The impact of digital technology use on adolescent well-being

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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.

Keywords: adolescent; digital technology; life satisfaction; media effect; mental health; smartphone; social media; social networking site; review; well-being

With each new technology come concerns about its potential impact on (young) people’s well-being. 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. 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 is an umbrella term that encompasses various devices, services, and types of use. Most adolescent digital technology use nowadays takes place on mobile devices. Offering the functions and affordances of several other media, smartphones play a pivotal role in adolescent media use and are thus considered a “metamedium.” 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...
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. 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. 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. 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. Understanding digital technology use as a general behavior negates 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. 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. In the case of smartphones, self-reported duration of use correlated moderately, at best, with objectively logged use. These findings are mirrored when comparing self-reports of general internet use with objectively measured use. 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. Negative mental health includes subclinical negative mental health, such as stress or negative affect, and psychopathology, such as depression or schizophrenia. Positive mental health is a synonym for well-being; it comprises hedonic well-being and eudaimonic well-being. 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. Similarly, levels of general life satisfaction remained stable during the last 20 years. Worth noting, the increase in mental health problems that has been reported could merely reflect increased awareness of psychosocial problems. 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, more recent investigations argued that the influences of potentially stabilizing factors such as genes and life circumstances are substantially larger. 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. The hypothesis has repeatedly found support in empirical studies, which demonstrate the stability of life satisfaction measures. 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. Therefore, digital technology use might well be a driver of hedonic well-being: Watching entertaining content...
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,” during which adolescents actively develop their personalities. Compared with adults, adolescents are more open-minded, more social-oriented, less agreeable, and less conscientious; more impulsive and less capable of inhibiting behavior; more risk-taking and sensation seeking; and derive larger parts of their well-being and life satisfaction from other peers. During adolescence, general levels of life satisfaction and self-esteem drop and are often at their all-time lowest. At the same time, media use increases and reaches a first peak in late adolescence. 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. 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. For one, although adolescents are in a phase of development, there might be more similarities between adolescents and adults than differences. Concerns about the effects of a new technology on an allegedly vulnerable group has historically often taken the form of paternalization. For example, and maybe in contrast to popular opinion, adolescents already possess much media literacy or privacy literacy.

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. 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.”

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. 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. 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.

Myriad studies lend empirical support to adolescents’ mixed feelings, reporting a wide range of positive, neutral, or negative 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. In an analysis of 43 studies on the effects of online technology use on adolescent mental well-being, Best et al 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 report a small positive relationship. Similarly, Lissak reports positive relations between excessive screen time and insufficient sleep, physiological stress, mind wandering, attention deficit-hyperactivity disorder, and...
(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.\textsuperscript{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.\textsuperscript{47}

It is important to note that the overall quality of the literature these meta-analyses rely upon has been criticized.\textsuperscript{48} This is problematic because low quality of individual studies biases meta-analyses.\textsuperscript{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.\textsuperscript{50} In addition, much research cannot be reproduced because the data and the analysis scripts are not shared.\textsuperscript{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.\textsuperscript{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.\textsuperscript{60} In a sample of 1749 Australian adolescents, Houghton et al.\textsuperscript{13} 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 corrections for multiple testing. Combining a longitudinal design with experience sampling in a sample of 388 US adolescents, Jensen et al.\textsuperscript{64} 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.\textsuperscript{53} 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.\textsuperscript{56} Employing a similar analytical approach, Orben, Dienlin, and Przybylski\textsuperscript{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.\textsuperscript{68} 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.\textsuperscript{59,60} Two studies with smaller and mostly student samples instead found mixed\textsuperscript{61} or no effects of abstinence on well-being.\textsuperscript{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.\textsuperscript{9} For example, meaningful social interactions have been shown to increase social gratification in adults,\textsuperscript{63,64} whereas passive media use or media use as procrastination has been negatively related to well-being.\textsuperscript{5,8} This distinction should also apply to adolescents.\textsuperscript{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.\textsuperscript{65}
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. However, evidence for this position is mixed; other empirical studies did not find this pattern of effects.

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 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 technology 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; 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. 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. 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).
Adults have always criticized the younger generation, and media (novels, rock music, comic books, or computer games) have often been one of the culprits. Media panics are cyclical, and we should refrain from simply blaming the unknown and the novel. 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. 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.

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