Kids These Days: Are Face-to-Face Social Skills among American Children Declining?[1]

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Many social commentators posit that children's social skills are declining as a result of exposure to technology. But this claim is difficult to assess empirically because it is challenging to measure "social skills" with confidence and because a strong test would employ nationally representative data of multiple cohorts. No scholarship currently meets these criteria. The authors fill that gap by comparing teachers' and parents' evaluations of children's social skills among children in the Early Childhood Longitudinal Study 1998 and 2010 cohorts. The authors find no evidence that teachers or parents rate children's face-to-face social skills as poorer among more recent cohorts, even when accounting for family characteristics, screen time use, and other factors. In addition, within cohorts, children with heavy exposure to screens exhibit similar social skills trajectories compared to children with little exposure to screens. There is a notable exception—social skills are lower for children who access online gaming and social networking many times a day. Overall, however, the results represent a challenge to the dominant narrative that social skills are declining due to technological change.

Are children's social skills declining? Social commentators worry that exposure to new technologies (e.g., TV, computers, phones, tablets, video games)

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has reduced the development of children's and youths' ability to negotiate successful face-to-face interactions. This concern has become popularized by the TED talks "Connected but Alone?" (Turkle 2012) and "How Social Media Makes Us Unsocial" (Graham 2014) and the books *Generation Me* and *iGen* (Twenge 2014, 2017). These widely discussed talks and books lament the decline in youths' ability to conduct face-to-face conversations and develop meaningful, authentic relationships.

But the evidence is limited. The question requires comparing children's social skills across different cohorts, preferably before and after the internet boom, but we are aware of no social science research that has done this in a systematic way, especially with samples that represent American youth at the national level. As a result, the public discussion regarding the decline in children's face-to-face social skills has continued without the benefit of careful social science analysis. We begin to fill that gap by analyzing several nationally representative data sets in which teachers and parents assessed children's social skills.

TECHNOLOGICAL CHANGE AND SOCIAL RELATIONSHIPS

Concerns about the consequences of moving away from agrarian living toward a more urban, modern society were central to the establishment of the field of sociology. The transformation from farming to industrialization and the resulting social problems motivated early writings of Tönnies (1974), who distinguished between traditional and modern societies. Tönnies described agrarian societies as characterized by gemeinschaft—strong kin ties and connections based on sameness (e.g., race/ethnicity, religion, and values)—while modern societies were characterized by gesellschaft, where human relations become more impersonal and indirect and based on efficiency. The problem in modern societies is that people become less connected with their groups, have fewer common beliefs, and as a consequence are more vulnerable to feeling alienated. Weber expanded on these ideas, noting how modern bureaucracies can become impersonal, privileging rationality and efficiency over individual needs. Similarly, Durkheim emphasized the potentially damaging effects of technological advances on community (DiMaggio et al. 2001). Of course, the transition from an agrarian to an industrialized society is not the only way technological change affects human relationships. Increasing globalization, immigration, urbanization, and continuing technological advances all renew concerns about how modernization affects social cohesion and may continue to undermine feelings of group connectedness and meaning, albeit through new mechanisms.

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Exposure to screen-based technologies is thought to undermine social life in several ways. With respect to children's social skills, the thesis is straightforward—screen exposure diminishes children's ability to form and maintain genuine friendships, get along with people who are different, comfort and help others, and express feelings, ideas, and opinions in positive ways. Some screen-based technologies may facilitate interaction, albeit digital, but skeptics worry that digitally based interactions can be problematic for several reasons. Digital interactions may limit the ability to read tone of voice or body language—necessary skills for successful complex face-to-face interactions. And the anonymity that often accompanies digital interactions can embolden bad behavior, such as trolling and cyberbullying, the well-known ugly side of online interactions. Hamnshu Tyagi, a psychiatric researcher, described the problem as follows: "Teenagers who socialise online put less value on their 'real world' selves which puts them at risk of impulsive and even suicidal behaviour. They may be less able to form relationships as they do not learn the physical clues involved with communication including body language, tone of voice and facial expressions" (Smith 2008).

An additional concern is that time in front of screens replaces time that could be spent developing these skills in face-to-face interactions. One large shift, for example, has been the percentage of children who use the internet at home—from 11% in 1997, the first year for which such estimates are available, to 60% in 2017 (Child Trends 2018). Kraut et al. (1998) initially found evidence for a negative relationship between internet use and sociability. They observed the impact of internet access on 169 people in 73 Pittsburgh-area households during their first couple years of online connectivity in 1995–96. The researchers found that time on the internet was associated with less communication with family members in the household, declines in the size of one's social network, and an increase in depression and loneliness (Kraut et al. 1998). But in a follow-up study, the researchers no longer found negative associations between internet use and well-being, suggesting that as people became more familiar with the technology over time, the negative consequences of exposure may dissipate (Kraut et al. 2002).

MORAL PANIC AND TECHNOLOGY

An alternative position is that the concerns over screen-based technology merely represent the most recent "moral panic" often expressed after the introduction of new technologies. For example, during the 1920s and 1930s, parents criticized how radio and movies depicted violence and took time away from other more prosocial activities (Leick 2019). In the late 1940s, concerns over the growing practice of including comics in the Sunday paper eventually led to Senate hearings to investigate a possible link with juvenile crime. And when television (1950s) and videos games (late 1970s) grew in popularity,

parents' apprehension about their consequences rose accordingly (Leick 2019). The historical commonalities in response to new technology are difficult to ignore—parents recall their own childhoods with nostalgia, worry about the addictive nature of new media, and complain that children do not play outside or engage their imaginations enough. Resistance to new technologies tends to be strong initially but eventually fades as the technology becomes embedded in everyday life. This historical recognition alerts us to the possibility that cell phones and computer usage may inspire the latest manifestation of parental anxiety regarding changes in children's autonomy.[2] Of course, noting that parents often resist new technologies in predictable ways does not, by itself, preclude the possibility that parents' concerns may be legitimate.

ARE AMERICAN CHILDREN'S FACE-TO-FACE SOCIAL SKILLS DECLINING?

Amid rapid technological change and despite widespread concern, current evidence does not provide a clear answer to the question: Have American children's face-to-face skills declined? Nevertheless, some scholars have argued that growing screen exposure has reduced the youngest generation's social skills. For example, Twenge concludes that "iGen'ers are not practicing their in-person social skills as much as other generations did. . . . They are more likely to make mistakes onstage when it matters: in college interviews, when making friends in high school, and when competing for a job. Life's social decisions are still made primarily in person, and iGen gets less experience in such situations" (2017, p. 91).

This conclusion is based on analyses, however, that do not directly gauge social skills. Twenge (2017) analyzed data from the Monitoring the Future surveys, administered every year to seniors in high school since 1975, and noted that many problematic behaviors (e.g., less time hanging out with friends, more loneliness, poorer sleep habits, and increased suicide and depression) began or increased after 2007, the year the iPhone was introduced. These mental health outcomes are important, but they do not directly address the question of declining social skills.

There are also reasons to doubt whether the growth of smartphone usage is the cause of some of the recent declines in mental health outcomes. For example, although teen suicide rose 46% between 2008 and 2015, rates were

[2] This cycle is not just evident in modern societies with rapid technological change but rather a persistent feature of history. For example, in his dialogue *Phaedrus*, Plato has Socrates tell the story of Thamus, king of the Egyptians, who refused to teach his subjects writing, claiming that "if men learn this, it will implant forgetfulness in their souls; they will cease to exercise memory because they rely on that which is written, calling things to remembrance no longer from within themselves, but by means of external marks. What you have discovered is a recipe not for memory, but for reminder" (Cooper 1997, pp. 551–52). We thank a reviewer for suggesting this point.

similarly high in the 1990s, a period before smartphones and significant online interactions (National Center for Health Statistics 2019). And as Twenge acknowledges, other changes in youths' behavior occurred since the advent of smartphones that were positive. Youths drank less alcohol, engaged in less unprotected sex, had fewer car accidents, and smoked less (Twenge 2017). While there may exist real changes in behavior between the newest generation of youth and those before them, these changes are less alarming when considered in a broader historical perspective and appear to be both positive and negative. The fact that the advent of the iPhone coincides with some recent trends may represent a correlational rather than causal relationship. Importantly, the rhetoric regarding the consequences of technology for children's social skills does not match the evidence.

A COMPLICATED RELATIONSHIP BETWEEN TECHNOLOGY AND SOCIETY

Not all scholars have assumed that modernization undermines human relations. Fischer (1975) criticized previous theorists (e.g., Simmel, Wirth, Durkheim, and Tönnies) for viewing the consequences of urbanism as necessarily negative, what he termed the "deterministic approach" to urban theory. For example, Wirth (1940) famously posited that urbanism led to social disorganization and individual alienation, but Fischer argued that the effects of population density are more complex—they can strengthen social life by creating the conditions for subcultures to flourish. While subcultures can be a source of intergroup friction, they can also provide a sense of identity and community. Fischer noted how the consequences of social change, in this case urbanization, were multifaceted and not necessarily negative.

Similarly, many scholars are now challenging a deterministic view of technology—that it necessarily undermines human relationships. Digital technologies may be complex, in some cases disrupting social relationships but enhancing social connections in other cases, especially in physically isolated locations. For example, the internet and mobile connectedness have transformed social networks by empowering individuals and encouraging the expansion of personal relationships beyond local conditions (Rainie and Wellman 2012). Pushing this line of thinking even further, others point out how online groups can reduce mental health stigma and provide meaningful peer support (Betton et al. 2015; Naslund et al. 2016).

A more nuanced perspective recognizes that new technologies likely have both positive and negative consequences for social relations. For example, although digital technologies might provide a mechanism for avoiding social interactions for some individuals (e.g., playing video games), they may facilitate greater interaction for others (e.g., arranging meetups). And even screen-based activities thought to be isolating, like playing video games, often have social

components (e.g., multiplayer games) that provide a platform for engaging traditional issues of social importance (e.g., developing autonomy from parents, creating and maintaining norms, and developing meaningful identities) and potentially creating new ones. Some scholars note that technology does not necessarily displace face-to-face interactions but can develop alongside them as families often watch TV, play video games, and stream content together (Livingstone et al. 2018).

A growing group of scholars have examined the potentially positive effects of internet usage for a wide range of outcomes. Howard, Raine, and Jones (2001) observed early users of the internet and noted that e-mail helped them build social networks by maintaining more frequent contact with families and friends. Skype and Facebook allow individuals to easily share details of their lives. And among teenagers, cell phones have encouraged contact with friends, sharing good and bad news, gossiping, complaining, and sanctioning peers. These technological advances have the potential to promote both face-to-face contact and community and may not subtract from social skills in the way commentators have suspected. Valkenburg and Peter (2009) even suggest that internet use promotes self-disclosure because online interactions are characterized by reduced visual and auditory clues. They argue that people are more comfortable revealing important information about themselves via the internet because they are less concerned about how others view them. Ito et al. (2010) note how new media are used to enhance existing friendships and romantic relationships,[3] negotiate parent/child relationships, link interest-driven groups (e.g., gamers), and provide platforms for creativity (e.g., blogging, fan fiction, podcasting) and new economic activity. And the growth of graphics interchange format (GIF) animations can convey nuance and multiple layers of meaning, addressing some of the limitations of text-only communication and providing new platforms for conveying affect and demonstrating cultural knowledge (Miltner and Highfield 2017). This research suggests that we may be overestimating the negative consequences of new technologies while underestimating the ways in which they enable face-to-face meetings and connections.[4]

Several noteworthy studies reveal this nuance. For example, in a longitudinal sample of 3,354 eight- to nine-year-old Australian children, there was no association between computer use and children's growth in social-emotional well-being, gauged by teacher's evaluations of the child's unhappiness, worries, anxiety, and fearfulness (Hatzigianni, Gregoriadis, and Fleer 2016). And a longitudinal sample from the Netherlands of 852 adolescents initially observed

[3] There is some evidence that Americans are more likely to have romantic partners if they have internet access (Rosenfeld and Thomas 2012).

[4] Even the concern that online time is sedentary has been challenged by scholars who point to games such as Pokémon Go, which mixes a smartphone game with outdoor physical activity (LeBlanc and Chaput 2017).

in September 2012, and then observed again one and two years later, suggests that there may even be positive effects of the use of social network sites (SNS; e.g., Facebook, Snapchat, Twitter).[5] The authors found a positive relationship between SNS use and social self-esteem (e.g., "I find it easy to make friends," "It is easy to like me") in all three waves of data, and some evidence, albeit weak, that SNS use in early waves was associated with increases in social self-esteem in later waves (Valkenburg, Koutamanis, and Vossen 2017). In addition, use of SNS was positively related to increases in empathy for others (Vossen and Valkenburg 2016).

But other longitudinal studies suggest more negative consequences to screen exposure. For example, Shakya and Christakis (2017) analyzed the nationally representative Gallup Panel Social Network Study survey and reported that a one–standard deviation increase in the number of times an individual "likes" a Facebook post, clicks a link, or updates his or her status was associated with a 5%–8% of a standard deviation decline in self-reported mental health over the next two years. And Primack et al. (2009) analyzed 4,142 adolescents from the National Longitudinal Survey of Adolescent Health and noted that, for each additional hour of television viewing, respondents were 8% more likely to develop depressive symptoms seven years later. Overall, these longitudinal studies provide a complex view of the relationship between exposure to technology and outcomes in general—some suggesting that screen exposure reduces well-being while others indicating that it improves it—and produce varying results depending on the kind of screen exposure at stake (e.g., computer use, social network site, television). Again, however, the distinction between mental health outcomes and social skills is important. While these mental health studies are relevant to our interests, we note that none of them directly gauges children's social skills.

CONCEPTUALIZING AND OPERATIONALIZING SOCIAL SKILLS

We conceptualize "social skills" as the ability to successfully negotiate the expectations of others in social interactions.[6] This definition is deliberately broad

[5] Their measure of social self-esteem was based on responses to four questions ("I find it easy to make friends," "I have a lot of friends," "I am popular among my peers," and "It is easy to like me.").

[6] The term "social skill" did not emerge in force in the literature until the late 1970s. The concept became more psychometrically developed in the 1980s, with clear validity and reliability estimates established in the 1990s (the decade of our first data point). The key difficulty is distinguishing among the many ways social skills could be conceptualized. For example, the following terms are evident in the literature before the 1990s and likely capture aspects of social skill but vary in reliability and validity in unknown ways: social competence, social performance, social development, social withdrawal, social maladjustment, social isolation, social success, human relations skills, and social interaction. Our operationalization of social skills primarily targets children's ability to get along with peers and likely does not capture

and includes interactions with peers, siblings, parents, teachers, and other adult figures. It encompasses face-to-face skills but also includes digital communications in which children and teens negotiate peer relations and maneuver through the social world via texts and posts to social media. In the contemporary world, responding appropriately to difficult e-mails, negotiating social media interactions, and maintaining connections with knowledgeable digital users may be components of a broader set of "social skills" that go beyond the face-to-face. Our conceptualization of "social skills," therefore, is sensitive to the kinds of interpersonal skills useful for navigating the modern world.

Our theoretical interest in social skills is broadly conceptualized, but we necessarily operationalize a subset of these skills—face-to-face skills among peers—an issue we raise in the discussion. We use teachers' and parents' ratings of children's interactions with peers, noting that our measure then represents both peer-based skills and the ability to meet the expectations of adult figures.

Determining whether social skills have declined over time is challenging because it requires a standardized measure that has both validity and reliability. And even if we produce a measure with good psychometric properties, it is difficult to separate real changes in social skills from potential changes in their subjective evaluation. For example, if teachers and parents come to rate children's social skills more leniently over time, then we could observe no change in skills even if social skills really declined. This problem leaves social scientists in an awkward position—popular claims about the degeneration of social skills abound without acknowledging the significant methodological challenges involved. Our approach is to produce stronger evidence than what currently exists, while recognizing the inherent challenges in isolating real changes in skills from changes in how those skills are evaluated, a point we return to in the discussion.

HYPOTHESES

Influenced by the scholarship emphasizing a balanced view of new technologies (they may be both positively and negatively linked to adolescent social skills), and given the sparse empirical evidence indicating a decline in face-to-face social skills, we hypothesize as follows:

HYPOTHESIS 1.—*Average face-to-face social skills among American children and adolescents have not declined over time*.

Of course, American children's social skills might have changed over time for other reasons, aside from technological change. One reason has to do with

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more complex skills, like the ability to manage and maintain intransitive relationships (e.g., having two close friends who do not like each other), deflect attention from oneself to others, and get peers to open up emotionally, not to mention the skill of combative verbal sparring and talking to strangers in public places.

a wide range of shifts in the American family. Parents' education level has tended to increase over time, a change that should result in a corresponding increase in children's social skills, given the positive association between parents' education and children's social and behavioral skills (Jennings and DiPrete 2010). In addition, high-SES parents appear to be making an increasingly deliberate attempt to cultivate children's skills. Financial investments in children (e.g., extracurricular activities, child care, private tutoring, camps) have been increasing over the last several decades, especially among top quintile income earners (Kornrich and Furstenberg 2013). While parents' financial investments may not result in greater social skills, they may be an indicator of a parenting shift toward what Lareau (2003) calls "concerted cultivation"—a style of parenting characterized by deliberate investments designed to promote the child's well-being in all areas, including social skills. In addition, state spending on preschool has increased significantly in the last couple decades, from $2.4 billion in 2002 to $7.6 billion in 2017, coinciding with larger enrollments. And prompted by the mandated cognitive tests for third through eighth graders, many states have implemented more stringent learning standards in the early grades too, perhaps pressuring schools to require higher levels of readiness among kindergartners.

We attempt to model some of these social changes and, given the weight of the literature for hypothesis 1, we anticipate the following result:

HYPOTHESIS 2.—*Net of other changes in the environment, average social skills among children and adolescents have not declined overtime.*

It is also possible that average social skills have stayed constant but that variation in skills has increased due to growing economic inequality and a growing gap between the investments high- and low-income parents make (Kornrich and Furstenberg 2013). Income inequality has been increasing (Piketty 2014) and likely has had consequences for family life. To the extent that economic stress has become more divergent across American homes, we would expect that the opportunity for children to develop social skills has also become more varied.

On the basis of the increasingly disparate home environments of children, we hypothesize as follows:

HYPOTHESIS 3a.—*Variance in children's social skills has increased over time.*

HYPOTHESIS 3b.—*Skill gaps across social groups (socioeconomic, racial/ethnic) have increased over time.*

Finally, while our primary objective is to determine whether social skills are declining, we are also interested in assessing the specific role of screen exposure. One way of gaining leverage on the causal relationship between screen exposure and outcomes is to assess whether individuals with low levels of screen exposure enjoy greater improvements in social skills over time than children with high levels of screen exposure. As reviewed, some research employing this kind of study design produces a neutral or even favorable picture

of the relationship between technology use and social outcomes. However, we view the literature as failing to provide a clear consensus with respect to the consequences of screen exposure for social skills, and so we hypothesize as follows:

HYPOTHESIS 4.—*Children who are heavy technology users will exhibit similar gains in social skills relative to children who are not heavy technology users.*

DATA AND METHODS

Our research question is best addressed with nationally representative data of multiple cohorts. All of the data sets we use meet that criterion. Our primary analysis involves comparing two cohorts of children, one assessed in 1998, when exposure to home computers and the internet was modest, and another assessed in 2010, after computer usage had risen sharply. For example, in 1997 about half of 6–11-year-olds had access to a computer in the home, while in 2010 over 80% had access. And in 1997, about 10% of 6–11-year-old children used the internet at home, while that percentage jumped to 55 in 2010 (Child Trends 2018). Clearly this was a period of rapid expansion of both computers and internet availability.

Samples

Cohort 1—Early Childhood Longitudinal Study, Kindergarten Cohort of 1998 (ECLS-K:1998)

Collected by the National Center for Education Statistics (NCES), the ECLS-K:1998 provides information for a nationally representative sample of 21,260 children attending kindergarten in the fall of 1998–99. The ECLS-K employed a multistage probability sampling design in which 100 primary sampling units (PSUs; counties or groups of counties) were selected with probability proportional to size, and then roughly 1,200 schools were sampled, and about 24 students within each school were selected. Children were assessed by teachers at the beginning and end of kindergarten, beginning and end of first grade, spring of third grade, and spring of fifth grade. They were assessed by parents at the beginning and end of kindergarten and at the end of first grade. We analyze the children with valid scores on our dependent variables. At the beginning of kindergarten there were 19,150 valid cases.[7] In our cohort comparison analyses, we use a wave-specific weight so that data are representative of American children at that stage of schooling.

[7] This number increases somewhat (to 19,950) at the end of kindergarten, as additional children were sampled from schools that refused to participate in the fall but were converted into respondents by the spring. Sample sizes are rounded to the nearest fiftieth.

Cohort 2—ECLS-K:2010

The ECLS-K:2010 data are a nationally representative sample of 16,450 students who were enrolled in kindergarten in the fall of 2010.[8] Again, ECLS-K used a multistage probability sampling design in which PSUs were sampled, then roughly 1,000 schools were sampled within PSUs, and about 19 students within each school were selected. Children's social skills were evaluated by teachers at the beginning (valid $N = 13{,}400$) and end of kindergarten, the end of first grade, the end of second grade, and the end of the third, fourth, and fifth grades. They were evaluated by parents at the beginning and end of kindergarten and at the end of first grade. Again, we employed wave-specific weights to produce estimates of population parameters.

Supplemental Analyses: NELS

The National Education Longitudinal Study (NELS) is a nationally representative sample of 24,600 eighth graders in 1988. The data were collected using a three-stage sampling procedure, where PSUs, then schools, and then children within schools were selected. The NELS:1988 cohort was born around 1974 and grew up during a period when home computers were not widely available.

Missing values.—We impute for missing values using Stata's mi command with 20 data files and 150 burn-ins. Our imputation models included all independent variables in our analyses. We calculate for missing values on the dependent measures and conduct final models with imputed values for our social skills measures, but as a robustness check, in supplementary analyses we drop missing cases on the dependent measures (von Hippel 2007) and find nearly identical results.

Measures

Social skills.—We rely primarily on teachers' assessments of children's social skills. Fortunately, teachers were asked the same questions in both the 1998 and 2010 ECLS-K data sets.[9] The teachers were asked several questions related to children's interpersonal skills, that is, ability to (1) form and maintain friendships, (2) get along with people who are different, (3) comfort or help other children, and (4) express feelings, ideas, and opinions in a positive way. Reliability for this scale ranged from .86 to .89 (see table A1 for reliabilities of all scales). In addition, we gauge children's self-control through teacher's

[8] Some refer to these data as ECLS-K:2011, but we refer to them as the 2010 data because that is when children were first observed, similar to the 1998 cohort.

[9] There were very minor changes made to two items of the teacher rating scale between 1998 and 2010. For example, in one case, they changed the form of the verb ending in "ing" to present tense. NCES officials believe that these minor changes were not significant enough to change the meaning or interpretation of the items (personal communication, Jill McCaroll, associate project officer, ECLS, May 8, 2017).

responses to four questions about the child's ability to (1) respect the property rights of others, (2) control temper, (3) accept peer ideas for group activities, and (4) respond appropriately to pressure from peers. Reliability for self-control (teacher) ranged from .79 to .82. Our measures of interpersonal skills (teacher) and self-control (teacher) overlap conceptually, both gauging interactions with peers, and are highly correlated empirically ($r = .80$). For some of our analyses, we combine children's scores on interpersonal skills (teacher) and self-control (teacher) (adding both scores together) to produce a broader indicator we refer to as *social skills (teacher)*.[10]

Parents were also asked about children's social skills in both 1998 and 2010, and we constructed two variables (interpersonal skills and self-control) from their responses. Interpersonal skills (parents) is a composite of questions parents were asked about children's ease in joining in play, ability to make and keep friends, and positive interactions (comforting, helping) with peers. Reliability for this scale ranged from .67 to .70. Self-control (parents) was constructed from questions about the frequency with which a child fights, argues, throws tantrums, and gets angry. Reliability for self-control (parents) ranged from .73 to .75.[11] But unlike teacher scores, the correlation between parent ratings of interpersonal skills and self-control is low ($r = .20$), suggesting less uniformity in how parent's rate their child's social skills across dimensions.

How disparate are teacher and parent measures? We combined the two teacher measures and the two parent measures and correlated these composite indicators of social skills across every wave for both the 1998 and the 2010 cohorts (see tables A3 and A4). The correlations are modest. For example, for both the 1998 and the 2010 cohorts, teacher and parent evaluations of social skills for the same wave of data correlate around .20, indicating that the two authority figures provide largely distinct evaluations of children's social skills. While the wording of the teacher and parent questions is not precisely the same, they assess similar domains, and so it is informative to compare the means on the distinct scales too. Parents tend to rate their children more favorably than do teachers with respect to interpersonal skills and less favorably with respect to self-control, perhaps indicating how teachers observe more peer-related behavior while parents observe more sibling-related behavior (table 1). We will use teacher reports in our fifth grade analyses because parent reports were only collected from kindergarten to first grade.

[10] In supplemental analyses, we explored other measures that arguably gauged some dimension of children's social skills such as externalizing problem behaviors (child argues, fights, gets angry, acts impulsively, and disturbs ongoing activities) and internalizing problem behaviors (anxious, lonely, sad, or has low self-esteem) and found largely similar results.

[11] The scores we analyze are not adjusted for estimated reliability because preliminary analyses confirmed that reliability-adjusted vs. unadjusted scores were so similar (the reliabilities are nearly the same across the two cohorts) that this adjustment had no practical consequence for our research question.

TABLE 1
CHILDREN'S SOCIAL SKILLS (Teacher and Parent Ratings) IN 1998 AND 2010, ECLS-K:1998 and ECLS-K:2010

	TEACHER-RATED SOCIAL SKILLS			PARENT-RATED SOCIAL SKILLS		
	1998	2010	1998 vs. 2010	1998	2010	1998 vs. 2010
Kindergarten fall:						
N	19,200	13,400		19,200	13,400	
Interpersonal skills	2.95	2.98	NS	3.31	3.44	***
	(1.32)	(1.03)	***	(1.00)	(.95)	***
Self-control	3.07	3.07	NS	2.83	2.88	***
	(1.39)	(1.01)	***	(.78)	(.92)	***
Social skills (interpersonal + self-control)	6.02	6.05	NS	6.14	6.32	***
	(2.60)	(1.90)	***	(1.31)	(1.50)	***
Kindergarten spring:						
N	20,000	16,100		20,000	16,100	
Interpersonal skills	3.08	3.12	***	3.42	3.44	*
	(1.25)	(1.04)	***	(.92)	(.89)	***
Self-control	3.14	3.17	NS	2.87	2.94	***
	(1.44)	(1.09)	***	(.86)	(.88)	**
Social skills (interpersonal + self-control)	6.22	6.29	**	6.28	6.38	***
	(2.59)	(2.04)	***	(1.41)	(1.31)	***
First grade spring:						
N	16,750	9,700		16,750	9,650	
Interpersonal skills	3.07	3.14	***	3.38	3.45	***
	(1.23)	(1.12)	***	(.98)	(.84)	***
Self-control	3.14	3.21	***	2.94	3.02	***
	(1.30)	(1.07)	***	(1.03)	(.75)	***
Social skills (interpersonal + self-control)	6.21	6.35	***	6.32	6.47	***
	(2.45)	(2.13)	***	(1.59)	(1.26)	***

NOTE.—Sample size rounded to nearest fiftieth. SDs are in parentheses. Two-sample *t*-tests are used to determine whether mean and variance differences between 1998 and 2010 data were statistically significant. NS = not significant.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

Screen exposure.—We measured children's exposure to screens through several measures. TV viewing was gauged by parents' responses to a question about how many hours per week their child watches TV. To measure computer use, we rely on the indicator frequency of computer use (1 = no use to 4 = every day).[12] Our measure of "high level of computer use" is of children

[12] In preliminary analyses, we explored type of computer activity but found no strong relationship to social skills.

who use the computer every day. Our indicator of video game use is based on a question parents were asked about the number of hours of video games their child plays per week. The 2010 data also have measures of online gaming, social networking, and texting, messages, or e-mail. Fifth grade children were asked how often (from 1 = never to 5 = many times a week) they played an online game against other online players or used a social networking site (i.e., Facebook, Twitter, Instagram, or Vine) using an app, cell phone, computer, iPad or tablet, or other electronic devices. They were also asked how often they send texts, messages, or e-mails using an app, cell phone, computer, iPad, tablet, or other electronic device.

Concerted cultivation.—Following Bodovski and Farkas (2008), we create a composite measure of parental investments in children, or "concerted cultivation," using four different measures of parenting behavior: school-based parental involvement (i.e., communicating with the school, volunteering in the classroom, attending PTA meetings), trips (i.e., museums, libraries, and sporting events), extracurricular activities (i.e., child participation in music, dance, sports), and home-based parental involvement (i.e., reading, singing songs, telling stories to the child). Measures were compiled across waves, with concerted cultivation measures available in nearly every wave from kindergarten to fifth grade. Replicating Bodovski and Farkas (2008), we summed the frequency of each measure to create an overall scale we label *total concerted cultivation activities*. We also standardized the total and created a dummy measure indicating children with scores of one standard deviation or higher on these measures to capture high levels of concerted cultivation.

Control variables.—We also include several covariates in our multivariate analyses: SES is a composite constructed by the NCES using household income, parents' occupations, and parents' educations. Parental educational expectations of their child are based on parents' responses to a question about how far in school they expect their child to go when surveyed at the start of kindergarten. Answers ranged from 0 = less than high school to 6 = graduate school. In some multivariate models we include a wide range of statistical controls for sibling size, parents' age (averaged), whether both biological parents are in the home, whether the child is disabled, age of child at assessment, child's body mass index (BMI), child's health, and birth weight. See table A2 for more description, metrics, coding, and percentage missing.

Analytic Strategy

Our primary analyses are simple—to determine whether social skills have declined, we produce estimates of the population mean for children's social skills for both ECLS-K cohorts (1998 and 2010) at each wave of data for both teachers' and parents' reports. We use the independent two-sample *t*-test and

report *P*-values. We also test whether variance in social skills has changed over time.

These tests represent our main analysis, but we recognize that any changes in social skills between 1998 and 2010 could be obscured by other factors. For example, increased parental education or greater parental investments could offset a decline in social skills that might be due to greater screen exposure. For this reason, we estimate models that include controls for parents' SES and parental educational expectations and indicators of concerted cultivation, all factors that could potentially account for changes in children's social skills. These models allow us to consider whether social skills have declined net of other changes in the family.

In addition, we estimate within-cohort models as a way to gain leverage on isolating the causal effect of screen exposure on social skills, by testing whether children who experienced heavy screen exposure gained fewer social skills than children who experienced little screen exposure within each cohort. Here we predict teacher-rated social skills in fifth grade, net of social skills at kindergarten entry, which controls for the kind of unobserved differences between children with high versus low levels of screen exposure that influenced social skills at kindergarten entry. For example, if children with high levels of screen exposure tend to grow up in less structured environments (a factor not well captured by our control variables), this difference likely shapes kindergarten scores. While these lagged dependent variable models have a greater claim to identifying causal relationships than traditional regression models, they are still vulnerable to producing biased estimates to the extent that high-exposure children are different from low-exposure children in ways that (1) are not captured by our covariates, (2) change over time, or (3) fail to remove confounds unrelated to the kindergarten measure of social skills.

RESULTS

Did Average Skills Decline between 1998 and 2010?

From the teachers' perspective, children's social skills did not decline between 1998 and 2010. On a scale of 1–4, the average teacher evaluation of students' interpersonal skills at the beginning of kindergarten was largely unchanged between 1998 and 2010 ($\bar{x} = 2.95$ in 1998 and $\bar{x} = 2.98$ in 2010; see table 1). And teachers' evaluations of self-control were also comparable across the two cohorts ($\bar{x} = 3.07$ in 1998 and $\bar{x} = 3.07$ in 2010; table 1).

Similar patterns persist as the children progress through school. At each grade level, when a direct comparison between the two cohorts is available, teacher evaluations in 2010 tend to be a bit higher than in 1998. At the end of kindergarten, first grade, third grade, and fifth grade, teachers' evaluations of children's interpersonal skills and self-control are all slightly higher in 2010 than in 1998, although these differences are small and do not consistently

reach statistical significance (tables 1 and 2). Because teacher evaluations for interpersonal skills and self-control are similar, we combined the two and display how this composite measure differs across cohorts over time in figure 1. Evaluations in 2010 are always a little higher than in 1998, although the substantive differences are small.

TABLE 2
CHILDREN'S SOCIAL SKILLS (Teacher Ratings) IN 1998 AND 2010, ECLS-K:1998 AND ECLS-K:2010

	1998	2010	1998 vs. 2010
Second grade spring:			
N		7,700	
Interpersonal skills		3.13	
		(1.04)	
Self-control		3.23	
		(1.07)	
Social skills (interpersonal + self-control)		6.35	
		(2.02)	
Third grade spring:			
N	14,450	7,400	
Interpersonal skills	3.03	3.13	***
	(1.15)	(1.06)	***
Self-control	3.15	3.27	***
	(1.14)	(1.09)	***
Social skills (interpersonal + self-control)	6.18	6.40	***
	(2.20)	(2.07)	***
Fourth grade spring:			
N		5,950	
Interpersonal skills		3.12	
		(1.12)	
Self-control		3.28	
		(1.05)	
Social skills (interpersonal + self-control)		6.41	
		(2.09)	
Fifth grade spring:			
N	11,350	5,750	
Interpersonal skills	3.01	3.14	***
	(1.56)	(.90)	***
Self-control	3.18	3.31	***
	(1.45)	(.90)	***
Social skills (interpersonal + self-control)	6.20	6.45	***
	(2.89)	(1.71)	***

NOTE.—Sample size rounded to nearest fiftieth. SDs are in parentheses. Two-sample *t*-tests used to determine whether mean and variance differences between 1998 and 2010 data were statistically significant differences.

* $P < .05$

** $P < .01$.

*** $P < .001$.

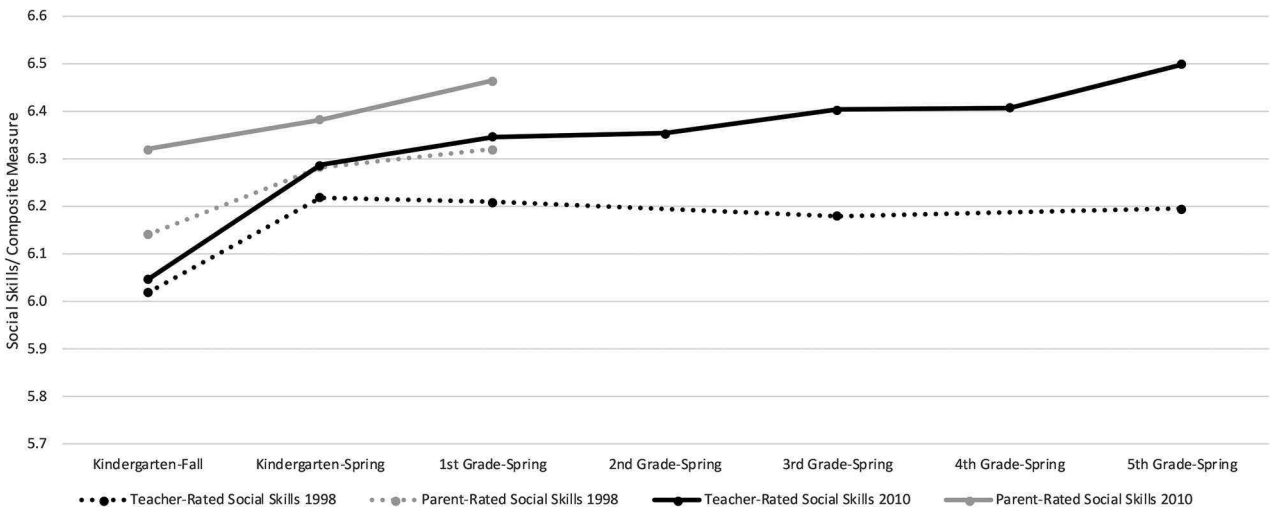

FIG. 1.—Mean of teacher- and parent-rated social skills across school years, comparing ECLS-K:1998 data with ECLS-K:2010 data

The story is similar if we rely on parents' reports of children's social skills. For example, at kindergarten entry, parents' reports of children's interpersonal skills are slightly higher in 2010 ($\bar{x} = 3.44$) than in 1998 ($\bar{x} = 3.31$, $P < .001$; table 1). Similarly, parents' evaluations of children's self-control are more favorable in 2010 ($\bar{x} = 2.88$) than in 1998 ($\bar{x} = 2.83$, $P < .001$). Following children up until the end of first grade (the last point in which parents' evaluations are available), the parent evaluations in 1998 and 2010 are very similar, with slightly higher evaluations in 2010 than in 1998, all reaching statistical significance. The patterns for parents' evaluations of interpersonal skills and self-control are not as similar, but for comparison we combined the two and display this composite across cohorts in figure 1. Evaluations in 2010 are a little higher than in 1998, especially in kindergarten, but again the substantive differences are small.

Did Changing Home Lives and Screen Use Affect Social Skills between 1998 and 2010?

It is noteworthy that children's home lives appear to have improved between 1998 and 2010 across several indicators (tables 3 and 4). For example, how often a family member reads to the child at kindergarten entry increased from 3.22 in 1998 to 3.36 in 2010 ($P < .001$; see table 3), and the proportion of children taking music lessons increased from .07 in 1998 to .09 in 2010 ($P < .001$; see table 4). Perhaps the most dramatic increase was in parents' educational expectations for their child (reported at kindergarten entry). In 1998, the average response was 4.07 (4 = parent expects child to attend two or more years of college) versus 5.20 (5 = parent expects child to finish a four or five year degree, 6 = parent expects child to complete a masters degree) in 2010—a jump of more than a point on a scale ranging from 1 to 6. Similarly, mother's education increased from 4.14 in 1998 to 4.57 in 2010 ($P < .001$), and household income dropped slightly, from $74,501 in 1998 to $73,738 in 2010 (adjusted for inflation), a likely outcome of the 2008 recession.[13]

To what extent do family and demographic characteristics alter our estimates of social skills across the two time periods? Very little. For fifth graders in 2004, the unconditional estimate of our composite measure of social skills is $\bar{x} = 6.20$ (see table 2) and, calculating predictions for table 5, the conditional estimate is $\bar{x} = 6.16$. In 2016, the unconditional estimate is $\bar{x} = 6.45$ and, calculating predictions from table 6, the conditional estimate is $\bar{x} = 6.37$.[14] These analyses indicate that, even though several features of

[13] We would have liked to have made similar comparisons across screen exposure, but the questions about computer usage and TV viewing changed over time.

[14] We calculated the conditional estimate predicting scores with the following child profile: white, male, not disabled, in excellent health, in home with both biological parents

children's lives improved between 1998 and 2010, statistically controlling for these changes does not alter our conclusion that children's social skills remained roughly the same (or sometimes increased slightly) over time.

It is worth noting, however, that the control variables operate somewhat differently across the two cohorts. In 1998, controls for family environment (SES, parents' educational expectations, and concerted cultivation) reduce considerably the estimates for screen exposure (TV viewing, computer use). In 2010 these statistical controls play a more modest role—the coefficients for screen exposure change less from model 2 to model 3 in table 6, suggesting that the selectivity of those using digital technology weakened over time.

Did Variance in Skills Decline between 1998 and 2010?

We anticipated that variance in social skills would increase across cohorts, but our conclusion depends on whether we focus on teacher or parent reports. For example, the standard deviation of teachers' evaluations of children's interpersonal skills at kindergarten entry declined from 1.32 in 1998 to 1.03 in 2010 ($P < .001$; see table 1). The standard deviation for teachers' evaluations of children's self-control at kindergarten entry also declined from 1.39 in 1998 to 1.01 in 2010 ($P < .001$). With the exception of parents' evaluations at the start of kindergarten, patterns are similar to those of teachers—modest evidence of a decline in variance (fig. 2). In addition, we tested whether socioeconomic, gender, or racial/ethnic gaps in social skills changed between cohorts. With only minor exceptions, social skills improved, regardless of SES (fig. 3), sex (fig. 4), and race/ethnicity (fig. 5). We found little evidence that these gaps meaningfully changed between 1998 and 2010. The only gap that changed in a statistically significant way was the Asian/white gap, which became slightly smaller over time.

Is Screen Exposure Related to Social Skills Development within Cohorts?

Here, our main question is whether children with heavy screen exposure gain fewer social skills as they age compared to children with little screen exposure. For both cohorts we predicted children's fifth grade social skills while controlling for kindergarten social skills. For ease of presentation, we use our

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and whose parents have average SES, of average age, average rates of concerted cultivation and parental expectations, average sibling size, average age of assessment, average BMI at the end of kindergarten, and born with average birth weight. Estimates for other profiles (e.g., black, female) yielded similar results. The differences between the unconditional and conditional estimates are virtually unchanged when we also consider high frequency screen time users. The predicted mean social skill score for this group is $\bar{x} = 6.23$ in 2004 and $\bar{x} = 6.31$ in 2016.

aggregate measure adding together interpersonal skills and self-control, titled *social skills*. Only teacher reports are available at this wave.

In table 5 we present the results of predicting social skills in fifth grade for the 1998 cohort, with the two indicators of screen exposure available (TV viewing and computer use), along with potentially confounding measures. In model 1 we note that TV viewing is negatively associated with fifth graders' social skills—both children in the middle 80% of TV viewing and those in the highest 10% have lower social skills than the reference group (the bottom 10% of TV viewers). This negative association is countered, however, by a positive association with computer use. Children who used a computer even modestly exhibited better social skills than children who never used a computer. As one might expect, both the negative association with TV viewing and the positive association with computer use decline considerably in model 2, when a few controls for demographic characteristics are included, and they decline even further in models 3 and 4, when we include indicators of SES, parents' educational expectations, and concerted cultivation.

We also estimate these same four models while including a control for children's social skills observed in kindergarten (models 5–8). These models control for unobserved differences between those with high and low exposure to screens that influenced the kindergarten scores, and so likely have a stronger claim to causality. While SES and parents' educational expectations predict social skills improvement between kindergarten and fifth grade, estimates for screen exposure (TV viewing and computer use) are no longer statistically significant (models 7 and 8). Overall, there is virtually no evidence that children with heavy exposure to screens are disadvantaged in terms of social skills among fifth graders in 2004.

The story is largely identical when we estimate the same kind of model for the 2010 cohort (in year 2016 at fifth grade), but it is more nuanced (table 6). For this cohort we have the advantage of additional measures of screen exposure (video game use, online gaming, social networking, and texting, messaging, and e-mail). Like the 1998 cohort, there is a negative coefficient for TV viewing, but it never reaches statistical significance. Again there is an indication that computer use is positively associated with social skills, and it is statistically significant in some models. Whether or not we account for prior social skills, using a computer three to six times a week versus not at all is associated with a .22 ($P < .05$) increase in social skills (metric ranges from 2 to 8) in fifth grade, net of controls in the model (compare models 4 and 5, table 6).

Surprisingly, video game use shows a positive relationship with social skills as does texting, messaging, or e-mailing.[15] Consistent with a balanced view

[15] Video gaming is measured in third grade and rated by parents, whereas online video gaming is measured in fifth grade and is rated by the child. This may account for why the two measures have a low correlation of .17.

TABLE 3
FAMILY ENVIRONMENT CHANGES ACROSS COHORTS, ECLS-K:1998 AND ECLS-K:2010

	KINDERGARTEN FALL			KINDERGARTEN SPRING			FIRST GRADE SPRING			THIRD GRADE SPRING		
	1998	2010	1998 vs. 2010	1998	2010	1998 vs. 2010	1998	2010	1998 vs. 2010	1998	2010	1998 vs. 2010
N	19,150	13,400		19,950	16,100		16,750	9,650		14,450	7,400	
Household income				74,501.00	73,738.00	NS						
				(242,558.00)	(215,934.00)							
Mother's education level				4.14	4.57	***						
				(4.80)	(5.71)							
Father's education level				4.08	4.25	**						
				(5.47)	(6.02)							
How far parent expects child to go in school	4.07	5.20	***							3.97	5.13	***
	(2.24)	(2.56)								(2.50)	(2.10)	
Parent involvement in the home:												
How often family members read to child	3.22	3.36	***				3.13	2.94	***			
	(1.73)	(1.93)					(1.66)	(1.77)				
How often child helps with chores	3.27	2.96	***				3.27	2.77	***			
	(1.31)	(1.60)					(1.63)	(1.17)				
How often a family member tells stories to child	2.73	3.06	***									
	(1.47)	(2.00)										

How often a family member sings songs to child	3.10 (1.53)	3.15 (1.39)	**
How often a family member helps child do arts and crafts	2.65 (1.00)	2.78 (1.29)	***
How often a family member plays games/puzzles with child	2.78 (1.14)	2.87 (1.24)	***
How often a family member talks about nature/does science project with child	2.19 (1.37)	2.29 (1.77)	***
How often a family member builds something or plays construction toys with child	2.34 (1.17)	2.48 (1.41)	***

NOTE.—Sample size rounded to nearest fiftieth. Income adjusted for 2010 dollars. SDs are in parentheses. NS = not significant.
* $P < .05$.
** $P < .01$.
*** $P < .001$.

TABLE 4
CONCERTED CULTIVATION CHANGES ACROSS COHORTS, ECLS-K:1998 AND ECLS-K:2010

	KINDERGARTEN SPRING			FIRST GRADE SPRING			THIRD GRADE SPRING		
	1998	2010	1998 vs. 2010	1998	2010	1998 vs. 2010	1998	2010	1998 vs. 2010
N	19,950	16,100		16,750	9,650		14,450	7,400	
Parent involvement in the school:									
Family member attended back-to-school night	.72	.80	***	.77	.86	***	.82	.88	***
	(.93)	(.67)		(.77)	(.78)		(.76)	(.53)	
Family member attended PTA meeting	.33	.36	**	.40	.43	NS	.43	.44	NS
	(1.22)	(1.26)		(1.19)	(1.26)		(1.11)	(1.17)	
Family member attended a school event	.64	.78	***	.72	.82	***	.78	.82	**
	(1.19)	(.93)		(1.00)	(.69)		(.91)	(.66)	
Family member volunteered in the classroom	.45	.56	***	.47	.55	***	.46	.51	**
	(1.17)	(1.31)		(1.13)	(1.25)		(1.13)	(1.25)	
Extracurricular activity:									
Child participated in music lessons	.07	.09	***	.10	.12	**	.17	.19	
	(.43)	(.46)		(.54)	(.54)		(.66)	(.73)	
Child participated in art classes or lessons	.07	.09	**	.10	.10	NS	.11	.12	NS
	(.48)	(.48)		(.62)	(.58)		(.56)	(.42)	
Child participated organized clubs or recreational programs (i.e., Scouts)	.13	.12	NS	.27	.23	**	.30	.25	***
	(.59)	(.55)		(1.00)	(.74)		(1.00)	(.87)	

Child participated in athletic activities (i.e., basketball, soccer, baseball, gymnastics)	.44 (1.19)	.49 (1.11)	***	.53 (1.12)	.57 (1.06)	**	.57 (.98)	.60 (1.06)
Trip:								
Family member visited the library with child	.52 (.94)	.58 (.94)	***					
Family member visited gallery, museum, historical site with child	.30 (.85)	.34 (.99)	***					
Family member visited zoo, aquarium, petting farm with child	.40 (1.47)	.47 (1.36)	***					
Family member went to play, concert, live show with child	.37 (.88)	.39 (.84)	**					
Family member attended athletic or sporting event with child	.42 (.81)	.45 (.81)	**					

NOTE.—Sample size rounded to nearest fiftieth. SDs are in parentheses. NS = not significant.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

TABLE 5
CHILDREN'S SOCIAL SKILLS IN FIFTH GRADE IN 2004 (Composite of Teacher-Rated Interpersonal Skills and Self-Control) REGRESSED ON SCREEN TIME AND DEMOGRAPHIC CHARACTERISTICS, ECLS-K:1998

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
TV viewing (ref = lowest 10%):								
Middle 80%	−.17*	−.05	.02	.01	−.12	−.03	.02	.02
	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)
Highest 10%	−.28**	.03	.16	.16	−.16	.07	.17	.17
	(.10)	(.11)	(.11)	(.11)	(.10)	(.11)	(.11)	(.11)
Computer use (ref = never):								
Once or twice a week	.33***	.18*	.07	.06	.23**	.13	.05	.04
	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)
3–6 times a week	.47***	.26***	.07	.07	.32***	.18**	.04	.04
	(.07)	(.07)	(.08)	(.08)	(.07)	(.07)	(.07)	(.07)
Every day	.38**	.20	.01	.00	.20	.09	−.06	−.06
	(.13)	(.13)	(.12)	(.12)	(.13)	(.13)	(.12)	(.12)
SES (SD)			.10**	.10**			.09**	.09**
			(.03)	(.03)			(.03)	(.03)
Parental educational expectations			.10***	.10***			.08**	.08**
			(.03)	(.03)			(.02)	(.02)
Concerted cultivation:								
Total			.04				.03	
			(.03)				(.02)	

Parental involvement in schools				.07*				.05
				(.03)				(.03)
Trips				.04				.04
				(.03)				(.03)
Extracurricular activities				−.02				−.02
				(.03)				(.03)
Parental involvement at home				−.03				−.03
				(.02)				(.02)
Constant	6.04***	5.63***	5.67***	5.72***	4.09***	4.43***	4.51***	4.56***
	(.09)	(.46)	(.45)	(.46)	(.15)	(.45)	(.45)	(.45)
Prior social skills	No	No	No	No	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes

NOTE.—TV viewing compiled at the spring of kindergarten, first, third, and fifth grade, and computer use, at the spring of kindergarten, first, third, and fifth grade. Controls: sibling size, parent age (averaged), both biological parents in home, child disabled, age of assessment, child BMI, child health, birth weight, race/ethnicity, and sex. Results are weighted and imputed. SEs are in parentheses. $N = 11{,}350$.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

TABLE 6
Children's Social Skills in Fifth Grade in 2016 (Composite of Teacher-Rated Interpersonal Skills and Self-Control) Regressed on Screen Time and Demographic Characteristics, ECLS-K:2010

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
TV viewing (ref = lowest 10%):								
Middle 80%	−.09	−.07	.03	.03	−.06	−.05	.03	.03
	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)
Highest 10%	−.16	−.06	.11	.12	−.10	−.02	.12	.12
	(.10)	(.09)	(.10)	(.10)	(.09)	(.09)	(.10)	(.10)
Computer use (ref = never):								
Once or twice a week	.10	.12	.15*	.14	.10	.12	.14*	.13*
	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)
3–6 times a week	.08	.18	.23*	.22*	.10	.18	.23*	.22*
	(.11)	(.10)	(.10)	(.10)	(.10)	(.09)	(.09)	(.09)
Every day	.15**	.07	.02	.01	.08	.03	−.01	−.02
	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)
Video game use (ref = lowest 10%):								
Middle 80%	.20**	.12*	.03	.03	.14*	.09	.02	.01
	(.06)	(.05)	(.05)	(.05)	(.06)	(.05)	(.05)	(.05)
Highest 10%	.30***	.23**	.15*	.14*	.24**	.20**	.13	.12
	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)

Texting, messages, e-mail (ref = never):								
Less than once a week	.26***	.19**	.16**	.16**	.20**	.15**	.13*	.13*
	(.06)	(.05)	(.05)	(.05)	(.06)	(.06)	(.05)	(.05)
A few times a week	.42***	.31***	.28***	.28***	.33***	.25***	.23***	.23***
	(.06)	(.06)	(.06)	(.06)	(.06)	(.05)	(.05)	(.05)
About once a day	.35***	.25***	.21***	.21***	.25***	.17**	.15*	.15*
	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)
Many times a day	.25**	.11	.08	.08	.16*	.06	.03	.03
	(.08)	(.07)	(.07)	(.07)	(.08)	(.07)	(.07)	(.07)
Online gaming (ref = never):								
Less than once a week	−.03	.06	.04	.05	−.02	.05	.04	.04
	(.05)	(.05)	(.05)	(.05)	(.06)	(.06)	(.06)	(.06)
A few times a week	−.20***	−.01	−.02	−.03	−.14**	.01	.00	−.01
	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)
About once a day	−.29***	−.09	−.09	−.09	−.23***	−.07	−.07	−.07
	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)
Many times a day	−.58***	−.28***	−.25***	−.25***	−.45***	−.22**	−.21**	−.21**
	(.06)	(.07)	(.07)	(.07)	(.06)	(.06)	(.06)	(.07)
Social networking (ref = never):								
Less than once a week	−.03	−.04	−.02	−.03	−.05	−.05	−.03	−.04
	(.06)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)
A few times a week	−.03	−.01	.00	−.01	−.05	−.03	−.02	−.03
	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)	(.05)
About once a day	−.02	−.04	−.02	−.03	−.03	−.05	−.03	−.04
	(.07)	(.06)	(.06)	(.06)	(.07)	(.06)	(.06)	(.06)
Many times a day	−.24***	−.20**	−.17**	−.17**	−.22***	−.18**	−.16**	−.16**
	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)	(.06)

TABLE 6 (*Continued*)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Socioeconomic status (SD)			.10***	.09**			.09**	.08**
			(.03)	(.03)			(.03)	(.03)
Parental educational expectations			.10***	.09***			.08***	.07**
			(.02)	(.02)			(.02)	(.02)
Concerted cultivation:								
Total			.05*				.04	
			(.02)				(.02)	
Parental involvement in schools				.08***				.06**
				(.02)				(.02)
Trips				.01				.02
				(.02)				(.02)
Extracurricular activities				.00				−.01
				(.02)				(.02)
Parental involvement at home				.00				−.01
				(.02)				(.02)
Constant	6.31***	6.14***	5.98***	6.01***	4.65***	4.97***	4.89***	4.93***
	(.09)	(.30)	(.28)	(.28)	(.14)	(.32)	(.30)	(.30)
Prior social skills	No	No	No	No	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes

NOTE.—TV viewing assessed in the spring of kindergarten, first, second, and third grade; video game use, in the spring of first, second, third, and fourth grade; computer use, in the spring of kindergarten; and texting, online gaming, and social networking, in the spring of fifth grade. Controls: sibling size, parent age (averaged), both biological parents in home, child disabled, age of assessment, child BMI, child health, birth weight, race/ethnicity, and sex. Results are weighted and imputed. SEs are in parentheses. $N = 5{,}750$.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

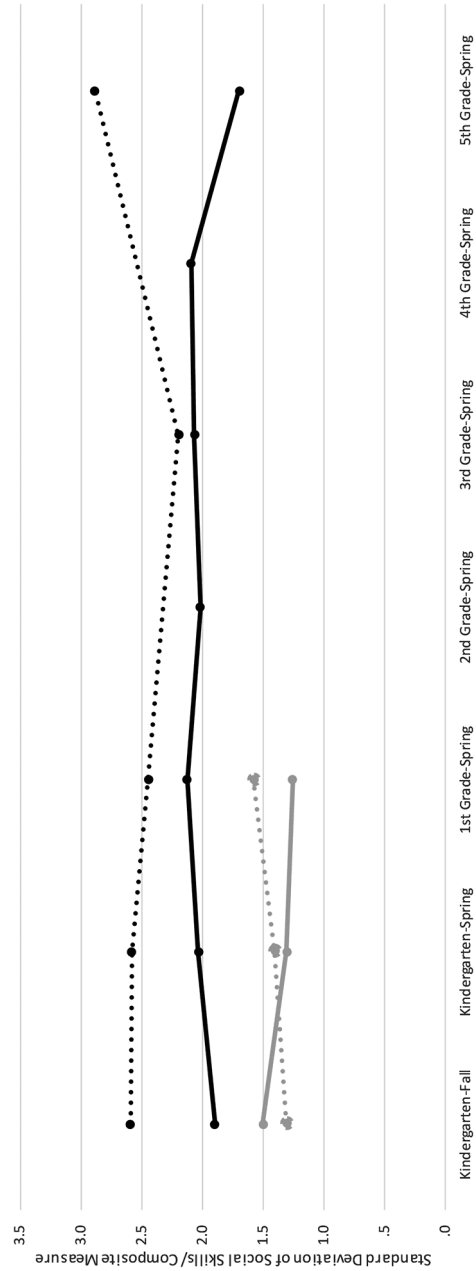

FIG. 2.—Variance of teacher- and parent-rated social skills across school years, comparing ECLS-K:1998 data with ECLS-K:2010 data

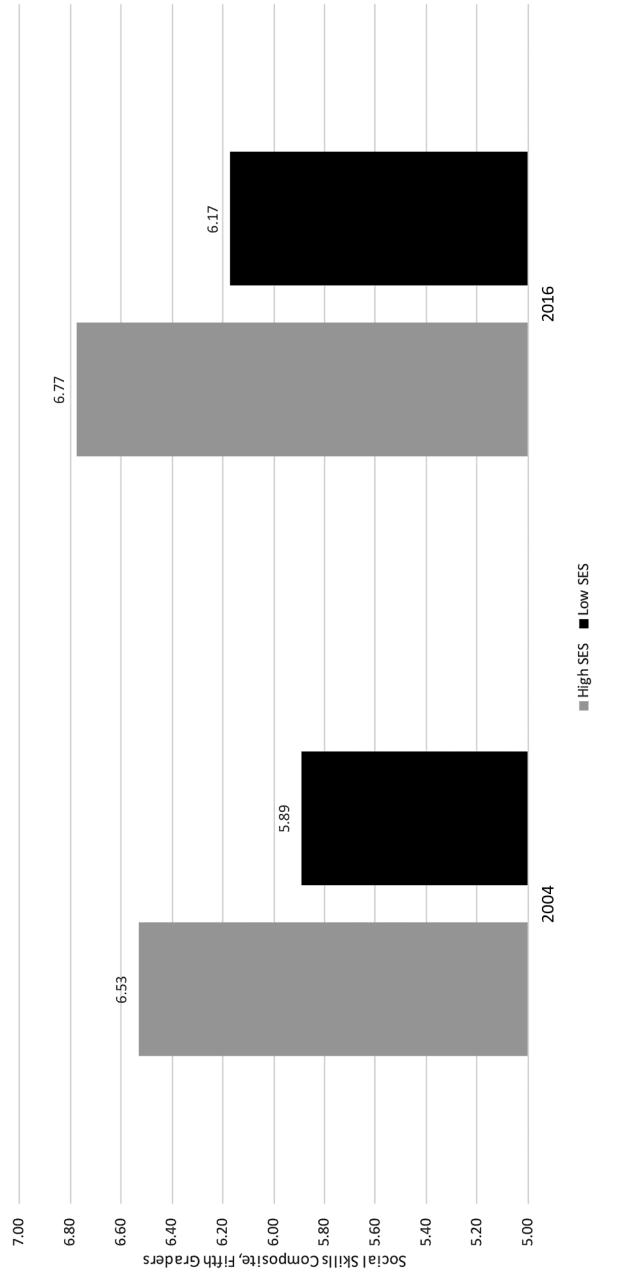

FIG. 3.—Fifth grade SES gaps in social skills were similar in 2004 and 2016

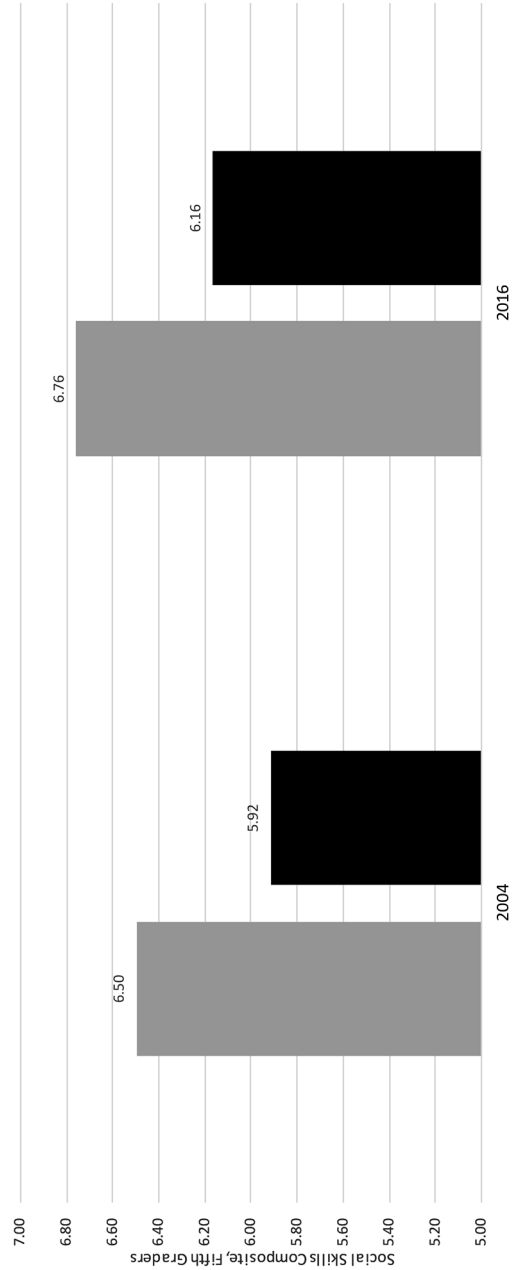

FIG. 4.—Fifth grade gender gaps in social skills were similar in 2004 and 2016

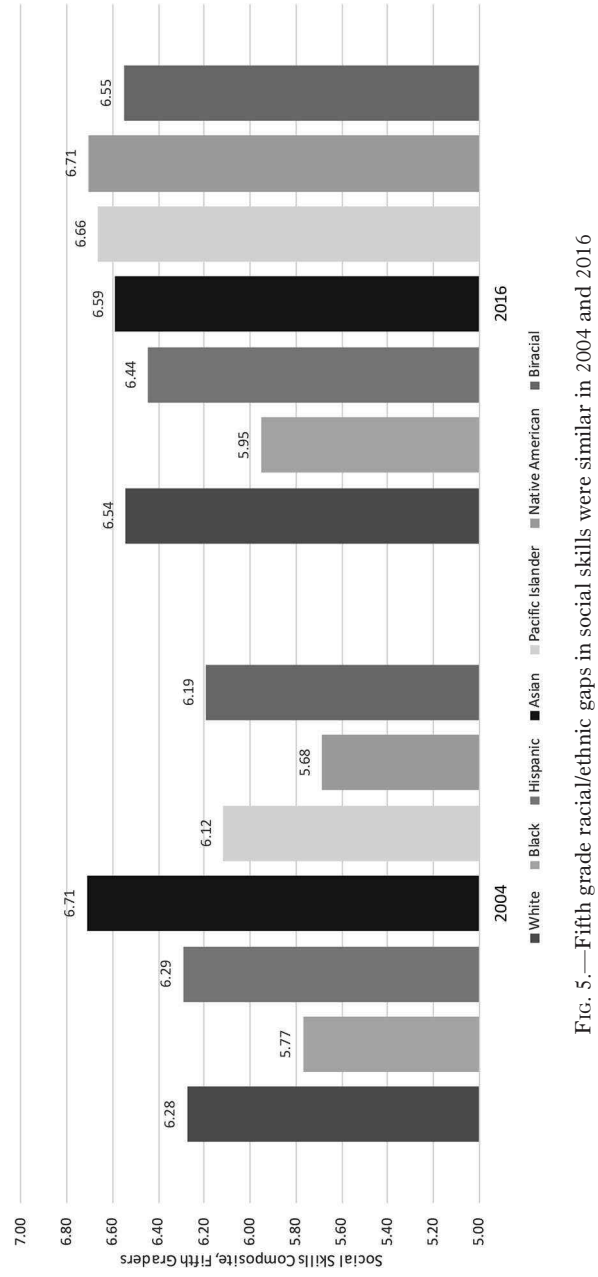

FIG. 5.—Fifth grade racial/ethnic gaps in social skills were similar in 2004 and 2016

of technological change, we find frequent (many times a day) online gaming ($-.21$, $P < .01$, model 8) and social networking ($-.16$, $P < .01$, model 8) have consistently negative associations with social skills (see table 6). Yet, when we standardize our measure of social skills, these negative associations are a modest $-.17$ and $-.13$ SD, respectively. In other words, our analysis of the 2010 cohort reveals a slight reduction in social skills only for those who spend very high levels of time on social networking sites and are frequent gamers online.[16]

Do forms of advantage/disadvantage (e.g., social class and concerted cultivation) play a role? A positive relationship between computer use and social skills might indicate that using a computer increases a child's social skills, but it may be that the computer use estimate is confounded by other unmeasured advantages typical of the kinds of families that can afford a computer. Alternatively, a negative association between TV viewing and social skills might represent a causal relationship, or it might be the result of an association between TV viewing and family disadvantage. This seems to be the case in table 5 (1998 cohort) where coefficients for TV viewing and computer use change when we include statistical controls for SES, parental educational expectations, and concerted cultivation (models 2 and 3). It is worth noting, however, that this is less true in table 6 (2010 cohort), where model 3 does not appear to influence the coefficient estimates for screen exposure much. The difference in this pattern from table 5 to table 6 may represent a shift between 1998 and 2010 in the association between screen exposure and family advantage/disadvantage. These patterns suggest that the association between screen exposure and advantage/disadvantage may have weakened over time. Consistent with this view, the bivariate correlation between computer use and SES was .40 in 1998 and .22 in 2010.

To broaden our understanding of how screen exposure matters, we also assessed its relationship with other indicators of child well-being available in the ECLS data sets—parents' ratings of children's depression (in first grade) and children's self-reported responses to questions about success with friends (e.g., "I am happy with the friends I have"; in third grade; see tables A5–A7). Once again, we found little evidence of a negative effect of screen exposure. TV viewing, computer use, and video game use produced little

[16] We also explored the extent that children initially judged as exhibiting poor social skills were prone to losing more social skills between kindergarten and fifth grade, especially if they had high exposure to screens. We created interactions terms for both the ECLS-K:1998 and ECLS-K:2010 kindergarten social skill measures and levels of screen exposure, predicting fifth grade social skills. Although we find, as expected, a strong relationship between social skills at kindergarten and social skills at fifth grade, interacting social skill levels (at the bottom 10%, middle 80%, or top 10%) with various levels of screen exposure did not influence this relationship. We are grateful to a reviewer for this suggestion.

association with these alternative measures of well-being in the most rigorous models.[17]

DISCUSSION

Despite broad-based concerns about "kids these days," our results provide no evidence that American children's face-to-face social skills have been declining. Instead, they suggest that children and youth have been able to maintain similar levels of face-to-face social skills while simultaneously increasing their exposure to screen-based technology. The strength of our analysis is that it provides the first assessment of nationally representative samples of children across cohorts. And while the concept of "social skills" is especially challenging to operationalize, the combination of both teachers' and parents' reports we rely on are arguably among the best measures available. A strong test of the hypothesis requires comparing cohorts with good measures of social skills, and our study is the first to meet these criteria.

Why did children's face-to-face social skills not decline in the way most would have expected? The least controversial explanation may be that moral panic works. Concern over the consequences of digital technologies raised sufficient worry over the issue, reducing the tide of negative consequences that would have otherwise followed. But this argument implies that social skills operate in a zero-sum manner, that more screen time means fewer face-to-face interactions. We suspect that the effects of screen exposure are more multifaceted—in some ways reducing social skills while in other ways promoting them. Technology can facilitate greater opportunity for face-to-face interactions (e.g., using social media to arrange face-to-face meetings), and the interaction skills children are exposed to on screens may, at some level, transfer over to face-to-face interactions. In this way, an hour spent on the computer may not clearly be an hour away from social skill building in the way skeptics have described. Because the positive effects of new technologies are often underappreciated, they may appear more disruptive than they are. Rather than undermining existing social relations, screen-based technologies may be better understood as providing a new platform by which children seek autonomy from parents, develop group norms and sanction peers, build and maintain identities, and, in some ways, develop social skills.

[17] Measures for online video gaming and social networking are available for fifth graders only. We also explored associations between screen time (TV viewing, video game use) and social skills indicators (number of friends, how helpful child is if someone is hurt, upset, or feeling sick) in the Adolescent Brain Cognitive Development (ABCD) study of 11,878 children ages 9–11 collected at 21 research sites across the United States. Consistent with the patterns reported here, the ABCD data show no evidence that screen exposure is negatively associated with indicators of social skills. Future waves of the ABCD data will allow us to estimate more rigorous causal models.

It is also possible that children's face-to-face skills did not decline because some other societal changes countered the negative effects of screen exposure. Mother's and father's educations are positively associated with children's social skills, and both increased between 1998 and 2010. In addition, a wide range of parental investments increased between the two cohorts. These other trends could have offset any negative effect of increased screen time. However, even when we statistically adjust for these other changes across cohorts, we find no evidence that children's social skills declined.

But there is a more controversial possibility—perhaps social skills and screen time are just not strongly linked. It could simply be that children's social skills derive from more meaningful, enduring sources than screen exposure. Parent and peer socialization, cultural expectations, and even personality traits may all have a much more profound influence. And while children spend an increasing amount of time in front of screens, these new social patterns may be less consequential than previously thought. From this perspective, scholars may sometimes observe correlations between screen time and social skills because of selectivity issues—the kinds of kids who use technology at high levels are different from those who do not.[18]

Moving Forward

While our study takes the first step toward assessing whether social skills have been declining with national data across cohorts and reasonable measures of social skills, we recognize that the issue remains unsettled for several reasons. First, it is possible that social skills among American children really are declining but our indicators were unable to detect the change. This raises a complex question that we cannot fully resolve. Can we confidently compare levels of a subjective concept like "social skills" over time? We relied on teachers' and parents' evaluations, which are necessarily subjective. Teachers and parents were asked to determine whether a child exhibited a particular skill "never," "sometimes," "often," or "very often." Suppose a 1998 teacher rated a child as showing sensitivity to the feelings of others "very often" because the child exhibited this behavior twice a week, while a 2010 teacher rated a child as doing it "very often" after only observing the behavior once a week. If this were the case, the 2010 ratings could be artificially inflated despite actual declines in social skills.

One way to circumvent this challenge would be to focus on more objective indicators of social skills. For example, researchers could compare how frequently children maintain eye contact with each other or hit each other to determine whether these easily counted behaviors have changed over time.

[18] We note, however, that the selectivity of children who are exposed to screens is decreasing over time, and so this explanation will be less powerful explaining future correlations.

We see value in these kinds of indicators, and ideally, we would supplement our study of subjective measures with more objective ones. Unfortunately, there are limited opportunities to track objective indicators of social skills like these over time for American children.

Even if we were able to confidently track objective indicators of social skills, however, our understanding of how social skills have changed would be incomplete without the kinds of subjective evaluations we studied here. Social skills are inherently context dependent and therefore require intimate knowledge of the expectations for behavior in the context in which they occur. Counting how frequently children maintain eye contact with peers has merit, but a teacher or parent is better positioned to assess how that behavior matters for peer relationships. It would be difficult to assess whether social skills declined across cohorts with exclusively objective indicators.

Nevertheless, we cannot dismiss the possibility that increasingly lenient standards among teachers and parents may have obscured a real decline in social skills. Before giving this position too much weight, however, we should emphasize that it is mere conjecture—we have no greater reason to believe that evaluations became more lenient over time than to believe that they became less lenient. While it is important to remain open to this possibility of growing leniency in evaluations, we think it reasonable to require evidence of this position before privileging it, especially given lessons from the moral panic literature.

A second reason for caution is that our primary analysis—children entering kindergarten—does not capture the peak period of screen exposure, which will come later in life. Nevertheless, there are several advantages to studying young children. In the period between the two ECLS-K cohorts, computer usage increased the fastest among young children, and so this is precisely the group that should have exhibited the biggest change in social skills between cohorts. In addition, the fifth graders we analyzed are typically 11–12 years old, a point where about two out of three have cell phones and are engaged with social media. In addition, there is reason to believe that our results would be similar if we had studied older children. Using another data source, we were also able to consider how social skills changed over time, albeit in a more limited manner, for 13–14-year-olds born around 1974 and in eighth grade around 1988 (NELS:1988) compared with those born around 1993 and in eighth grade around 2007 (ECLS-K:1998; ECLS-K:2010 only extends to fifth grade). For both of these cohorts, teachers were asked, "Does [student] relate well to others?" and across both cohorts teachers responded affirmatively for 90% of their students. Of course, this is only a single indicator of social skills, but the stability in social skills over time is consistent with our observations among the younger children in the ECLS-K cohorts.

Third, our analyses were focused on one subset of children's social skills—their face-to-face interactions. Successfully negotiating the modern world

increasingly requires that children also learn digital skills—sending appropriate texts and e-mails, posting to social media in a constructive way—as they navigate both friendships and eventually professional careers. So, even if we had found a decline in children's face-to-face skills, it might not have indicated a decline in overall social skills, because digitally based social skills matter too, and these skills may have increased. Thus, while face-to-face interactions remain central, a comprehensive understanding of children's social skills acknowledges the emerging role of digital interactions.

Finally, we know little about what children do in front of the screens. Screen time surely has heterogeneous effects on children's development depending on the content and activity, but our data did not allow us to assess the kinds of websites children visited or the kinds of social media interactions they had. Furthermore, we do not know the quality of their digital access, such as broadband speed. Thus, the way children use digital technology may be as important as the degree of exposure, an issue deserving more attention in the literature (see also Coyne et al. 2020).

Overall, the current narrative about technology's damaging effects on social relationships prompts a wider range of questions. Has the expansion of cell phone usage and internet access undermined social cohesion while promoting greater polarization? These broader concerns overlap with those expressed by early sociologists who, witnessing massive industrial change, observed the negative consequences of the division of labor, such as social detachment and loss of meaning coupled with dramatic social and economic upheaval. Yet, we do not find an alarming impact of such change when it comes to digital technologies and social skills. Instead, we echo Fischer's (1975) unease that scholars often default to "deterministic" assumptions about the negative consequences of modernization. We recommend a more agnostic, evidence-based approach.[19]

Conclusion

Should parents and educators limit children's screen time? If their goal in doing so is to promote children's face-to-face social skills, we find little evidence that this would work in a meaningful way. If screen time were an important

[19] Our study also prompts questions about the consequences of the screen time debate—how something as important as social skills can be influenced not only by the consumers of technology but also by the producers of technology. For example, we find that excessive online videogaming is modestly associated with lower levels of social skills. As important as it may be to consider how children might regulate screen time (an individual-level approach), it is also important to question more structural factors, such as the nature and design of online videogaming, how data are shared, privacy issues, etc. So even if the impact of online videogaming is modest or counteracted by other potential benefits of screen time, larger questions still remain about structural issues that exist regardless of what we find here. We thank a reviewer for pointing out these issues.

detractor from face-to-face skills, we should have seen a decline between our two cohorts, given the rapid increase in screen exposure between 1998 and 2010, and we should have observed consistent declines among children with the most screen time (within cohorts). We did observe that children who spend the most time playing online games and on social networking sites (about the top quintile of users) experience the weakest growth in social skills between kindergarten and fifth grade. These negative associations with technology use were modest, however, and countered by positive associations between moderate texting, computer use, and social skills growth.

If children's social skills are not declining over time, how do we explain the growing concerns over children's exposure to new technologies? A compelling explanation comes from the moral panic literature—that new technologies challenge existing norms and relationships and so frequently produce anxiety among the general population about "kids these days." The concerns over screen exposure are not unlike those that occurred after the advent of other new technologies, like the telephone and car, which upended parent/child relationships and allowed youths considerably greater freedom. It may be that present-day fears over screen-based technology represent the most recent response to technological change. Cell phones and internet access provide children with new levels of autonomy that prompt parental concern. Under these circumstances, anecdotal evidence about the pernicious effects of technology tends to capture the public imagination and produce a critical narrative that may be especially appealing under conditions of rapid social change, urbanization, and diversification (Finkelhor 2010). Our study, however, suggests that these concerns do not match the patterns revealed by a more systematic analysis.

APPENDIX

TABLE A1

Reliability of Teacher- and Parent-Rated Social Skills across Waves, ECLS-K:1998 and ECLS-K:2010

	Kindergarten Fall		Kindergarten Spring		First Grade Spring		Second Grade Spring		Third Grade Spring		Fourth Grade Spring		Fifth Grade Spring	
	1998	2010	1999	2011	2000	2012	2001	2013	2002	2014	2003	2015	2004	2016
Interpersonal skills:														
Teachers were asked to assess children's ability to (*a*) form and maintain friendships; (*b*) get along with people who are different; (*c*) comfort or help other children; (*d*) express feelings, ideas, and opinions in a positive way; and (*e*) show sensitivity to the feelings of others	.89	.86	.89	.87	.89	.86		.86	.89	.86		.86	.88	
Parents were asked about children's interactions with peers and adults. The three items address children's ease in joining in play, ability to make and keep friends, and positively interacting (comforting, helping) with peers	.70	.68	.68	.67	.69	.69								

TABLE A1 (*Continued*)

	Kindergarten Fall		Kindergarten Spring		First Grade Spring		Second Grade Spring		Third Grade Spring		Fourth Grade Spring		Fifth Grade Spring	
	1998	2010	1999	2011	2000	2012	2001	2013	2002	2014	2003	2015	2004	2016
Self-control:														
Teachers rated the ability of the children to (*a*) control behavior by respecting the property rights of others, (*b*) control temper, (*c*) accept peer ideas for group activities, and (*d*) respond appropriately to pressure from peers	.79	.81	.80	.82	.80	.81		.81	.79	.80		.80	.79	
Parents rated five items that indicate children's ability to control their behavior. Measures include items that are worded positively as well as negative behaviors that are reverse coded (e.g., frequency with which a child fights, argues, throws tantrums, or gets angry).	.74	.73	.75	.73	.75	.73								

NOTE.—Measures of social skills are aggregated from several items resulting in an averaged 1–4 scale (1 = never to 4 = very often).

TABLE A2
DESCRIPTIVE STATISTICS, ECLS-K:1998 AND ECLS-K:2010

	Description	Metric	% Missing[a]	ECLS-K:1998	ECLS-K:2010	Source
SES[b]	Composite measure of parents education level, occupation prestige, and household income	Final measure is standardized	0	−.07 (2.83)	.03 (2.95)	Parent
Parental educational expectations	Parents were asked what degree they expected their child to obtain	1 = less than high school to 6 = PhD, MD, or other advanced degree; final measure is standardized	18	−.05 (2.86)	.08 (2.16)	Parent
Concerted cultivation total	Aggregate of measures below: parental involvement in schools, trips, extracurricular activities, and parental involvement at home collected across several waves	Aggregated from measures below; final measure is standardized	38	−.04 (2.71)	.05 (2.31)	Parent
Parental involvement in schools	Aggregate of parent volunteered at school, attended school event, attended PTA/PTO meeting, and attended back-to-school night	1 = yes and 0 = no; final measure is standardized	9	−.06 (3.02)	.09 (2.15)	Parent
Trips	Aggregate of child has attended a sporting event, a play/concert/show, a zoo/aquarium/farm, a gallery/museum/historical site, and library/bookstore	1 = yes and 0 = no; final measure is standardized	10	−.02 (2.53)	.02 (2.11)	Parent
Extracurricular activities	Aggregate of child participates in art programs, drama classes, athletic activities, organized clubs or recreational programs, art classes or lessons, and music lessons	1 = yes and 0 = no; final measure is standardized	13	−.03 (2.55)	.07 (2.47)	Parent
Parental involvement at home	Aggregate of how often parent and child build things, talk about nature, play games, do art, sing songs, tell stories, read books, and do chores	1 = not at all to 4 = everyday; final measure is standardized	32	.00 (2.36)	.00 (1.79)	Parent

TABLE A2 (*Continued*)

	Description	Metric	% Missing[a]	ECLS-K:1998	ECLS-K:2010	Source
Sibling size	Number of siblings in the household	Continuous measure from 0 to 4; more than four siblings coded 4	17	1.41 (2.47)	1.45 (2.03)	Parent
Parent age	Average of both parents (when applicable) in the household	Continuous measure of average parent age from 19 to 74 years of age	17	34.32 (16.66)	34.58 (13.65)	Parent
Both biological parents in home	Both biological parents reside in the household	1 = both biological parents in the household, 0 = other	. . .	.63 (1.07)	.69 (1.11)	Parent
Child disabled	Child has a disability diagnosed by a professional	1 = child has a disability, 0 = child does not have a disability	9	.16 (.78)	.20 (.57)	Parent
Age of assessment	Age of child at kindergarten fall when first assessed	Continuous measure of assessment age from 48 to 91 months of age	11	68.64 (12.18)	67.59 (10.30)	Parent
Child BMI	BMI measured from child weight and height; weight and height were measured twice and the average used for the composite value	Continuous measures of BMI from 7.5 to 49	0	16.46 (4.22)	16.64 (4.06)	Direct measure
Child health	Scale of child's health	1 = excellent to 4 = fair or poor	18	1.70 (1.81)	1.61 (1.80)	Parent
Birth weight	Weight of child at birth in pounds and ounces	Continuous measure of birth weight from 3 to 11 pounds	23	7.34 (2.97)	7.28 (2.35)	Parent
Race/ethnicity	Parent reported race of the child		. . .			Parent
White.				.57 (1.79)	.52 (1.93)	Parent
Black				.16 (.99)	.13 (1.38)	Parent

Hispanic				.19	.25	Parent
				(1.38)	(1.73)	
Asian				.03	.04	Parent
				(.24)	(.54)	
Islander				.01	.00	Parent
				(.24)	(.09)	
Native American				.02	.01	Parent
				(1.12)	(.55)	
Multiracial/ethnic				.02	.04	Parent
				(.28)	(.31)	
TV viewing	Aggregated measure of video gaming hours across waves. Hours per week were divided by 7 to create an hours-per-day measure. Assessed in the spring of kindergarten, first, second, and third grade in ECLS-K:1998 and ECLS-K:2010	Final measure converted into deciles and recoded into bottom 10%, middle 80%, and highest 10% of viewers	16			Parent
Lowest 10%				.10	.09	
				(.65)	(.49)	
Middle 80%				.79	.81	
				(.94)	(.53)	
Highest 10%				.11	.10	
				(.73)	(.55)	
Computer use	In an average week, how often the child uses the computer. Assessed in the spring of kindergarten, first, third, and fifth grade in ECLS-K:1998 and only in the spring of kindergarten in ECLS-K 10	0 = never to 4 = every day	8			Parent
Never				.18	.28	
				(1.28)	(.86)	
Once or twice a week				.42	.38	
				(1.04)	(.62)	
3–6 times a week				.35	.23	
				(1.18)	(.68)	
Every day				.05	.11	
				(.41)	(.37)	

TABLE A2 (*Continued*)

	Description	Metric	% Missing[a]	ECLS-K:1998	ECLS-K:2010	Source
Video game use	Aggregated measure of hours of video gaming across waves. Hours per week were divided by 7 to create an hours-per-day measure. Assessed in the spring of first, second, third, and fourth grade in ECLS-K:1998 and ECLS-K:2010.	Final measure converted into deciles and recoded into bottom 10%, middle 80%, and highest 10% of viewers	9			Parent
Lowest 10%				...	.08 (.38)	
Middle 80%				...	.83 (.51)	
Highest 10%				...	.10 (.49)	
Texting, messages, e-mail	How often child send texts, messages, or e-mails using an app, cell phone, computer, iPad or tablet, or other electronic device. Assessed in the spring of fifth grade	1 = never to 5 = many times a day	1			Child
Never				...	.21 (.67)	
Less than once a week				...	.14 (.40)	
A few times a week				...	.19 (.50)	
About once a day				...	.15 (.43)	
Many times a day				...	.31 (.90)	

Online gaming	How often child plays an online game against another online player using an app, cell phone, computer, iPad or tablet, or other electronic device. Assessed in the spring of fifth grade	1 = never to 5 = many times a day	1		Child
Never.				. . .	.33 (.64)
Less than once a week . . .				. . .	.16 (.48)
A few times a week. . . .				. . .	.18 (.52)
About once a day				. . .	.12 (.43)
Many times a day				. . .	.21 (.70)
Social networking	How often child uses a social networking site like Facebook, Twitter, Instagram, or Vine using an app, cell phone, computer, iPad or tablet, or other electronic device. Assessed in the spring of fifth grade	1 = never to 5 = many times a day	1		Child
Never.				. . .	.47 (.79)
Less than once a week . . .				. . .	.12 (.45)
A few times a week. . . .				. . .	.11 (.36)
About once a day				. . .	.11 (.36)
Many times a day				. . .	.19 (.63)

NOTE.—Results are weighted and imputed. SDs are calculated from multiple imputation mean estimates ($SE\sqrt{n}$) and reported in parentheses. ECLS-K:1998 N = 11,350; ECLS-K:2010 N = 5,950.

[a] Values are rounded. For example, "0" represents values above .0% but below .49%.

[b] SES measure was 2%–15% missing before NCES imputing using the hotdeck method.

TABLE A3
CORRELATION MATRIX OF TEACHER- AND PARENT-RATED SOCIAL SKILLS OF CHILDREN BY GRADE, ECLS-K:1998

	Teacher-Rated Social Skills Kindergarten Fall	Parent-Rated Social Skills Kindergarten Fall	Teacher-Rated Social Skills Kindergarten Spring	Parent-Rated Social Skills Kindergarten Spring	Teacher-Rated Social Skills First Grade Spring	Parent-Rated Social Skills First Grade Spring
Teacher-rated social skills, kindergarten fall	1					
Parent-rated social skills, kindergarten fall	.19	1				
Teacher-rated social skills, kindergarten spring	.66	.18	1			
Parent-rated social skills, kindergarten spring	.19	.59	.21	1		
Teacher-rated social skills, first grade spring	.41	.17	.46	.18	1	
Parent-rated social skills, first grade spring	.20	.54	.22	.57	.22	1

NOTE.—Results averaged across 20 imputed data sets.

TABLE A4
CORRELATION MATRIX OF TEACHER- AND PARENT-RATED SOCIAL SKILLS OF CHILDREN BY GRADE, ECLS-K:2010

	Teacher-Rated Social Skills Kindergarten Fall	Parent-Rated Social Skills Kindergarten Fall	Teacher-Rated Social Skills Kindergarten Spring	Parent-Rated Social Skills Kindergarten Spring	Teacher-Rated Social Skills First Grade Spring	Parent-Rated Social Skills First Grade Spring
Teacher-rated social skills, kindergarten fall	1					
Parent-rated social skills, kindergarten fall	.21	1				
Teacher-rated social skills, kindergarten spring	.68	.20	1			
Parent-rated social skills, kindergarten spring	.21	.65	.23	1		
Teacher-rated social skills, first grade spring	.44	.19	.50	.21	1	
Parent-rated social skills, first grade spring	.23	.58	.24	.62	.26	1

NOTE.—Results averaged across 20 imputed data sets.

TABLE A5

Children's Depression (Parent Rated) Regressed on Screen Time and Demographic Characteristics, First Graders in 2000 (ECLS-K:1998)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
TV viewing (ref = lowest 10%):						
Middle 80%	.06***	.05**	.04*	.05**	.04**	.03*
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
Highest 10%	.13***	.11***	.09***	.10***	.09***	.08**
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
Computer use (ref = never):						
Once or twice a week	−.03**	−.02	−.01	−.02*	−.01	.00
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
3–6 times a week	−.06***	−.04**	−.02	−.03*	−.02	.00
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Every day	−.06**	−.04	−.01	−.03	−.02	.00
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
Video game use (ref = lowest 10%):						
Middle 80%	. . .	. . .	. . .	. . .	. . .	. . .
Highest 10%	. . .	. . .	. . .	. . .	. . .	. . .
Constant	1.51***	1.37***	1.38***	.90***	.88***	.89***
	(.02)	(.09)	(.09)	(.03)	(.09)	(.09)
Prior social skills	No	No	No	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Mediators	No	No	Yes	No	No	Yes

Note.—TV viewing compiled from kindergarten and first grade; computer use, from kindergarten (spring) and first grade. Controls: sibling size, parent age (averaged), both biological parents in home, child disabled, age of assessment, child BMI, child health, birth weight, race/ethnicity, and sex. Mediators: SES, educational expectations, and concerted cultivation. Results are weighted and imputed. SEs are in parentheses.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

TABLE A6

CHILDREN'S DEPRESSION (Parent Rated) REGRESSED ON SCREEN TIME AND DEMOGRAPHIC CHARACTERISTICS, FIRST GRADERS IN 2012 (ECLS-K:2010)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
TV viewing (ref = lowest 10%):						
Middle 80%	.00	.00	−.01	−.01	.00	−.01
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
Highest 10%	.04	.04	.01	.02	.02	.00
	(.03)	(.03)	(.03)	(.02)	(.02)	(.02)
Computer use (ref = never):						
Once or twice a week	−.04**	−.04**	−.02	−.03**	−.03**	−.02*
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
3–6 times a week	−.04*	−.05**	−.03	−.03*	−.04*	−.02
	(.02)	(.02)	(.02)	(.01)	(.01)	(.01)
Every day	−.04*	−.04*	−.02	−.03	−.03	−.02
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
Video game use (ref = lowest 10%):						
Middle 80%	.01	.01	.01	.02	.01	.01
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
Highest 10%	.02	.02	.02	.01	.01	.01
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
Constant	1.47***	1.21***	1.23***	.82***	.73***	.75***
	(.02)	(.10)	(.10)	(.03)	(.10)	(.10)
Prior social skills	No	No	No	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes
Mediators	No	No	Yes	No	No	Yes

NOTE.—TV Viewing compiled from kindergarten and first grade; video game use, from first grade; and computer use, from kindergarten (spring). Controls: sibling size, parent age (averaged), both biological parents in home, child disabled, age of assessment, child BMI, child health, birth weight, race/ethnicity, and sex. Mediators: SES, educational expectations, and concerted cultivation. Results are weighted and imputed. SEs are in parentheses.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

TABLE A7
CHILDREN'S SELF-REPORTED RELATIONSHIPS IN THIRD GRADE REGRESSED ON SCREEN TIME AND DEMOGRAPHIC CHARACTERISTICS, ECLS-K:2010

	SELF-RATED FRIENDSHIP SCALE			I AM HAPPY WITH THE FRIENDS I HAVE			I AM HAPPY WITH ATTENTION FROM PARENTS		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
TV viewing (ref = lowest 10%):									
Middle 80%	−.14	−.01	.26	.00	.02	.05	−.03	.00	.05
	(.18)	(.17)	(.17)	(.03)	(.03)	(.03)	(.06)	(.06)	(.06)
Highest 10%	−.05	−.06	.40	−.07	−.03	.02	−.01	.00	.09
	(.25)	(.25)	(.24)	(.06)	(.06)	(.06)	(.09)	(.09)	(.09)
Computer use (ref = never):									
Once or twice a week	.33*	.15	−.04	.11***	.09**	.07*	.05	.02	−.02
	(.13)	(.13)	(.14)	(.03)	(.03)	(.03)	(.05)	(.05)	(.05)
3–6 times a week	.32	.13	−.13	.05	.03	.00	.05	.01	−.03
	(.17)	(.17)	(.18)	(.03)	(.04)	(.04)	(.05)	(.05)	(.05)
Every day	.17	.08	−.16	.09*	.07	.04	.13	.11	.06
	(.19)	(.19)	(.19)	(.04)	(.04)	(.04)	(.07)	(.07)	(.07)
Video game use (ref = lowest 10%):									
Middle 80%	.06	.07	.11	−.02	−.04	−.03	−.09	−.08	−.07
	(.23)	(.22)	(.22)	(.04)	(.04)	(.04)	(.07)	(.07)	(.07)

Highest 10%	−.08	.10	.20	−.04	−.03	−.02	−.12	−.05	−.04
	(.30)	(.30)	(.30)	(.05)	(.06)	(.06)	(.11)	(.10)	(.11)
Constant	17.15***	17.05***	16.62***	4.68***	4.53***	4.49***	4.25***	3.81***	3.74***
	(.26)	(1.20)	(1.17)	(.04)	(.19)	(.19)	(.08)	(.28)	(.28)
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Mediators	No	No	Yes	No	No	Yes	No	No	Yes

NOTE.—TV viewing compiled from kindergarten, first, second, and third grade; video game use, from first, second, and third grade; and computer use, from kindergarten (spring). For the self-rated friendship scale, children were given the following statements to rate: I have lots of friends, I make friends easily, I get along with kids easily, I am easy to like, other kids want me to be friends, and I have more friends than others. Questions were aggregated then standardized. The combined alpha was .777. Controls: sibling size, parent age (averaged), both biological parents in home, child disabled, age of assessment, child BMI, child health, birth weight, race/ethnicity, and sex. Mediators: SES, educational expectations, and concerted cultivation. Results are weighted and imputed. SEs are in parentheses.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

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