

Editorial

Disentangling the Impact of Screen Time on Development and Well-Being:
Problems, Challenges, and Opportunities

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A response to JAMA Pediatrics manuscript (PAM19-0140): "Screen media usage and academic performance in children and adolescents: a systematic review and meta-analysis of cross-sectional studies."

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Concerns about the effects of screen time on myriad developmental, health and productivity outcomes in children and adolescents dates back to the advent of screens themselves. Indeed, the earliest study of the effects of screens on functioning was conducted in 1949 as a collaboration between Columbia Broadcasting System and researchers from Rutgers University. Perhaps unsurprisingly, they found that having a television increased family cohesion, did not promote viewer passivity, and did not replace other diversions, such as outdoor activities and socializing.¹ Very few early TV viewers would likely have imagined the role screens play in our lives today. The modern age is marked by screen use for purposes that accomplish a wide variety of things formerly unrelated to a screen. Talking to someone remotely, looking through magazines, reading a book, managing banking, playing games (whether Fortnite or monopoly), connecting with friends, all discrete activities prior to the current age, frequently now include some element of screen interaction. This proliferation of screen-based activities, all broadly accessible through a growing number of screen interfaces (e.g. mobile devices, personal computers, laptops, or smart fashion such as watches or glasses) means that screens occupy a broad swath of daily life for many of us. Because of this, understanding effects of new technological affordances on human wellbeing and productivity outcomes, such as academic performance, is now highly and perpetually salient. Indeed, it has become an increasingly dominant concern for scientists, parents, and policy makers.

What we have learned so far

In this issue of JAMA Pediatrics, Adelantado-Renau et al. present a meta-analysis investigating the relationship between screen media usage and academic performance in children and adolescents. Based on 30 survey studies, they find that overall screen media usage was not associated with academic performance. Last year, Marker, Gnams and Appel similarly conducted a meta-analysis on social network site use and its effect on academic performance of young adults show similar result patterns.⁸ Using largely cross-sectional surveys and correlational designs, a growing body of research similarly documents the relationship between overall screen time and cardiovascular risks², sleep duration or quality^{3,4}, loneliness⁵, depression⁶, and life-satisfaction⁷. In sum, they suggest that the relationship between screen time and different indicators of well-being and/or functioning is often inconsistent and, at best, small. Recent multiverse analyses further demonstrate

that such effects are heavily contingent on analytic methods and decisions.⁹ Moreover, only a few of the studies used a preregistered confirmatory approach, making it possible that selective reporting and analytical flexibility resulted in overinterpretation of small trends. Also notable is that the focus of many of these studies include an implicit assumption, common among those of us who did not grow up as digital natives, that screen-based media use is separate from everything else people do, that it needs to be investigated as a distinct phenomenon, and that it has unique effects on performance and well-being.

We posit that while the screenification of our lives adds a unique dimension to contemporary developmental contexts, we should not assume that overall amount of screen time is a singularly impactful factor in overall well-being. Advancement of person x technology scholarship requires moving beyond between-person relationship analysis so common in current research in this area. As Adelantado-Renau et al. note in the discussion, studies seeking to disentangle effects will need to grapple with variables and variance components that are not well captured in measures of overall screen time -- such as user motive, the specific device used, degree of active versus passive engagement, specific content engaged with, and the larger context as well as the specific situations in which children and adolescents use screen media. Effects may further be affected by a host of other variables such as peer network size and satisfaction, mental health history and status.

How we should proceed

Identifying the what and how specific screen-based media elements impact on well-being and functioning poses both conceptual and empirical challenges. To do this scholars will first need to focus on the circumstances under which regular and specific media use takes place and thus might impact performance (e.g., how does the effect of Snapchat use on homework completion vary by age, mood state, parental monitoring, and friendship network satisfaction?). They will also need to take into account significant changes in structural factors that once unquestionably defined the contours of age-related daily life, particularly for youth: walls and doors, perceived privacy, time of day or night, virtual vs. real relationship interactions, social network distributions (offline and online), and duration of exposure to specific content (e.g. a child can be in her bedroom but engaged in any number of activities previously impossible from one's bedroom in the middle of the night) since these are likely

to influence development and outcomes of interest in important but under-explored ways.

Disentangling these many nuanced factors, contexts, situational circumstances, temporal effects, and interactions will certainly require purposeful and interdisciplinary collaboration, with scholars versed in social and computer sciences.

Even more fundamentally, it requires abandoning the idea that we can measure the impact of screen time on the overall, between-person level since use of different mediums can have different and sometimes even contradictory effects within one person. Thus, including situational and contextual factors is critical. Adopting such a perspective, however, requires identifying ways of conceptualizing and operationalizing contexts and situations. The situational frameworks proposed by Rauthmann, Sherman and Funder¹⁰ or Masur¹¹ could be worthwhile starting points.

Second, future studies will require entirely new methodological approaches. One of the first tasks will be to overcome inherent limitations in the most commonly used measures of screen time. Current measures are generally too broad to be of conceptual or empirical utility. Measures such as screen time suggests that technology use is like taking medication, where every additional minute or hour has a clear impact on the individual's well-being or functioning. In truth, such methods cannot accurately describe and capture the ever-morphing, fragmented interaction individuals experience with ideas, individuals, and themselves through their screens. Moreover, retrospective self-report measures are problematic since individuals have a difficult time reliably estimating the actual amount of screen time.¹² Although a well-known challenge, capturing actual (logged) participant screen time in relation to well-being or functioning is very rare. Future studies should thus explore ethical methods of tracking participants' actual media use.

As a first step, it will be important to adopt methodological approaches that capture media use in a variety of different situations and contexts. For example, methods such as experience sampling methods (ESM) permits useful assessment of within-person and situational dynamics of media use^{13,14}. Combining tracking (logging media use) and ESM approaches, for example, is likely to yield useful and nuanced insights into media use and overall functioning. For example, Bayer et al. triggered small questionnaires in response to participants' natural Facebook posting behavior and found that it can have small, yet fleeting effects on participants' subsequent mood.¹³ We believe that a

rigorous adaption of this type of automatic ESM may allow researchers to reduce recall bias, assess states rather than traits, and link deviations and fluctuations to the manifold situational factors and circumstances outlined in the previous paragraphs.

As a second step, future research needs to engage with what participants actually see and interact with on their screens. Reeves et al. recently proposed an end-to-end system that allows capturing the “screenome” of life in media -- a record of individual experiences represented as a sequence of screens that people view and interact with over time.¹⁵ Such a methodological approach captures “both the general structure of everyone’s screen experiences and the individual variants within that structure that are related to unique social, psychological, and behavioral characteristics and experiences” (p. 3) and thereby matches the time-scales with the specific ways in which study participants engage with media. Such an approach would inevitably provide rich quantitative and qualitative data likely to robustly augment understanding of the complex relationship between screen-based activities and various dimensions of well-being, particularly if coupled with ESM and/or studies over time. Despite its inherent appeal, however, such methodical approaches pose significant ethical challenges. Careful consideration about how to balance these with the considerable potential inherent in such methods is clearly merited.

Finally, in order to describe and analyze the impact of screens on development and wellbeing, media use and well-being will need to be measured or even tracked over time. Although a small number of longitudinal studies exist, classic panel analyses based on a handful of waves spread across 2 to 4 years is not enough to tease apart effects. Longitudinal investigations are needed to disentangle age vs. cohort effects and to model natural growth curves and their correlations. Such studies are not common practice because they require time and money -- both scarce resources in academia. We thus urge policy makers and funders to invest, support, and facilitate long-term investigations. Finally, we urge social media companies to work and collaborate with independent researchers in order to facilitate large-scale and hence more futile investigations of user engagement data.

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