Associations of Different Media Activities With Behavioral Strengths and Difficulties and School Performance in Adolescents: a Cross-Sectional Analysis

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Abstract

Background: This study investigates the times adolescents engage in different media activities (including entertaining and educational activities) and explores associations with behavioral strengths and difficulties and school grades.

Methods: This cross-sectional study included 664 10- to 18-year-old adolescents (350 boys, 314 girls) participating in the LIFE Child study in Germany. Participants completed questionnaires on their media use, on strengths and difficulties (using the Strengths and Difficulties Questionnaire), and on their school grades in mathematics and first language. Associations of the times engaged in different media activities via mobile phone or computer (traditional communication, social media use, gaming, playing learning games, watching videos, and searching for information) with behavioral strengths/difficulties and school grades were assessed using linear regression analyses (adjusting for age, gender, and socioeconomic status).

Results: With the exception of playing learning games, each media activity was followed for almost one hour per day, with high inter-relations between the single activities. Gaming, watching videos, social networking, traditional communication, and playing learning games were significantly associated with more behavioral difficulties in at least one domain (emotional problems, conduct problems, hyperactivity/inattention, peer-relationship problems, prosocial behavior) and with lower school grades. Searching for information showed the weakest associations with behavioral difficulties and no association with school grades. In a multivariate analysis, searching for information was associated with fewer behavioral difficulties.

Conclusions: Using media to search for information might weaken the adverse effects of other media activities on school performance and behavioral adjustment.

Background

Electronic media, especially mobile phones, play an increasingly important role in the lives of today's youth [1]. This development is alarming given the quantity of studies showing negative associations between intensive media usage and various aspects of mental and physical health [2] or academic achievement [3, 4]. It is still unclear how these associations might be explained. One hypothesis is that intensive media use displaces other activities, e.g., physical activity [1], social interactions [5], or doing homework [6], and that the lack of these activities promote behavioral difficulties and problems in school. Another possible explanation is that children with health problems, behavioral difficulties or low academic achievement are particularly interested in media or use media as means of coping, i.e., to relax or to escape from everyday problems [7]. Also, specific personality traits might promote both higher media usage and psychopathology, e.g., low self esteem [8, 9].

It is important to further investigate why and under what conditions media use could promote behavioral problems. Apart from individual vulnerabilities or resilience factors, the specific media activities adolescents engage in (e.g., use for entertaining versus educational purposes) may also be relevant. It is, therefore, important to distinguish between different media activities and to investigate their independent associations with behavioral adjustment.

Gaming, social networking, and watching videos represent the most common media activities of German adolescents [10], indicating that adolescents use electronic media mainly for the purpose of entertainment. Excessive gaming has been reported to be associated with externalizing and internalizing problems [5, 11], lower social competence [12], and poorer academic performance [12–14]. Playing violent video games, in particular, could be linked to aggressive behavior, lower amounts of prosocial behavior [15–17] and poorer school performance [13]. At the same time, some studies underline the cognitive, emotional, and social benefits of video games [18], especially of learning, challenging and prosocial games [19, 20]. These investigations stress the importance to distinguish different types of video games.

With respect to the use of social networking sites, previous studies showed associations with more psychological distress and poorer mental health [21, 22], especially more internalizing behavioral problems and depressive symptoms [23, 24]. However, some studies also observed associations with externalizing problems and violence [25, 26]. Furthermore, social networking has been shown to be related to poorer academic performance [27–29]. It is suggested that the associations between social networking and psychopathology can be mediated by the experience of cyberbullying [30] and the fear of missing out, i.e., the worry of missing relevant information or interactions if not permanently connected [31].

For watching videos, previous studies mainly investigated the TV use of children and adolescents and revealed associations with more behavioral difficulties [32, 33] and poorer academic performance [6, 13, 34]. Far less is known on watching videos online. The effects of these types of video watching might differ from television watching as videos on the internet (e.g., on YouTube [35]) focus on other contents, are usually shorter, and may include additional features such as social networking.

Whereas the media activities gaming, social networking, and watching TV/videos and their associations with health and academic performance have been investigated in several studies, other media activities such as searching for information/doing homework or traditional ways of communication (e.g., telephone calling, mailing) are understudied. Furthermore, studies exploring different – academic as well as entertaining – media activities in the same study are rare [36, 37]. A very recent study showed that the use of social media for the purpose of searching for information was not associated with negative mental health outcomes, whereas social media use for other purposes was [37]. This finding suggests that searching for information is a media activity whose effects on behavioral adjustment differ from effects of other media activities.

The aim of the present study was to investigate the popularity of several media activities (playing (video) games, playing learning games, social networking, watching videos, traditional communication (telephone calling, mailing), and searching for information) pursued via mobile phone or computer. Furthermore, we assessed associations of the time spent with each of these media activities with behavioral strengths and difficulties and school grades in mathematics and German (first language). Based on previous study findings, we expected associations of gaming, video watching, and social networking with externalizing as well as internalizing problem behavior and poorer school performance. Regarding the more academic media activities (use of learning games and searching for information), we expected no or negative associations with behavioral difficulties and no or positive associations with school performance.

Methods

Participants

Data were collected between July 2017 and January 2020 in the LIFE Child Study Center in Leipzig, Germany. The LIFE Child study is a cohort study aiming to monitor child development from pregnancy to early adulthood [38]. Participants are mainly recruited via advertisements at different institutions, e.g., schools or Health Centers. All children and adolescents interested in the study and not suffering from chronic or syndromal diseases are allowed to participate.

For the present project, only cross-sectional analyses were performed. In the case that children had participated at more than one time point during the period of data acquisition (n = 332), only data collected at the last study visit were considered. The final sample comprised 664 adolescents (350 boys and 314 girls) aged between 10 and 18 years (M = 14.00, SD = 2.13).

The LIFE Child study was designed in accordance with the Declaration of Helsinki, and the study protocol was approved by the Ethics Committee of the Medical Faculty of the University of Leipzig (Reg. No. 264/10-ek). All parents provided informed written consent before participation of their children. From the age of 12 years on, children also gave informed written consent.

Measurements

Data on mobile phone and computer use, behavioral strengths/difficulties and school grades were assessed using questionnaires completed by the adolescents themselves. Their parents provided information on socioeconomic status (SES).

Media use: The media questionnaire used here was designed in 2017 by researchers of the LIFE Child study and was already used in another study project [39]. The English version of the questionnaire is shown in Additional file 1. The questionnaire assesses the use of different media devices, namely TV, games console, computers (including personal computers, tablets, laptops), and mobile phones (including smartphones and other mobile phones). As the activities a device might be used for were assessed for computer and mobile phone use only, the present analyses focus on the use of these media devices. A first block of questions assessed the time spent with each device. Separate questions were asked for the use on weekends and weekdays and for online and offline use of either mobile phone or computer. The following response categories could be chosen: never, 30 minutes, 1-2 hours, 3-4 hours, more than 4 hours. A second block of questions assessed the specific activities mobile phones or computers might be used for. Children indicated how often (in relation to the total time spent with the device (computer or mobile phone)) they usually spend time with each of the following activities: a) gaming (excluding learning games), b) playing learning games, c) searching for information, d) social media use, e) traditional communication, and f) watching videos. Tradition communication included telephone calling or writing text messages (via mobile phone se) or mailing (via computer). Response categories were never, sometimes, and often.

Behavioral strengths and difficulties: Behavioral strengths and difficulties of the participants were assessed using the German version of the Strength and Difficulties Questionnaire (SDQ) [40]. This screening instrument consists of five scales, each represented by five items. Four of these scales assess behavioral difficulties (emotional problems, conduct problems, symptoms of hyperactivity/inattention, peer-relationship problems).

One scale assesses the strength prosocial behavior. The score in each scale ranges between 0 and 10, with higher scores indicating more behavioral difficulties/strengths.

School grades: Participants reported on their school grades in mathematics and German (first language) as documented on the most recent school record. In Germany, school grades range from 1 to 6, with a lower number indicating better performance (1 = "very good", 2 = "good", 3 = "satisfactory", 4 = "sufficient", 5 = "deficient", 6 = "insufficient").

SES: The SES of all study participants was assessed by a composite score (Winkler index). This score combines information on parental education, parental occupation, and the household equivalent income [41]. It ranges between 3 and 21, with higher scores indicating higher SES. In a large representative German sample [41], cut-offs were created to distinguish low (lowest 20%), middle (middle 60%), and high SES families (highest 20%) based on the score. These cut-offs were used to categorize the SES of participating families accordingly.

Data analysis

All analyses were performed using R [42]. In order to better evaluate the duration of participants' computer and mobile phone use, response categories of the corresponding questions were transformed into durations (never = 0, 30 minutes = 0.5, 1-2 hours = 1.5, 3-4 hours = 3.5, more than 4 hours = 5), and offline and online use were summed up. Furthermore, usage times on weekends and weekdays were averaged ((usage on weekdays*5 + usage on weekends*2)/7).

To estimate the time spent with the different media activities, information on the total duration of mobile phone or computer use and the frequency of media activities were combined. The scores for the frequencies of the single media activities were assigned weights ("never" = 0, "sometimes" = 1, "often" = 2) and the estimated time per activity was calculated as follows: Total mobile phone (or computer) usage time*weight for the specific activity/sum of all weights per child. Finally, the durations of the single media activities via mobile phone and computer were summed up (e.g., social media use = social media use via mobile phone + social media use via computer).

Interrelations between the different media activities were assessed using Spearman correlation coefficients. Associations of the different media activities with behavioral strengths and difficulties were investigated using linear regression analyses. The scores on the different scales of the SDQ or school grades were included as dependent variables, and the durations of the different media activities were included as independent variables. In a first step, separate analyses, i.e., one model per media activity, were performed. In a second step, all activities were included in one model. All associations were indicated by non-standardized regression coefficients. Age, gender, and SES (low versus middle versus high) were included as control variables in all models.

Results

Data description

The distribution of SES in the present sample showed an overrepresentation of adolescents from the high SES (34%) and an underrepresentation of adolescents from low SES families (10%). Table 1 displays the media use, behavioral strengths and difficulties and school grades of the participants. On average, the participating adolescents spent nearly 2 hours per day using a computer and nearly 3 hours per day using a mobile phone. While boys used computers more often than girls, girls spent more time using mobile phones than boys. Figure 1 illustrates the average times girls and boys engaged in the different media activities. The most popular media activity was watching videos, with an average daily usage of more than 1 hour. Learning games were played very rarely, with most children reporting not using learning games at all (Median = 0). Boys played games more frequently than girls, whereas all other media activities were slightly more popular with girls than boys.

Table 1
Means (and SD) for media usage times, behavioral strengths and difficulties, and school grades in the study sample.

	Total sample N = 664	Boys N = 350	Girls N = 314
Daily media usage times (in hours)			
Total mobile phone and computer usage	4.49 (3.05)	4.55 (3.18)	4.63 (2.91)
Computer usage	1.81 (1.93)	2.05 (2.09)	1.55 (1.71)
Mobile phone usage	2.77 (1.96)	2.50 (1.95)	3.08 (1.93)
Behavioral strengths/ difficulties			
Emotional problems	2.35 (2.21)	1.61 (1.74)	3.18 (2.38)
Conduct problems	1.66 (1.39)	1.79 (1.49)	1.50 (1.25)
Hyperactivity/Inattention	3.54 (2.12)	3.61 (2.23)	3.47 (1.99)
Peer-relationship problems	2.18 (1.70)	2.08 (1.67)	2.28 (1.73)
Prosocial behavior	7.86 (1.72)	7.54 (1.78)	8.22 (1.59)
School grades			
Grade in mathematics	2.68 (0.95)	2.72 (0.96)	2.64 (0.95)
Grade in German (first language)	2.38 (0.79)	2.58 (0.78)	2.16 (0.75)
Note. According to the German school system, school grades range from 1 (best) to 6 (worst).			

Interrelations between different types of intensive mobile phone or computer use

The correlations between the durations of the different media activities are displayed in Table 2. As can be seen, gaming, searching for information, social networking, traditional communication, and watching videos were strongly interrelated, with social networking and gaming showing the strongest associations (rho = .61, *p* < .001). In contrast, playing learning games showed only a weak, though significant, correlation with searching

for information (rho = .09, p = .027). The correlations between playing learning games and other media activities were not significant.

Table 2
Interrelations (indicated by spearman correlation coefficients) between the daily durations of different media activities.

	2	3	4	5	6
1 Gaming	.05	.33***	.35***	.25***	.43***
2 Learning games		.09*	− .03	.02	.02
3 Searching information			.51***	.43***	.57***
4 Social networking				.57***	.61***
5 Traditional communication					.43***
6 Watching videos					
* $p < .05$, *** $p < .001$.					

Associations of total mobile phone and computer usage with behavioral strengths and difficulties and school grades

The analyses revealed significant associations between longer total mobile phone and computer durations and more emotional problems ($b = .09$, $p < .001$), more conduct problems ($b = .09$, $p < .001$), more symptoms of hyperactivity/inattention ($b = .10$, $p < .001$), more peer-relationship problems ($b = .09$, $p < .001$), and less prosocial behavior ($b = − .08$, $p < .001$). Furthermore, longer media usage durations showed significant associations with poorer school grades in mathematics ($b = .05$, $p < .001$) and German ($b = .04$, $p < .001$).

Associations between the durations of different media activities and behavioral strengths and difficulties

The associations between different types of media usage and behavioral strengths and difficulties are presented in Table 3. In the non-adjusted models (i.e., when the durations of the different media activities were included in separate models), each media activity showed significant associations with more behavioral difficulties in at least one domain (emotional, conduct, hyperactivity/inattention, peer-relationship, prosocial). Watching videos showed the strongest associations with all behavioral difficulties. For example, for children spending 5 hours per day playing video games, the average score in the hyperactivity/inattention scale was estimated 4.9, compared to 3.2 in children playing no video games. In contrast, searching for information and playing learning games were significantly associated with only two types of behavioral difficulties.

Table 3

Associations (indicated by non-standardized regression coefficients (+ 95% CI)) between the durations of different media activities and behavioral strengths and difficulties.

	Emotional problems		Conduct problems		Hyperactivity/ inattention		Peer-relation problems		Prosocial behavior	
	Not adjusted[a]	Adjusted[b]	Not adjusted[a]	Adjusted[b]	Not adjusted[a]	Adjusted[b]	Not adjusted[a]	Adjusted[b]	Not adjusted[a]	Adjusted[b]
Gaming	.16 (-.01 .34)	.05 (-.16 − .25)	.20*** (.08 − .31)	.08 (-.05 − .21)	.29** (.11 − .47)	.18 (.03 − .39)	.25** (.10 − .39)	.16 (-.01 − .32)	− .29*** (-.44 to − .15)	− .23** (-.39 to − .07)
Learning games	.65** (.22− 1.08)	.52* (.08 − .97)	.30* (.02 − .59)	.24 (-.05 − .53)	.19 (-.26 − .64)	.13 (-.33 − .58)	.15 (-.20 − .51)	.02 (-.35 − .39)	− .16 (-.51 − .20)	− .12 (-.48 − .25)
Searching information	.26* (.03 − .48)	.05 (-.22 − .31)	.11 (-.03 − .26)	− .17* (-.34 to − .01)	.03 (-.20 − .26)	− .36** (-.63 to − .09)	.23* (.04 − .41)	.05 (-.17 − .27)	− .05 (-.23 − .13)	.25* (.03 − .46)
Social networking	.17 (-.03 − .38)	− .07 (-.33 − .20)	.32*** (.19 − .46)	.18* (.01 − .35)	.27* (.06 − .48)	.01 (-.27 − .28)	.17* (.01 − .34)	− .07 (-.29 − .15)	− .22** (-.39 to − .06)	− .04 (-.26 − .18)
Traditional communic	.36* (.08 − .65)	.24 (-.10 − .57)	.46*** (.27 − .65)	.29** (.07 − .50)	.41** (.12 − .71)	.27 (-.07 − .61)	.26* (.02 − .49)	.12 (-.15 − .40)	− .26* (-.49 to − .02)	− .10 (-.37 − .18)
Watching videos	.24** (.07 − .40)	.16 (-.06 − .37)	.22*** (.11 − .33)	.10 (-.04 − .24)	.35*** (.18 − .52)	.34** (12. − .56)	.24*** (.11 − .38)	.17 (-.01 − .34)	− .27*** (-.40 to -13)	− .22* (-.39 to − .04)

[a] Adjusted for age, gender, and SES. [b] Adjusted for age, gender, SES, and the durations of the other media activities.

*$p < .05$, ** $p < .01$, *** $p < .001$.

In the adjusted models (i.e., when the durations of the different media activities were included in the same model), gaming (excluding learning games) was significantly associated with less prosocial behavior ($b = − .23$, $p = .006$), and playing learning games was significantly associated with more emotional problems ($b = .52$, $p = .022$). Using social networking sites and traditional communication were significantly related to more conduct problems ($b = .18$, $p = .041$; and $b = .29$, $p = .009$, respectively), and watching videos showed significant associations with more symptoms of hyperactivity/inattention ($b = .34$, $p = .002$) and less prosocial behavior ($b = − .22$, $p = .014$). Regarding the media activity searching for information, the analyses revealed significant associations with fewer conduct problems ($b = − .17$, $p = .048$) and fewer symptoms of hyperactivity/inattention ($b = − .36$, $p = .009$). For children spending 3 hours searching for information, the scores on the hyperactivity/inattention scale was estimated 2.8, compared to 3.9 for children not using computer/mobile phone for searching for information. These findings indicate that the associations between the other media activities and these behavioral difficulties were significantly weakened if media were at least partly used for the purpose of searching for information. Furthermore, searching for information was significantly related to more prosocial behavior ($b = .25$, $p = .025$).

Associations between the duration of different media activities and school grades

The associations between the different types of media usage and school grades are presented in Table 4. In the non-adjusted models, each media activity (except searching for information) was associated with poorer performance in at least one school subject (mathematics and/or German). Only searching for information was not significantly associated with school grades. In the adjusted models, only two associations reached significance. Traditional communication was significantly associated with poorer performance in mathematics ($b = .17$, $p = .022$). Furthermore, the analyses revealed a significant association between gaming and poorer performance in first language ($b = .09$, $p = .017$). For children playing video games for 5 hours per day, the

average school grade in the first language was estimated 2.8 (satisfactory), compared to 2.3 (good) in children playing no video games. All other associations did not reach significance.

Table 4

Associations (indicated by non-standardized regression coefficients (+ 95% CI)) between the durations of different media activities and school grades

	Mathematics		First language	
	Not adjusted[a]	Adjusted[b]	Not adjusted[a]	Adjusted[b]
Gaming	.08* (.01 − .16)	.01 (-.07 − .10)	.12*** (.06 − .18)	.09* (.02 − .16)
Learning games	.16 (-.04 − .35)	.13 (-.07 − .32)	.17* (.01 − .32)	.14 (-.02 − .31)
Searching information	.05 (-.05 − .15)	− .09 (-.21 − .03)	.07 (-.01 − .15)	− .04 (-.14 − .06)
Social networking	.18*** (.10 − .27)	.12 (-.01 − .23)	.14*** (.07 − .22)	.09 (-.01 − .19)
Traditional communication	.26*** (.13 − .39)	.17* (.03 − .23)	.16** (.06 − .27)	.07 (-.05 − .19)
Watching videos	.11** (.03 − .18)	.04 (-.05 − .14)	.08* (.02 − .14)	− .01 (-.08 − .07)
Note. According to the German school system, school grades range from 1 (best) to 6 (worst).				
[a] Adjusted for age, gender, and SES. [b] Adjusted for age, gender, SES, and the durations of the other media activities.				
*p < .05, ** p < .01, *** p < .001.				

Discussion

Media usage in the present sample

The average daily media usage times observed in the present sample (nearly 2 hours computer usage, nearly 3 hours mobile phone usage) underline the importance of electronic media, especially the mobile phone, in the lives of today's youth. Gaming (excluding learning games), social media use, watching videos, and searching for information were the media activities engaged in most frequently. These observations are in line with findings of a representative German survey on the media and internet usage of 12- to 19-year-old adolescents [10]. Traditional communication, in contrast, was observed less frequently, and the frequency of playing learning games was negligible. Our analyses show that all media activities (with the exception of playing learning games) were strongly interrelated, indicating that adolescents engage in several media activities with comparable intensity.

Associations between media usage and behavioral strengths and difficulties

The present findings indicate a relation between longer mobile phone/computer usage times and behavioral difficulties. These results are in line with several previous cross-sectional [43, 44] and longitudinal studies [45]. A possible explanation is that media usage displaces other, more physical [1] or social activities [5]. At the same time, children suffering from behavioral difficulties might use electronic media to relax or to escape from everyday worries [7]. The association might also be explained by third factors that underlie both media use and behavioral difficulties, e.g., a low self-esteem [8, 9].

Regarding the single media activities, the analyses suggest that gaming (excluding learning games), social networking, traditional communication, and watching videos show the strongest associations with behavioral difficulties. Even independently of each another, each of these media activities showed significant (though only weak) associations with behavioral difficulties in at least one domain. Social networking and traditional communication, the two activities that might be subsumed under the term "communication", showed associations with conduct problems. This finding is surprising given that previous studies suggest associations with internalizing rather than externalizing behavior [24]. A possible explanation is that

adolescents with conduct problems might show aggressive behavior not only in real but also in online social interactions, e.g., via cyberbullying [26].

The media activities gaming and watching videos were associated with less prosocial behavior and, in the case of watching videos, more symptoms of hyperactivity/inattention. One explanation is that lower social competence contributes to a higher engagement in these media activities [12]. The associations with less prosocial behavior might, furthermore, be explained by the content of video games or videos. Several studies showed associations between violent media contents and more aggressive and less prosocial behavior [15–17]. However, as we did not assess the specific contents of videos or video games, this explanation is speculative. The association between watching videos and symptoms of hyperactivity/inattention might be explained by the fast pace of online videos. Fast-paced and highly stimulating media might increase general arousal and favor an attentional style of scanning and shifting, which may hinder sustained attention and impulse control [36].

With respect to learning games, the hypothesis of no or negative associations with behavioral difficulties could not be confirmed. Even after adjustment for other, more popular, media activities, playing learning games was significantly associated with more emotional problems. However, it is important to consider the very low popularity of learning games in the present sample. Possible associations with behavioral difficulties might be further investigated in studies focusing on specific populations, i.e., on children playing learning games more frequently than the participants in our study.

Regarding the media activity searching for information, our analyses suggest that this activity can weaken the associations between other media activities and behavioral difficulties, especially externalizing behavioral problems and less prosocial behavior. This is in line with findings of another recent study showing that social media use for the purpose of searching for information is not associated with any negative outcomes [37]. One possible explanation is that using media for academic purposes such as doing homework is beneficial for their behavioral adjustment. On the other hand, the finding might indicate that children showing an especially prosocial behavior and only few signs of externalizing problem behavior use mobile phones and computer not only for entertainment but also for academic purposes.

Associations between media usage and school grades

As already observed in other studies [3, 4], our analyses showed significant associations between longer mobile phone/computer usage times and poorer performance in mathematics and first language. A possible explanation is that media use displaces more academic activities such as reading or doing homework [6]. On the other hand, adolescents having trouble at school might use media to escape from these worries [12].

Regarding the single media activities, all activities except searching for information were associated with poorer performance in at least one school subject (mathematics and/or first language). However, in the multivariate analysis, only the association between traditional communication and school performance in mathematics and the association between gaming and school performance in first language remained significant. Additionally, the associations were rather weak. These findings suggest that the negative associations between media use and school performance are mainly due to the engagement in entertaining and social media activities. Searching for information was the only media activity not related to school

performance. However, it showed no beneficial effect on school performance, probably because searching for information may not only include school-relevant behavior (e.g., doing homework), but also school-irrelevant behavior, e.g., reading magazines online.

Strengths and limitations

To the best of our knowledge, the present study is the first to investigate associations between different media activities (including understudied activities such as searching for information) and behavioral difficulties and school performance in a large sample of adolescents. However, a lack of representativeness (e.g., over-representation of high SES families and of children growing up in an urban area) might limit the generalizability of the study findings. Also, the cross-sectional design of the study does not allow for causal inferences. Finally, even if the study distinguished between different media activities, a more detailed differentiation (e.g., regarding different types of videos or games) would have reinforced the insights.

Conclusion

Gaming (excluding learning games), social media use, searching for information, and watching videos are the media activities engaged in most frequently by adolescents. Most importantly, the present findings suggest that gaming, communication (traditional as well as via social media), and watching videos are associated with more behavioral difficulties and poorer school performance. Searching for information, in contrast, was shown to weaken the associations between the engagement in these media activities and behavioral difficulties. These findings suggest that it might be beneficial to use media not only for entertainment but also for more academic purposes.

List Of Abbreviations

SDQ
Strengths and Difficulties Questionnaire
SES
Socioeconomic status

Declarations

Ethics approval and consent to participate

Informed written consent was provided by all parents before the inclusion of their children in the study. The study was conducted in accordance with the Declaration of Helsinki. The study protocol was approved by the Ethics Committee of the Medical Faculty of the University of Leipzig (Reg. No. 264/10-ek).

Consent for publication

Not applicable

Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available due to ethical restrictions. The LIFE Child study is a study collecting potentially sensitive information. Publishing data sets is not covered by the informed consent provided by the study participants. Furthermore, the data protection concept of LIFE requests that all (external as well as internal) researchers interested in accessing data sign a project agreement. Researchers that are interested in accessing and analyzing data collected in the LIFE Child study may contact the data use and access committee (dm@life.uni-leipzig.de).

Authors' contributions

TP performed the measurements, analyzed and interpreted the data and wrote the article. CM supported the statistical data analysis, created the graphics, and critically reviewed the manuscript. NG was responsible for data collection and critically reviewed the manuscript. WK supervised the project and critically reviewed the manuscript. All authors read and approved the final manuscript.

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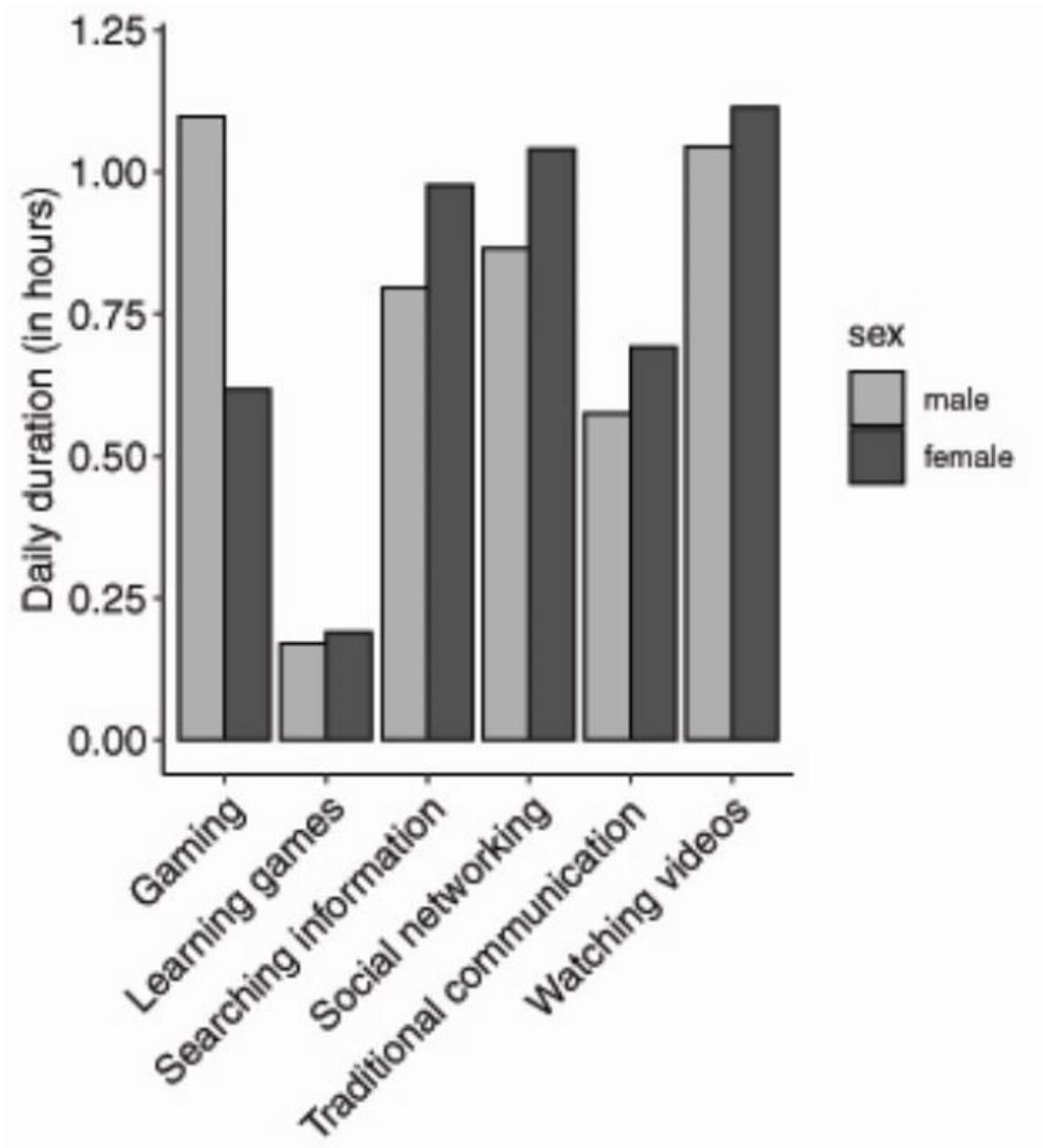
Figures

Figure 1

Daily durations of different media activities (via mobile phone and/or computer) for boys and girls.

Supplementary Files

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