Soc Indic Res*. 2001;54(1):81-108. doi:10.1023/A:1007219227883.

16. Krueger RF, McGue M, Iacono WG. The higher-order structure of common DSM mental disorders: internalization, externalization, and their connections to personality. *Personal Individ Differ*. 2001;30(7):1245-1259. doi:10.1016/S0191-8869(00)00106-9.

17. Diener E, Lucas RE, Oishi S. Advances and open questions in the science of subjective well-being. *Collabra Psychol*. 2018;4(1):15. doi:10.1525/collabra.115.

18. Ritchie H, Roser M. Mental Health. *Our World Data*. https://ourworldindata.org/mental-health. Published April 2018. Accessed December 5, 2019.

19. Dienlin T. Have Europeans become more or less happy since the advent of smartphones and social media? https://tobiasdienlin.com/2018/07/05/since-the-advent-of-smartphones-have-we-become-more-or-less-happy/. Published July 5, 2018.

20. Ortiz-Ospina E, Roser M. Happiness and life satisfaction. *Our World Data*. https://ourworldindata.org/happiness-and-life-satisfaction. Published 2013. Revised May 2017. Accessed December 5, 2019.

21. Vos T, Allen C, Arora M, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388(10053):1545-1602. doi:10.1016/S0140-6736(16)31678-6.

22. Dumesnil H, Verger P. Public awareness campaigns about depression and suicide: a review. *Psychiatr Serv*. 2009;60(9):1203-1213. doi:10.1176/ps.2009.60.9.1203.

23. Pinker S. *Enlightenment Now: The Case for Reason, Science, Humanism, and Progress*. New York; London: Viking; Allen Lane; 2018.

24. Lyubomirsky S, Sheldon KM, Schkade D. Pursuing happiness: the architecture of sustainable change. *Rev Gen Psychol*. 2005;9(2):111-131. doi:10.1037/1089-2680.9.2.111.

25. Brown NJL, Rohrer JM. Easy as (happiness) pie? A critical evaluation of a popular model of the determinants of well-being. *J Happiness Stud*. Published online May 9, 2019. doi:10.1007/s10902-019-00128-4.

26. Lucas RE. Adaptation and the set-point model of subjective well-being: does happiness change after major life events? *Curr Dir Psychol Sci*. 2007;16(2):75-79. doi:10.1111/j.1467-8721.2007.00479.x.

27. Dienlin T, Masur PK, Trepte S. Reinforcement or displacement? The reciprocity of FtF, IM, and SNS communication and their effects on loneliness and life satisfaction. *J Comput-Mediat Commun*. 2017;22(2):71-87. doi:10.1111/jcc4.12183.

28. Trepte S, Dienlin T, Reinecke L. Influence of

Original article

social support received in online and offline contexts on satisfaction with social support and satisfaction with life: a longitudinal study. *Media Psychol*. 2015;18(1):74-105. doi:10.1080/15213269.2013. 838904.

29. Blakemore S-J. Adolescence and mental health. *Lancet*. 2019;393(10185):2030-2031. doi:10.1016/ S0140-6736(19)31013-X.

30. Caspi A, Roberts BW, Shiner RL. Personality development: stability and change. *Annu Rev Psychol*. 2005;56(1):453-484. doi:10.1146/annurev. psych.55.090902.141913.

31. Hammond CJ, Potenza MN, Mayes LC. Development of impulse control, inhibition, and self-regulatory behaviors in normative populations across the lifespan. In: *The Oxford Handbook of Impulse Control Disorders*. Oxford, UK: Oxford University Press; 2012:232-244.

32. Balluerka N, Gorostiaga A, Alonso-Arbiol I, Aritzeta A. Peer attachment and class emotional intelligence as predictors of adolescents' psychological well-being: a multilevel approach. *J Adolesc*. 2016;53:1-9. doi:10.1016/j.adolescence.2016.08.009.

33. Orth U, Maes J, Schmitt M. Self-esteem development across the life span: a longitudinal study with a large sample from Germany. *Dev Psychol*. 2015;51(2):248-259. doi:10.1037/a0038481.

34. Gomez V, Grob A, Orth U. The adaptive power of the present: perceptions of past, present, and future life satisfaction across the life span. *J Res Personal*. 2013;47(5):626-633. doi:10.1016/j. jrp.2013.06.001.

35. Przybylski AK, Weinstein N. A large-scale test of the goldilocks hypothesis: quantifying the relations between digital-screen use and the mental well-being of adolescents. *Psychol Sci*. 2017;28(2):204-215. doi:10.1177/095679761 6678438.

36. Cohen S. *Folk Devils and Moral Panics: The Creation of the Mods and Rockers*. 3rd ed. London, UK; New York, NY: Routledge; 2002.

37. Valkenburg PM, Peter J. The differential susceptibility to media effects model. *J Commun*. 2013;63(2):221-243. doi:10.1111/jcom.12024.

38. Livingstone S. Privacy, data protection and the evolving capacity of the child: what the evidence tells us. *Media@LSE*. https://blogs.lse.ac.uk/ medialse/2018/11/08/privacy-data-protection-and-the-evolving-capacity-of-the-child-what-the-evidence-tells-us/. Published November 8, 2018. Accessed December 5, 2019.

39. Valkenburg PM, Koutamanis M, Vossen HGM. The concurrent and longitudinal relationships between adolescents' use of social network sites and their social self-esteem. *Comput Hum Behav*. 2017;76:35-41. doi:10.1016/j.chb.2017.07.008.

40. Kerestеš G, Štulhofer A. Adolescents' online social network use and life satisfaction: a latent growth curve modeling approach. *Comput Hum Behav*. 2020;104:106187. doi:10.1016/j.chb.2019. 106187.

41. Booker CL, Skew AJ, Kelly YJ, Sacker A. Media use, sports participation, and well-being in adolescence: cross-sectional findings from the UK Household Longitudinal Study. *Am J Public Health*. 2015;105(1):173-179. doi:10.2105/AJPH.2013. 301783.

42. Meier A, Reinecke L. (2020, April 6). Computer-mediated communication, social media, and mental health: A conceptual and empirical meta-review. doi:10.31234/osf.io/573ph.

43. Best P, Manktelow R, Taylor B. Online communication, social media and adolescent wellbeing: a systematic narrative review. *Child Youth Serv Rev*. 2014;41:27-36. doi:10.1016/j.childyouth.2014. 03.001.

44. McCrae N, Gettings S, Purssell E. Social media and depressive symptoms in childhood and adolescence: a systematic review. *Adolesc Res Rev*. 2017;2:315-330. doi:10.1007/s40894-017-0053-4.

45. Lissak G. Adverse physiological and psychological effects of screen time on children and adolescents: literature review and case study. *Environ Res*. 2018;164:149-157. doi:10.1016/j. envres.2018.01.015.

46. Wu YJ, Outley C, Matarrita-Cascante D, Murphrey TP. A systematic review of recent research on adolescent social connectedness and mental health with internet technology use. *Adolesc Res Rev*. 2016;1(2):153-162. doi:10.1007/s40894-015-0013-9.

47. Marker C, Gnambs T, Appel M. Active on Facebook and failing at school? Meta-analytic findings on the relationship between online social networking activities and academic achievement. *Educ Psychol Rev*. 2018;30(3):651-677. doi:10.1007/ s10648-017-9430-6.

48. Orben A, Etchells P, Przybylski AK. Three problems with the debate around screen time. Available at: https://www.theguardian.com/science/ head-quarters/2018/aug/09/three-problems-with-the-debate-around-screen-time. Accessed May 2020.

49. Ioannidis JPA. The mass production of redundant, misleading, and conflicted systematic reviews and meta-analyses. *Milbank Q*. 2016;94(3):485-514. doi:10.1111/1468-0009.12210.

50. Whitlock J, Masur PK. Disentangling the association of screen time with developmental outcomes and well-being: problems, challenges, and opportunities. *JAMA Pediatr*. 2019;173(11):1021-1022. doi:10.1001/jamapediatrics.2019.3191.

51. Orben A, Dienlin T, Przybylski AK. Reply to Foster and Jackson: open scientific practices are the way forward for social media effects research. *Proc Natl Acad Sci U S A*. 2019;116(31):15334-15335. doi:10.1073/pnas.1909553116.

52. Coyne SM, Rogers AA, Zurcher JD, Stockdale L, Booth M. Does time spent using social media impact mental health?: An eight year longitudinal study. *Comput Hum Behav*. 2019;104:106160. doi:10.1016/j.chb.2019.106160.

53. Houghton S, Lawrence D, Hunter SC, et al. Reciprocal relationships between trajectories of depressive symptoms and screen media use during adolescence. *J Youth Adolesc*. 2018;47(11): 2453-2467. doi:10.1007/s10964-018-0901-y.

54. Jensen M, George MJ, Russell MR, Odgers CL. Young adolescents' digital technology use and adolescents' mental health symptoms: little evidence of longitudinal or daily linkages. *Clin Psychol Sci*. 2019;7(6):1416-1433. doi:10.1177/ 2167702619859336.

55. Heffer T, Good M, Daly O, MacDonell E, Willoughby T. The longitudinal association between social-media use and depressive symptoms among adolescents and young adults: an empirical reply to Twenge et al. (2018). *Clin Psychol Sci*. 2019;7(3):462-470. doi:10.1177/2167702618812727.

56. Orben A, Przybylski AK. Screens, teens, and psychological well-being: evidence from three time-use-diary studies. *Psychol Sci*. 2019;30(5):682-696. doi:10.1177/0956797619830329.

57. Orben A, Dienlin T, Przybylski AK. Social media's enduring effect on adolescent life satisfaction. *Proc Natl Acad Sci U S A*. 2019;116(21): 10226-10228. doi:10.1073/pnas.1902058116.

58. Orben A, Przybylski AK. The association between adolescent well-being and digital technology use. *Nat Hum Behav*. 2019;3(2):173-182. doi:10.1038/s41562-018-0506-1.

59. Allcott H, Braghieri L, Eichmeyer S, Gentzkow M; National Bureau of Economic Research. The welfare effects of social media. Published January 2019. Revised November 2019.

60. Tromholt M. The Facebook experiment: quitting Facebook leads to higher levels of well-being. *Cyberpsychology Behav Soc Netw*. 2016;19(11):661-666. doi:10.1089/cyber.2016. 0259.

61. Vanman EJ, Baker R, Tobin SJ. The burden of online friends: the effects of giving up Facebook on stress and well-being. *J Soc Psychol*. 2018;158(4):496-508. doi:10.1080/00224545.201 8.1453467.

62. Hall JA, Xing C, Ross EM, Johnson RM. Experimentally manipulating social media abstinence: results of a four-week diary study. *Media Psychol*. 2019:1-17. Published online November 5, 2019. doi:10.1080/15213269.2019.1688171.

63. Bayer JB, Ellison N, Schoenebeck S, Brady E, Falk EB. Facebook in context(s): measuring emotional responses across time and space. *New Media Soc*. 2018;20(3):1047-1067. doi:10.1177/1461444816681522.

64. Domahidi E. The associations between online media use and users' perceived social resources: a meta-analysis. *J Comput-Mediat Commun*. 2018;23(4):181-200. doi:10.1093/jcmc/zmy007.

65. Thorisdottir IE, Sigurvinsdottir R, Asgeirsdottir BB, Allegrante JP, Sigfusdottir ID. Active and passive social media use and symptoms of anxiety and depressed mood among Icelandic adolescents. *Cyberpsychology Behav Soc Netw*. 2019;22(8): 535-542. doi:10.1089/cyber.2019.0079.

66. Katevas K, Arapakis I, Pielot M. Typical phone use habits: intense use does not predict negative

well-being. In: *Proceedings of the 20th International Conference on Human-Computer Interaction with Mobile Devices and Services - MobileHCI'18*. Barcelona, Spain: ACM Press; 2018:1-13. doi:10.1145/3229434.3229441.

67. Johannes N, Meier A, Reinecke L, et al. *The Relationship between Online Vigilance and Affective Well-Being in Everyday Life: Combining Smartphone Logging with Experience Sampling.* *PsyArXiv*; 2019 October 15. doi:10.31234/osf.io/t3wc2.

68. Bruggeman H, Van Hiel A, Van Hal G, Van Dongen S. Does the use of digital media affect psychological well-being? An empirical test among children aged 9 to 12. *Comput Hum Behav*. 2019;101:104-113. doi:10.1016/j.chb.2019.07.015.

69. Livingstone S, Ólafsson K, Helsper EJ, Lupiáñez-Villanueva F, Veltri GA, Folkvord F. Maximizing opportunities and minimizing risks for children online: the role of digital skills in emerging strategies of parental mediation. *J Commun*. 2017;67(1):82-105. doi:10.1111/jcom.12277.

70. Fam JY. Prevalence of internet gaming disorder in adolescents: a meta-analysis across three decades. *Scand J Psychol*. 2018;59(5):524-531. doi:10.1111/sjop.12459.