IT and communication technologies dominate adolescent downtime

By Sandra Bohmann and Jürgen Schupp

Today's teenagers spend their free time very differently than they did 15 years ago: engagement with IT and communications technologies is now their most significant leisure activity. Representative statistics based on data from the Socio-Economic Panel (SOEP) longitudinal study indicate that Internet and computer-based recreation plays a major role for more than 95 percent of all 17-year-olds in Germany, regardless of gender. Even though access to the Internet and computer-based technologies is now widespread across all social classes, usage patterns differ according to certain socio-demographic characteristics. While lower household income is associated with higher Internet activity, it is not a factor in social networking or gaming. The latter remains a male domain, but boys' and girls' Internet usage and social network engagement do not differ: here the type of high school plays a *determining* role. Students in academically oriented German high schools (Gymnasien) are more likely to be active on social media on a daily basis than are students in secondary schools (Realschulen and Hauptschulen), which are less academically oriented. Education policymakers have started acknowledging the pivotal role that technology plays in young people's lives and have announced a campaign targeted to adolescents of all social segments and at all types of high schools. It aims to strengthen students' command of technology while discussing the risks of digital communication, and investigate how education can leverage more of the new opportunities in digital media.

The importance of computer-based and Internet activities is growing

It is hard to miss the extent to which digitalization and technology in general permeate teenagers' lives in public spaces, schools, and the family. No other way of spending leisure time has experienced such a rapid dynamic development as electronic entertainment media – the Internet above all, followed by Internet-based chats, gaming, and engagement with social networks. Based on the SOEP data on teenagers for the period 2000–2014, the report at hand demonstrates the extent to which technological progress has changed everyday life for teenagers. It also looks at how structural differences in the use of modern information and communication technologies have emerged and the way their use has changed over time.

Computer-based and Internet leisure activities are at the top with teenagers

Almost all of the 17-year-olds who were surveyed between 2012 and 2014 stated that they engaged in at least one IT-related leisure activity on a daily or weekly basis (Figure 1). At the beginning of the 2000s, slightly more than half of the 17-year-olds gave this answer. A close-up view of the IT-related activities with which teens spend their leisure time shows that the explosive increase in this leisure area is based on the increased use of the Internet for surfing and chatting, and engagement with social networks. On the other hand, the proportion of those who play computer games at least once a week has remained relatively steady at approximately 50 percent of teenagers since the early 2000s. It has even dropped slightly of late.

The trend presented above is primarily driven by the fact that more and more young people spend time with IT- and communication-based leisure activities on a daily basis. This underlines the predominantly high everyday relevance of computer and Internet technology. Fifteen years ago, less than 30 percent of young people spent time with computers on a daily basis. Of the respondents who were surveyed between 2012 and 2014, 85 per-

Box 1

Baseline data

The baseline data are provided by the Socio-Economic Panel (SOEP) [1] and its survey of young people in particular. For the longitudinal study, DIW has commissioned KANTAR Public (formerly TNS Infratest Sozialforschung) to survey an annual representative sample of households in Germany. Currently, over 20,000 persons in over 11,000 households are participating in the survey.

Data on 17-year-olds

Since 2000, 17-year-olds have received annual questionnaires requesting information on their leisure activities and use of information and communication technologies. Overall, 6,081 of the 17-year-olds born in the period 1984–2014 completed the in the year when they turned 17. Around 5,930 of them provided information on how they spend their downtime. This report uses all the available years in order to map trends over time. For this purpose, several birth years have been combined into cohorts (Table 1). Extrapolation factors make it possible to weight the data to make them representative, which allows for generalizing upon the information the young people from each birth year give to the interviewers.

Table 1

Pooling of cohorts by birthcohorts and survey-years

	Survey years			
	Cohort 1	Cohort 2	Cohort 3	Cohort 4
Birthcohorts	2001–2003	2004–2007	2008–2011	2012–2014
Cohort 1: 1984 to 1986	1,027			
Cohort 2: 1987 to 1990		1,386		
Cohort 3: 1991 to 1995			1,434	
Cohort 4: 1995 to 1997				1,673

Source: SOEP v.31, 17-year-olds.

Pooling cohorts allows investigating time-trends while keeping enough observations for statistical inference.

1 For information on the SOEP, see Gert G. Wagner et al.: The German Socio-Economic Panel Study (SOEP) – Scope, Evolution and Enhancements. Schmollers Jahrbuch 127 (1) (2007), 161–191.

cent said they spent time on the computer or Internet every day. While television dominated teenagers' daily leisure activities for years,they have now come to prefer engaging in social networks or surfing and chatting online as ways of spending their downtime. Watching television is a leisure time activity that is increasingly done weekly rather than daily.[1]

The data captured in the SOEP only provide information on the portion of daily use, but the most recent German Federal Statistical Office time use survey, which was conducted in 2012 and 2013, provides more precise data on the amount of time spent with IT-related activities per day. A comparison with data from the previous time use survey from 2001/2002 (Table 1) shows that not only the portion of children and teenagers who spend their free time with IT and communication technologies has increased, but the length of time they spend with the technologies every day has also risen.

The average time spent with these technologies has increased by approximately 30 minutes since the last survey in 2001/2002 and now stands at around four hours for boys and three hours for girls,[2] The time-use survey also confirms that other media, such as television, are used less often than they used to be.

Classic leisure activities down for the first time

Since the first survey of teenagers in the SOEP[3] in 2000, their participation in athletic, musical, and cultural activities has risen continuously. The most recent cohort, whose data were captured 2012–2014, shows a slight drop in the participation in classic leisure activities, but the level is still much higher than what was observed at

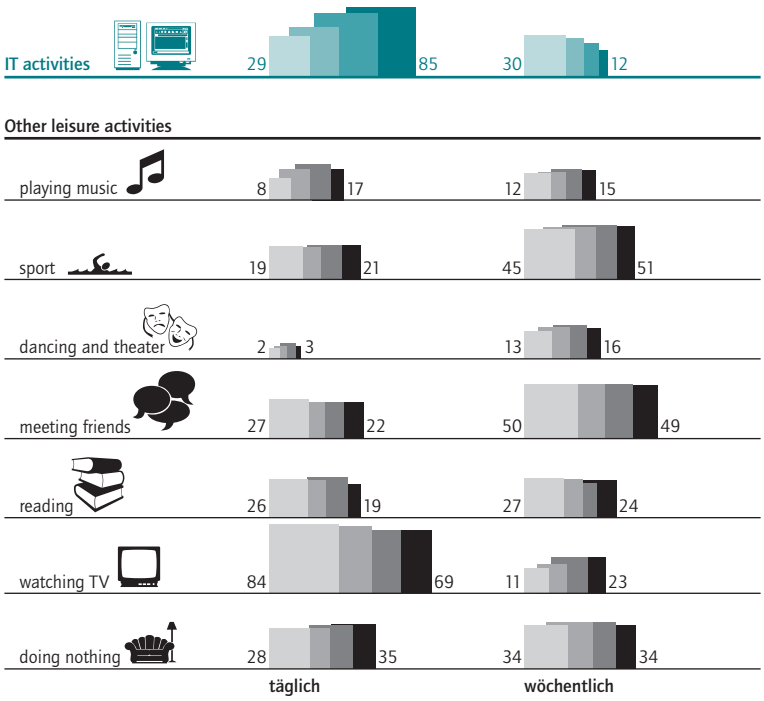
1 The SOEP data do not permit any statements about the extent to which teenagers have replaced "classical television" with watching television shows on the Internet.

2 However, when comparing this to the information in the SOEP, always consider that the age group in the time use study inherently has a greater age variation among ten- to 17-year-olds.

3 See Adrian Hille, Annegret Arnold and Jürgen Schupp, "Freizeitverhalten Jugendlicher: Bildungsorientierte Aktivitäten spielen eine immer größere Rolle," *DIW Wochenbericht* Nr. 40 (2013): 15–25.

Figure 1

Share of 17-year-olds who practice the listed leisure activities on a daily (left) or weekly (right) basis
Results by cohorts, in percentages



Results are presented separately for four cohorts surveyed in 2001–2003 (years of birth 1984–1986), 2004–2007 (years of birth 1987–1989), 2007–2010 (years of birth 1990–1993) und 2011–2014 (years of birth 1994–1997).

1 consists of different survey questions: frequency of surfing and chatting on the Internet (for 2006-2013), other surfing on the Internet (since 2014)
2 (since 2013).

Source: SOEP v.31, 17-year-olds, weighted, calculations by DIW Berlin.

Classical hobbies such as sports, music and dancing appear to suffer slightly from the dominance of IT-related leisure activities.

the very beginning of the survey. The portion of 17-year-olds who played music rose from about one-fifth in the period 2001–2003 to almost one-third from 2012 to 2014. Young people's athletic activity has also increased: now almost three out of four teenagers play sports at least once a week.[4]

Of course the analyses presented here do not permit any inferences as to whether this trend is related to the increase in Internet-based leisure activities. However, since the portion of young people who said the time they spend "just hanging out" every day has also gone up in tandem with musical and athletic activities, further analyses are needed to determine exactly which changes underlie the phenomenon of "teenage overload."[5]

Fewer and fewer teenagers read in their downtime

The SOEP data also indicate that fewer and fewer teenagers read when they have free time. Reading on both a daily and weekly basis decreased during the survey period. Fifty-three percent of the 17-year-olds in the oldest cohort, born between 1984 and 1986. read at least once a week. In the 1995–97 birth cohort the percentage dropped to 43 percent. It is entirely possible that today's teenagers read more online, but the simultaneous growth in the portion of those who said they never read indicates that overall, fewer young people are reading. The data in the time use survey, which also covers reading on electronic media, confirm the decline in the rate of reading. They also show that the young people who did read in 2012 and 2013 spent on average one hour a day reading – the same amount of time reported ten years ago.

Personal social contact in leisure time trending downward

Since the beginning of the survey, the portion of teenagers who meet friends (or their best friend) on a daily, or at least weekly, basis has slightly fallen. From 2001–2003, this was still a daily leisure activity for 27 percent (39 percent) of 17-year-olds. In the period 2012–2014, it was still the case for only 22 percent (26 percent).

However, one cannot conclude that the increasing digitalization of leisure time goes hand in hand with social isolation. After all, three-quarters of the latest cohort said they chatted, surfed the Internet, and engaged in social networks every day. This suggests that young people now interact with each other more via the Internet. It remains unclear however whether the social networks are really used for interaction or solely for the purpose of user-oriented self-presentation. Even if teenagers are in contact with each other more frequently via the Internet, the nature and quality of these screen-mediated relationships might differ rather dramatically from the kind of relationships that develop in personal interac-

4 Charlotte Cabane, Adrian Hille and Michael Lechner, "Mozart or Pelé? The effects of adolescents' participation in music and sports," *Labour Economics* 41 (2016): 90–103.

5 See Nils Minkmar, "Die Überforderung der Kindheit," *Frankfurter Allgemeine Zeitung*, July 10, 2013.

Table 1

Average time-use of 10- to 17-year-olds for selected leisure activities, per day
Results by sex, comparison between 2001/2002 and 2012/2013

	Male						Female					
	All		Practicing		Participation rate		All		Practicing		Participation rate	
	2001/2002	2012/2013	2001/2002	2012/2013	2001/2002	2012/2013	2001/2002	2012/2013	2001/2002	2012/2013	2001/2002	2012/2013
	hh : mm				Percent		hh : mm				Percent	
PC und smartphone use	**01:12**	**01:26**	**04:07**	**04:31**	**29,1**	**31,7**	**00:33**	**00:47**	**03:07**	**03:21**	**17,6**	**23,4**
Playing computer games	0:56	0:58	2:06	2:17	44,4	42,5	0:16	0:15	1:18	1:20	20,0	18,5
Computer and smartphone	0:13	0:24	1:38	1:38	13,3	24,8	0:09	0:25	1:12	1:21	12,8	30,1
Amongst these:												
Information purposes	0:05	0:08	1:29	1:22	6,1	9,4	0:04	0:08	1:03	1:13	6,0	10,7
Communication purposes	(0:01)	0:06	(1:08)	1:15	(1,2)	8,5	(0:01)	0:08	(0:40)	1:04	(3,0)	12,4
Phone calls[1] and text messages	0:03	0:04	0:23	0:36	12,7	11,2	0:08	0:07	0:37	0:40	22,5	17,8
Reading (including reading on electronic devices)	**0:20**	**0:16**	**1:01**	**1:04**	**32,4**	**25,9**	**0:28**	**0:26**	**1:06**	**1:12**	**42,9**	**35,6**
Use of other media (TV, video, DVD, radio, music)	**02:08**	**01:51**	**03:23**	**03:15**	**63,1**	**56,9**	**02:08**	**01:46**	**03:18**	**03:07**	**64,6**	**56,7**
Amongst these:												
watching TV, videos and DVDs	1:58	1:42	2:30	2:17	78,3	73,9	1:54	1:36	2:23	2:11	79,7	73,3
listening to music and radio	0:10	0:09	0:53	0:58	18,2	15,2	0:14	0:10	0:55	0:56	24,7	17,8
Sports and physical activities	**0:47**	**0:44**	**2:04**	**2:04**	**37,7**	**35,8**	**0:33**	**0:29**	**1:43**	**1:46**	**31,7**	**26,9**
Conversations	**0:23**	**0:26**	**0:55**	**0:58**	**41,4**	**45,5**	**0:34**	**0:37**	**1:05**	**1:06**	**52,5**	**55,6**
Volunteering	**(0:03)**	**(0:03)**	**(2:25)**	**(2:17)**	**(1,9)**	**(2,4)**	**(0:03)**	**(0:03)**	**(2:10)**	**(2:03)**	**(2,0)**	**(2,3)**

The table is based upon a large time-use study and indicates the time young people aged ten to 17 spend on average per day with the respective leisure activities in Germany, separately for both sexes. The first column (all) provides total averages for the respective activity, while the second column (practicing) shows the average amount of time spent with the respective activity per day by those who actually practice it. The third column (participation rate) indicates the share of girls and boys that practice that activitiy.

1 Phone calls include also calls via landline.

() = restricted validity due to small number of diary entries (50 to under 200 entries)

Source: Zeitverwendungserhebung 2012/2013 Statistisches Bundesamt Wiesbaden, Tabellenwerk (Tabelle 9.8), https://www.destatis.de/DE/Publikationen/Thematisch/EinkommenKonsumLebensbedingungen/Zeitbudgeterhebung/Zeitverwendung5639102139005.xlsx.

10- to 17-year-olds spend more and more time with PCs and smartphones while the use of other media declines.

tion.[6] As the portion of young people who said that they never met up with friends has remained constant under two percent throughout the entire period of observation, there is no indication for the assumption that new technologies have completely superseded social contact.[7]

The digital divide in use persists

Until 15 years ago the digital divide, in the sense of "inequality in access to private computers and the Internet," was the focus of the debate on structural differences in the use of modern information and communication technologies. At the beginning of the 2000s, adults and teenagers with lower household income and a low level of education owned their own computers and Internet access less frequently than others.[8] But the digital divide

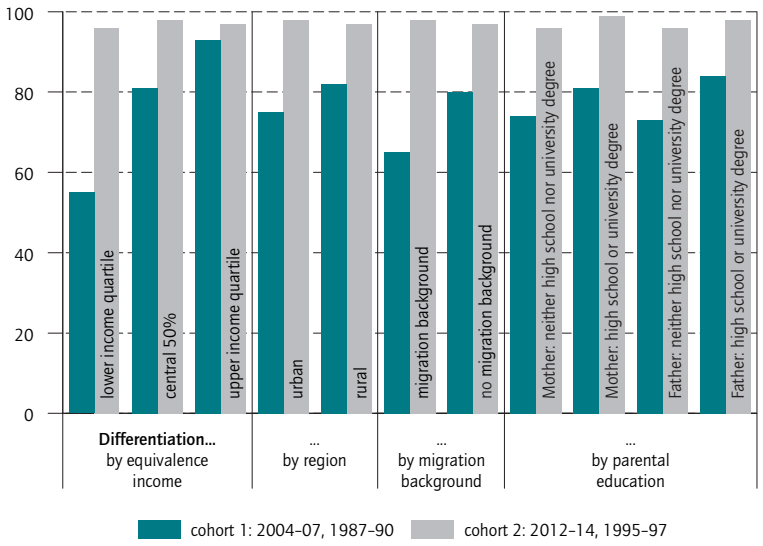
6 For a critical discussion of the effects of screen-mediated social interaction on social relationships, see Chapter III.2 in Hartmut Rosa, *Resonanz: Eine Soziologie der Weltbeziehung*, Berlin: Suhrkamp Verlag, 2016.

7 A SOEP study did not find evidence for teenagers in Germany without access to the Internet immediately after German Reunification having more social contacts than others. See Stefan Bauernschuster, Oliver Falck and Ludger Woessmann, "Surfing alone? The internet and social capital: Evidence from an unforeseeable technological mistake," *Journal of Public Economics* 117(C) (2011): 73–89.

8 See John P. Haisken-DeNew, Rainer Pischner and Gert G. Wagner, "Computer- und Internetnutzung hängen stark von Einkommen und Bildung ab: Geschlechtsspezifische Nutzungsunterschiede in der Freizeit besonders ausgeprägt," *DIW Wochenbericht Nr.* 67 (2000): 670–75 and John P. Haisken-DeNew,

Figure 2

Share of 17-year-olds with internet access at home
Results in percentages



Digital divide then and now: comparing Internet access at home for the second cohort (surveyed 2004–2007, years of birth 1987–1990) and the last cohort (surveyed 2012–2014, years of birth 1995–1997), (data for the first cohort not available).

Source: SOEP v.31, 17-year-olds, weighted, calculations by DIW Berlin.

Over the last ten years, the digital divide has almost been overcome.

as a gap in access, – at least as far as teenagers are concerned–has been largely closed in the past two decades and is no longer relevant.

Statistically significant differences by household income, parental educational level, and immigrant background that could still be observed in the second cohort are barely perceptible in the latest cohort (Figure 2). Almost all teenagers today have domestic Internet access. However, in the latest cohort of 17-year-olds, surveyed from 2012 to 2014, a slightly greater number of young people from lower-income households lacked access to the Internet than those from the three upper income quartiles.[9] Young people whose mothers graduated from high school or university have a particularly high rate of access. The 2015 *Shell Jugendstudie*, a longitudinal survey of German teenagers initiated in 1953,[10] showed that social background remains statistically significant when not only access to the Internet but also the number of means to access the Internet are observed. The more affluent children and teenagers are, the more means to access the Internet are available to them. Even if a divide in access continues to exist on a very high level, the digital divide in form of an access divide is in general considered to be overcome.[11]

In recent years, the debate focused on "digital inequality instead." Digital inequality describes the phenomenon in which the frequency and purpose of digital media use, as well as the type of skills users acquire in the process, vary systematically across demographic groups. As early as ten years ago, the SOEP data for adults showed that computer and Internet use varied strongly with the level of education.[12]

Taking the portion of teenagers who engage daily in at least one IT-related leisure activity[13] differentiated according to socio-demographic characteristics, and comparing them across cohorts shows that structural differences in use have changed significantly in the past two decades (Table 2).

Gender makes no difference when it comes to using the Internet

While boys still spend a much larger portion of their leisure time on IT-related activities in the oldest and second-oldest cohorts studied here, the gender difference in daily use of information and communication technologies is no longer statistically significant in the latest cohort. This is primarily because girls and boys surf the Internet, chat, and engage in social networks with equal frequency. As for computer games, the boys have the lead (see Box 2). This finding is particularly relevant

Rainer Pischner and Gert G. Wagner, "Private Internet-Nutzung: Bildung und Einkommen auch bei Jugendlichen von großer Bedeutung, " *DIW Wochenbericht* Nr. 68 (2001): 619-23.

9 To create income quartiles, equivalent incomes have to be calculated first. This is done by calculating the total household income and adjusting it for household structure, using a needs scale that takes the number of persons living in the household and their ages into consideration. This creates a basis of comparison for the income situations of households of varying sizes and compositions. Next, the households are assigned to one of four quartiles according to their equivalent incomes (top quartile with the highest equivalent income, the two middle quartiles – which we combined to create a "central middle" here, and the lowest income quartile with the lowest equivalent incomes).

10 Shell, *Jugend 2015: 17th Shell Jugendstudie*, Berlin: S. Fischer Verlag, 2015.

11 See Nadia Kutscher and Hans-Uwe Otto, "Digitale Ungleichheit - Implikationen für die Betrachtung digitaler Jugendkulturen," in: Kai-Uwe Hugger, *Digitale Jugendkulturen*, Wiesbaden: VS Verlag für Sozialwissenschaften, (2010): 73–87, and Chapter 5 in Nicole Zillien, *Digitale Ungleichheit – Neue Technologien und alte Ungleichheiten in der Informations- und Wissensgesellschaft*, Wiesbaden: VS Verlag für Sozialwissenschaften, 2009.

12 Adults with higher levels of education adopted new technologies faster and used them for educational and informational purposes rather than as leisure activities. See Sylvia E. Korupp, Harald Künemund and Jürgen Schupp,"Digitale Spaltung in Deutschland: geringere Bildung – seltener am PC, " *DIW Wochenbericht* Nr. 73 (2006): 289–94.

13 Gaming, surfing the Internet, chatting, and engaging in social networks are some of the IT-related leisure activities measured here. However, some of these activities were not part of the survey until later survey years. Also see the footnote to Table 2.

Table 2

Share of young people who practice at least one IT-related activity a day, sorted according to social origin and birthyears

In percent

Survey years	2000–2003[a]			2004–2007[b]			2012–2014[c]		
Birthyears	1984–1986			1987–1990			1994–1997		
	%	N	sign	%	N	sign	%	N	sign
Total	29	990		43	1,358		85	1,655	
Sex									
Girls	8	504	***	25	671	***	84	840	
Boys	48	486		59	687		86	815	
Parent education									
Mother has neither high school nor university degree	28	709		41	934	*	86	1,004	
Mother has high school or university degree	30	281		46	424		83	651	
Father has neither high school nor university degree	30	648		43	848		87	870	*
Father has high school or university degree	26	342		42	510		83	785	
School type									
Secondary school (Hauptschule/Realschule)	27	320		43	448		86	457	***
Vocational school (Berufsschule)	27	206		39	230		78	270	
High school (Gymnasium)	30	333		44	518		88	664	***
Equivalence income									
Lower income quartile	21	239	**	39	314		86	353	
Central mean	30	500	***	43	632	*	88	813	*
Upper income quartile	36	251	*	46	412		81	489	***
Migration background									
Migration background	23	209	**	40	284		85	444	
No migration background	31	781		43	1074		85	1,208	

Shows the share of young people who practice at least one IT-related leisure activity a day, respectively for the first cohort (birthyears 1984-1986), the second cohort (birthyears 1987-1990) und the last cohort (birthyears 1994-1997).

The survey was conducted on the following IT-activities:
a computer games, technical work and programming
b computer games, technical work and programming, surfing the Internet and chatting
c computer games, technical work and programming, surfing the Internet and chatting (2012 and 2013); surfing on social networks (from 2013 onwards) , other Internet surfing (from 2014 onwards)
Cohort 3 is not indicated separately because the activities surveyed were the same as for cohort 2.

*Significance: * p<0.10; ** p<0.05; *** p<0.01 (p-values in brackets)*

SOEP v.31, 17-year-olds; weighted, calculations by DIW Berlin.

There is almost no difference anymore between boys and girls.

because the desire to learn a profession in the IT sector correlates with the frequency of playing computer games but not with the frequency of other Internet-based leisure activities.

What counts is how affluent the parents are

The relationship between household income and the use of modern media has also undergone a marked change. In the older cohorts, the portion of young people who engaged in computer- and Internet-related leisure activities every day rose with household income. However, in the most recent cohorts, the highest participation rate is situated in the middle of the income distribution. In addition, significantly fewer teenagers from the top income quartile in the latest cohort said they spent their downtime with new media every day in comparison to the teenagers in the lower three quartiles. At the beginning of the 2000s, the lower level of participation of the teenagers in lower-income households was probably primarily due to financial constraints: in general, lower-income households were slower to adopt modern technologies.[14] In the higher-income households

14 John P. Haisken-DeNew et al., *DIW Wochenbericht* 67 (2000), Ibid. It should also be kept in mind that many computer games went hand in hand with relatively rigorous hardware and software requirements at the beginning of the 2000s. Gaming as a hobby could quickly become rather expensive. Whereas many of the computer (or smartphone) activities surveyed in the more recent cohorts, such as chatting and engaging in social networks, can be pursued with almost any end device.

Box 2

Excessive computer and online use as a means of stress reduction

Command of modern information and communication media is an essential prerequisite for social participation and professional success today. Various studies have confirmed the multiple positive consequences of reasonable use[1]. Excessive use of these technologies may nevertheless affect people's lives negatively. In addition to the sheer physical symptoms that result from long periods of screen-time, scientific studies have found correlations between excessive computer/Internet use and poor concentration, lower school-related motivation, poor grades, higher levels of aggression, and riskier behavior in general.[2] Potential negative consequences of the dominance of digital media in the everyday life of children and teenagers are also a topic of public discussion.[3] Warnings about the effects of excessive use of computers, the Internet, and smartphones on the brain, physical and mental health, and social relationships are myriad.[4] How to define appropriate, excessive, and problematic use is, however, still part of the academic debate.[5] The absolute duration of use does not determine whether a case of use behavior is problematic or not. Instead, criteria borrowed from the definitions of pathological gambling or substance dependence are used, for example: whether the use behavior can still be controlled, the existence of withdrawal symptoms, and the extent to which the use behavior has a negative impact on other areas of life.[6] Varying definitions and instruments of measuring problematic usage pattern often yield very different results. In an international study conducted in 2014, for example, 0.9 percent of German teenagers exhibited explicit addiction

1 See Mario Fiorini, "The effect of home computer use on children's cognitive and non-cognitive skills," *Economics of Education Review* 29(1) (2010): 55–72 or Kevin Durkin and Bonnie Barber, "Not so doomed: Computer game play and positive adolescent development," *Journal of Applied Developmental Psychology* 23(4) (2002): 373–92.

2 Leslie M. Alexander and Candace Currie, "Young people's computer use: implications for health education," *Health Education* 104(4) (2004): 254–61; Teena Willoughby, "A short-term longitudinal study of Internet and computer game use by adolescent boys and girls: prevalence, frequency of use, and psychosocial predictors," *Developmental Psychology* 44(1) (2008): 195; Valerie Carson, William Pickett and Ian Janssen, "Screen time and risk behaviors in 10- to 16-year-old Canadian youth," *Preventive Medicine* 52(2) (2011): 99–103 and Michael Dreier, Klaus Wölfling and Klaus Beutel, "Internetsucht bei Jugendlichen," *Monatsschrift Kinderheilkunde* 162nd year, 6 (2014): 496–502.

3 See "Wie viel Smartphone ist gut für Kinder?" *Focus* title story, September 3, 2016.

4 See Manfred Spitzer, *Cyberkrank! Wie das digitalisierte Leben unsere Gesundheit ruiniert*, Munich: Droemer Knaur (2015) and Manfred Spitzer, *Digitale Demenz. Wie wir uns und unsere Kinder um den Verstand bringen*, Munich: Droemer Knaur (2012).

5 To date, Internet/computer addiction has not been included in the latest version of the American Psychiatric Society's *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5). However, the "Internet gaming disorder [IGD]" has been accepted into the "Emerging Measures and Models" section in which disorder symptoms that have not been adequately researched are listed until they can be officially accepted as part of the manual. See Mark D.Griffiths, Daniel Luke King and Zsolt Demetrovics, "DSM-5 internet gaming disorder needs a unified approach to assessment," *Neuropsychiatry* 4th year, 1 (2014): 1–4.

6 Currently, there are at least 18 different measurement methods for and definitions of pathological Internet and gaming behavior. Some scientists have used the criteria for pathological gambling while other authors use the criteria that the DSM defines for addiction to psychotropic substances. For a brief overview and detailed information on the relevant literature, see Sabine Meixner, "Exzessive Internetnutzung im Jugendalter," *Kinder und Jugendschutz in Wissenschaft und Praxis*, 55th year, 1 (2010): 3–7.

of today, teenagers' lower level of participation is more likely due to the fact that they have especially high rates of participation in more structured and education-oriented leisure activities They simply have less time to surf, chat, and engage every day.[15] In a slightly different form, the results of the latest *Shell Jugendstudie* confirm this assertion. While 26 percent of young people in the two lower income quartiles indicated that they do not have time for other things due to their Internet activities, only ten percent of the young people in the upper two income quartiles agreed with the statement. Another indication for the hypothesis that parents in households with a higher socio-economic status make sure that young people do not spend too much time with new media, or that the young people themselves have internalized such thinking, is that young people whose parents graduated from high school or university also have lower daily participation levels in Internet surfing and computer games. Yet looking at the young people's own education, it appears that the ones who attend academically oriented high schools have the highest participation levels. As expected, fewer young people already taking part in vocational training programs (and therefore with less free time) are online on a daily basis than other high school students. There were no perceivable differences in overall use between the young people with and without an immigrant background.

15 Adrian Hille et al., (2013), Ibid. Another study in England was unable to find a causal relationship between access to the Internet and communication technologies at home and school performance, see Benjamin Faber, Rosa Sanchis-Guarner and Felix Weinhardt, "ICT and Education: Evidence from Student Home Addresses," *NBER Working Paper* 21306 (2015).

traits and ten percent were classified as being "at risk."[7] Another representative German study from 2013 came to the conclusion that 12.5 percent of the 14- to 17-year-olds surveyed exhibited pathological Internet behavior.[8] For effective and efficient prevention, it is important to know which children and young people are especially at risk of developing an excessive or pathological pattern of Internet and computer use. Various studies have shown that psycho-emotional stress – such as a troublesome family atmosphere[9] – is one of the key risk factors and that excessive, pathological Internet and computer use often serve as (inadequate) stress reduction strategies.[10] We used the SOEP data to check the extent to which daily use of the Internet and computers depends on emotional and social stress factors. For this purpose, the probability of engaging in specific IT-related leisure activities on a daily basis was estimated as a function of symptoms and causes of psychosocial stress (Table 3). Three SOEP questions asking the young people to indicate how often they felt sad, angry or anxious in the past four weeks were used as an instrument for measuring socioemotional stress.[11] We further controlled for level of satisfaction with grades and frequency of fighting with parents in order to directly test two possible causes of psychosocial stress.

The SOEP data confirm that teenagers who responded that they are often or very often sad, worried, or angry have a 20 percent higher likelihood of surfing and chatting on the Internet every day than those who are less often angry, worried, and sad. The likelihood of them pursuing any IT-related leisure activity is 12.5 percent higher. Contrary to expectations, the likelihood of playing computer games every day is not linked to emotional stress factors.

Young people who often or very often fight with at least one parent exhibit an eight percent higher probability of pursuing an IT-related leisure activity every day. Low satisfaction with grades is also linked to a significantly higher probability of engaging with social networks on a daily basis.

Overall, the SOEP data confirm that there is a positive relationship between psycho-emotional stress factors and the probability of pursuing IT-related leisure activities on a daily basis. What the data do not explain is why certain forms of digital media use are linked to certain stress factors but not others. These questions are left open for in-depth qualitative and quantitative studies in the future.

7 Michael Dreier et al., Ibid.

8 Moritz Rosenkranz et al., "Risikofaktoren für Probleme mit exzessiver Computer-und Internetnutzung von 14-bis 17-jährigen Jugendlichen in Deutschland: Ergebnisse einer deutschlandweiten Repräsentativerhebung," *Diskurs Kindheits-und Jugendforschung* 8(1) (2913).

9 For Germany, see Moritz Rosenkranz et al. (2013), Ibid and a further study for Taiwan: Ju-Yu Yen et al., "Family factors of internet addiction and substance use experience in Taiwanese adolescents," *CyberPsychology & Behavior* 10(3) (2007): 323–29.

10 Sabine Grüsser et al., "Exzessive Computernutzung im Kindesalter: Ergebnisse einer psychometrischen Erhebung," *Wiener klinische Wochenschrift – The Central European Journal of Medicine* 117(5–6) (2005): 188–95.

11 See footnote to Table 3.

Who engages in which IT-related leisure activities depends on a variety of socio-demographic traits

Alongside the temporal changes in the use structure of digital media over time, the SOEP data allow for a glimpse at the structural differences in use content (Table 3).

Since the relationship to some of the demographic characteristics has markedly changed over time, the multivariate analysis was restricted to the most recent cohorts of 17-year-olds born from 1994–1997. We examined the probability of engaging in a specific IT-related leisure activity on a daily basis, depending on membership in certain socio-demographic groups.

Teenagers from affluent households invest less leisure time in IT-based activities

The multivariate analyses confirmed the negative relationship between household income and engaging in IT-based leisure activities. Teenagers in households in the upper income segment have a probability of engaging in any IT-based leisure activity on a daily basis that is nine percent lower than that of teenagers from middle-income families. Their likelihood of being active in social networks on a daily basis is even 15 percent lower. With regard to surfing and chatting, the children of high earners are not different from those in the middle-income segment. However, young people in the lowest income quartile have a 15 percent lower probability of surfing and chatting on the Internet than the reference group from middle-income households.

Table 3

Relevance of different socio-demographic characteristics for the probability to practice specific IT activities on a daily basis

	Probability of daily practice of ...			
	At least one of the following IT-activities	Playing computer games	Surfing on the internet	Being active on social networks
Male	0.024 (0.509)	0.257*** (0.000)	−0.013 (0.781)	0.034 (0.607)
Lowest income quartile (reference category: central 50 percent)	−0.034 (0.464)	0.086 (0.277)	−0.146* (0.066)	0.021 (0.801)
Highest income quartile (reference category: central 50 percent)	−0.089* (0.083)	0.012 (0.818)	−0.071 (0.230)	−0.147* (0.065)
Mother's education in years	−0.005 (0.579)	0.015 (0.176)	−0.002 (0.885)	−0.007 (0.624)
Migration background (dummy)	−0.002 (0.964)	−0.090* (0.093)	−0.015 (0.773)	−0.097 (0.202)
Vocational training (reference category: Real- or Hauptschule)	−0.096 (0.275)	−0.037 (0.606)	−0.091 (0.266)	−0.099 (0.340)
Gymnasium (reference category: Real- or Hauptschule)	0.091* (0.082)	−0.086 (0.129)	0.036 (0.550)	0.235*** (0.005)
Reading (at least weekly)	−0.077** (0.043)	0.002 (0.968)	−0.098** (0.036)	−0.063 (0.367)
Meeting friends (at least weekly)	−0.037 (0.454)	−0.057 (0.441)	−0.012 (0.856)	−0.130 (0.200)
Emotional and psychological strain[1]	0.125* (0.062)	0.086 (0.415)	0.203*** (0.010)	0.228* (0.075)
Fighting with mother and father (frequently and very frequently)	0.083* (0.057)	0.023 (0.653)	0.069 (0.196)	0.042 (0.586)
Low satisfaction with school grades (3 and less on a scale from 0–10)	−0.029 (0.738)	−0.010 (0.912)	0.044 (0.724)	0.234* (0.063)
Observations	803	801	802	541

The coefficients of the logistic regression analysis above show changes in the probability of conducting the respective IT-related activities given a change in the respective predictor variable if all other predictor variables are held constant at their mean.

1 A person is assumed to experience emotional and psychological strain if at least two out of the three following criteria apply: often or very often felt a) sad, b) worried or c) angry in the four weeks before the survey.

*significance: * p<0.10; ** p<0.05; *** p<0.01 (p-values in brackets)*

Source: SOEP v.31, 17-year-olds, weighted, calculations by DIW Berlin.

Young people aiming at a high school degree or those who are not satisfied with their school grades have a higher probability to be active on social networks.

Teenagers with an immigrant background do not differ from those without an immigration background concerning their Internet activities and engaging in social networks, but they show a lower probability of gaming on a daily basis.

And teenagers who attend academically oriented high schools continue to be much more likely to engage in social networks than those who attend secondary schools.

Teenagers who read regularly spend less time online; social contacts do not influence online activity

Whether or not young people meet friends at least once a week has no influence on their daily activities in social networks or surfing and chatting online. However, young people who reported reading on a weekly or daily basis had a ten percent lower likelihood of surfing and chatting online on a daily basis. Equally the likelihood of pursuing an IT-related activity during their daily downtime was lower for young people who read regularly.

Conclusion and outlook

In the past two decades, the digital divide manifested as a social Internet access gap and has almost completely closed – at least for teenagers. Digital media's increasing availability, portability, and interconnection have established these technologies as young people's most frequently used leisure activity. Although the majority of socio-demographic differences in the use of total IT-related leisure activity have disappeared, there is a new digital divide along socio-demographic traits concerning the specific purpose for which the new media is used. For example, young people from the lower income quartile surf and chat online less frequently than those from households in the middle-income segment. Teenagers who attend secondary schools engage in social networks much less frequently than those who attend academically oriented high schools.

Participation in social discourse not only requires access to Internet-based medial content, but also the ability to encounter it critically.

Educational policy and policymakers in general are reacting slowly to many of these trends. On the one hand, there is a large gap between young people's media presence in their leisure time – and the IT skills they acquire in the process of using it – and the use of digital media in schools. On the other hand, schools should function as the place where young people discuss and learn to use new media responsibly. Training teenagers on how to use the new media– which now dominate their downtime activities – in a responsible and powerful way, and formulating educational goals has become a key pedagogical task for educators. Educational policymakers have finally recognized that they must react to the ongoing technological and media-related changes in the living environment of our youth. A recently announced government program[16] aims to strengthen young people's command of technology and the risks associated with digital communication and learning with the new opportunities digital media offer. The German government plans to make €5 billion available for digital tools in schools in the next five years. Merely expanding digital technology in schools will probably not be enough. As the government is well aware, the key is teaching young people how to use digital media as a new primary cultural technology.[17]

16 https://www.bmbf.de/de/sprung-nach-vorn-in-der-digitalen-bildung-3430.html

17 See German Bundestag, "Technikfolgenabschätzung (TA) Digitale Medien in der Bildung. Bericht des Ausschusses für Bildung, Forschung und Technikfolgenabschätzung," Bundestagsdrucksache 18/9606 (2016): 10.

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