

How are Czech adolescents using their phones? Analysis using objective smartphone data



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More Information About the Project

<https://irtis.muni.cz/research/projects/future>

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Introduction

Nowadays, most Czech children and adolescents have their own smartphones. In a recent representative survey by the Institute of Sociology of the Academy of Sciences, only 5% of Czech adolescents reported that they do not spend their free time on a mobile phone, computer, or tablet on a weekday (Patočková et al., 2022). In addition, Czech adolescents use mobile phones more often than computers to connect to the internet: 84% of Czech adolescents reported that they use a phone to connect to the internet at least once a day, while only 45% of adolescents use a computer to connect to the internet on a daily basis (Bedrošová et al., 2018). This raises the question that many parents also ask: What do adolescents do on their phones?

Research on mobile phone usage is currently based primarily on the estimates of usage by users themselves (self-report). However, studies have pointed out that users' estimates of their use of communication technologies are biased (De Reuver & Bouwman, 2015). This includes adolescents (Verbeij et al., 2021). The literature provides several reasons why the estimates are biased. One is the respondents' perceptions of

how much time spent using media is still acceptable. The other is which apps should or should not be used, which could be reflected in the estimate. In addition, researchers most often ask users to estimate their phone usage on a typical day, which is often difficult to quantify because the phone is usually used multiple times a day for short periods of time, making it difficult to accurately estimate the total time spent on specific mobile activities (Verbeij et al., 2021). Therefore, to get an idea of how much time adolescents spend using smartphones and what they do on them, we should not rely solely on estimates by the users themselves.

We developed a mobile application that 201 adolescents, aged 13 to 17, downloaded onto their phones so that we could collect data about how they use their mobile devices four times a year for a fortnight. In this report, we show how long and how many times a day adolescents use their phones and what apps they use. Such research is needed to better understand adolescents' use of technology, especially if we want to verify or dispel the myths surrounding adolescents' use of phones.

Methodology

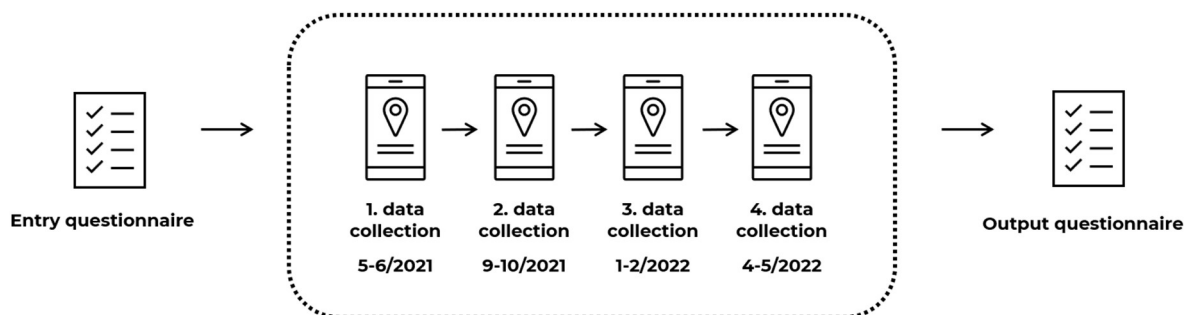
Study Design

This report is based on the results of a year-long study that ran from May 2021 to June 2022. As part of the study, adolescents completed an entry questionnaire to determine their demographic (e.g., gender, age) and psychosocial characteristics (e.g., social anxiety). Over the course of the year, adolescents then participated in four bi-weekly data collections — see Figure 1. For this purpose, they installed the IRTIS

App on their phones, which, among other things, allows for continuous data collection on smartphone usage and the administration of questionnaires.

In this report, we describe a slice of year-round smartphone use among adolescents. A more detailed description of the research methodology is summarized in the above-mentioned research protocol (Elavsky et al., 2022).

Figure 1: Research flow diagram, adapted from Elavsky et al. (2022).



Collection of Objective Data

The research app collected objective data on adolescents' phone usage. The advantage of objective data is that it is unbiased by participants' subjective attitudes, emotions, and thoughts, and what they remember (Elavsky et al., 2022). In our study, this included time spent using smartphones or individual applications. The IRTIS App recorded every app that was active on the smartphone while the mobile phone was switched on, such as Instagram,

Facebook, Google Chrome, and Spotify. That means that, if teens had multiple apps open at the same time, the IRTIS app always recorded only the one app they were actively using. Our app did not provide data on how adolescents used specific apps. For example, it did not measure how much time adolescents spent actively talking to others, who they talked to and about what, how long they spent looking at others' posts, or what they searched for on internet browsers.

Participants

Participants were adolescents recruited via professional research agency and through online advertisements on the social networks Facebook and Instagram. Only girls and boys between the ages of 13 and 17 who used an Android smartphone with internet access were included in the study. A total of 1,178 adolescents expressed interest; however, only some of them participated in the research. Some did not complete the informed consent form or their parents did not agree with their participation. Some did not install the research application or stopped cooperating. A total of 201 adolescents participated in the first wave of data collection, of whom 197 had sufficient data for analysis (58% boys, mean age 15). The fourth and final wave of data collection involved 123 adolescents, 113 of whom had sufficient data for analysis.

It should be noted that the sample of this survey is **not representative**. Therefore, the results should not be generalized to the entire population of Czech adolescents. The contribution of the data presented here is thus to verify the findings obtained in representative research using unique objective data, which would be difficult to collect in a representative sample.

Research Ethics

The study was approved by the Ethics Committee of Masaryk University (EKV-

2018-068). Prior to participation in the research, adolescents and their parents received all the information regarding the research and were assured of complete anonymity and the careful handling of collected data. They were also given the opportunity to withdraw from participation at any time. Participation was conditional on the signature of informed consent by the adolescent and his/her parent or legal guardian. After each data collection, the participants had the opportunity to win money vouchers worth 500 CZK and 2000 CZK in a lottery. At the end of the study, they had an opportunity to win money vouchers for the purchase of a mobile phone or a game console.

Analytical Process

For the purposes of this report, data from the IRTIS App from all participants and all four fortnightly waves of the survey were used. Due to technical issues (e.g., phones spontaneously shutting down, especially at night or during class, battery drain, errors in scanning or app synchronization), data were not collected all the time and sometimes data from different time periods were missing. For this reason, to be able to sufficiently identify complete records, we defined an "active day" — the period of the day between 8 a.m. and midnight — to be the time when most adolescents are awake and performing

their normal daily activities. If the proportion of adolescent data collected on an "active day" did not reach 40%, data from that day were excluded from further analyses.

In the first step, we aggregated the smartphone usage data for individual research participants by calculating the average values for each participant, this

time over the entire 24 hours. We then performed further statistical operations with these aggregated values. As a result of this procedure, each participant was counted just once, regardless of the number of days from which the data were obtained. This approach allows us to show and describe an average day with a mobile phone in the life of an adolescent.

Categorization of Mobile Apps

For this research, we coded the used applications into 15 categories. In this report we focus on the 6 most frequently used. The remaining 9 categories are listed as "Other". Detailed information about each category and the categorization process can be found in Appendix 1.

The most used categories of applications among our participants were:

Social Networking Apps: this category includes applications that allow you to share, view, and respond to the content (e.g., text, photos, videos) of online communities. Many applications of this type also offer additional functionality to users (e.g., enabling convenient communication between users, shopping, ranking). The social networking category included those applications whose primary function was to share content, as described above. These included Instagram, Facebook, TikTok, and Snapchat.

Communication Apps: this category includes apps through which it is possible to make calls or send SMS messages, but also instant messaging services and video calling applications, such as WhatsApp, Messenger, Skype, and email clients. Unlike social networking sites, instant messaging is intended for communication and not for sharing content with a potentially large group of unknown people.

Entertainment Apps: these apps provide users with access to entertaining content. They allow users to play audio, video, and text content. This includes apps for listening to music, podcasts, and radio, watching videos and movies, and reading books. These include Netflix, YouTube, Wattpad, and Spotify.

Games: this category includes all applications for playing games, both classic (e.g., chess) and modern, such as Minecraft or Clash of Clans.

Browsers: This category includes internet browsers (e.g., Google Chrome),

where adolescents can do a wide range of activities. We did not collect data on the specific websites visited by the research participants.

Practical Apps: This includes applications designed to manage different areas of life. For example, time management (e.g., calendar), tools and file management (e.g., notepad, cloud apps), weather, transport and maps, banking apps, school grades. These include, Google Calendar, Google Maps, and Bakaláři Online, which is a Czech app

used to access school grades and assignments.

Others: This category included the remaining applications, including system applications (e.g., mobile desktop, menus, settings), news, educational, health, shopping, and creative applications (see Appendix 1 for a detailed list). These categories were grouped together because they made up a very small percentage of the overall applications.

Results

In the following section, we report on how much time the participants of our study spent using their phones and each app category every day, and how this usage varied by gender, age, day of the week, and over the course of the year.

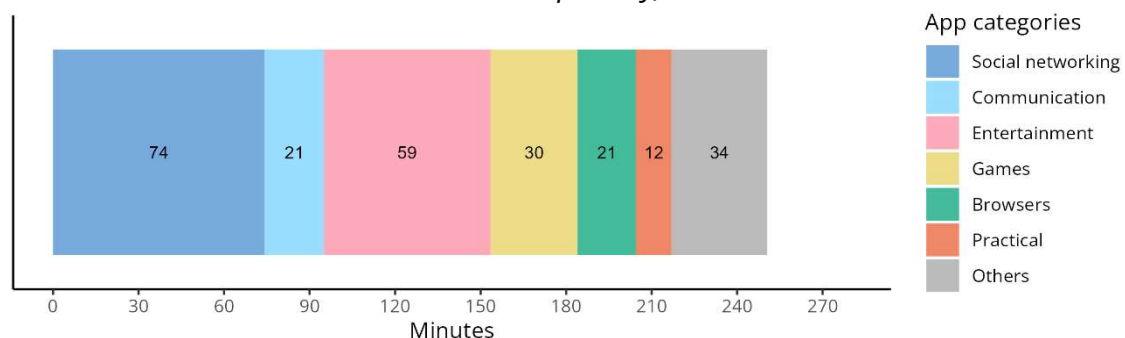
We also present data on phone usage during the day. Finally, we discuss how many times a day adolescents used their phones and how the frequency of use varied by type of use.

Time Spent Using Applications on Phone

In this section we show how many minutes a day on average the adolescents in our study spent on their

mobile phones and what types of apps they used. First, we look at the summary results presented in Figure 1.

Figure 1: Comparison of the average daily time spent on the phone by adolescents (in minutes per day).



Key Findings:

- On average, adolescents who participated in our research spent **more than 4 hours per day on their phones (specifically, 4 hours and 11 minutes)**.
- The most used categories were **social networking, entertainment, games, browsers, and communicators**.
- Adolescents spent the most time on **social networking sites**, with an average of more than an hour per day (74 minutes).
- **Adolescents spent almost an hour a day (59 minutes) with entertainment apps**, (i.e., watching video content or listening to music).

We will now try to put these findings in the context of the information already available from representative research

on a similar topic. According to a study conducted by the Institute of Sociology of the Czech Academy of Sciences, children

and adolescents, aged 11 to 15, spent time on a mobile phone, computer, or tablet on average 2 hours and 38 minutes on weekdays and 4 hours and 2 minutes on weekends (Patočková et al., 2022). Time with these devices was most often spent playing games or on social networks, but also watching movies, series and videos, or surfing the internet (Patočková et al., 2022). In our research, where we use objective data, **the average time spent on the phone alone was just over 4 hours**. An explanation for this may be that the time of use is much more fragmented on phones, and it is not a continuous block of use, so it may be more difficult to

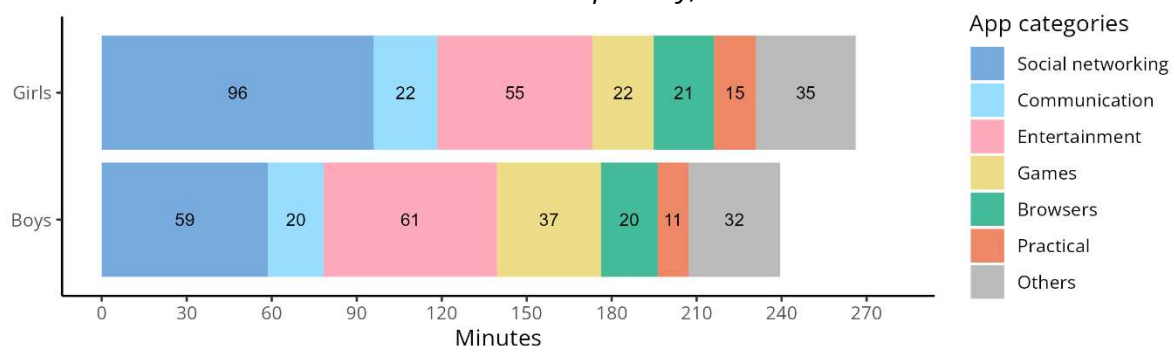
estimate the exact time using self-report (Verbeij et al., 2021). The type of activity does not differ much. Social networks and entertainment apps were the most used in our research, with adolescents often watching videos or movies on platforms such as YouTube or Netflix, which is consistent with research from the SAA. Similar conclusions were also reached in the EU Kids Online survey of European Children and Adolescents, where more than half of the Czech adolescents aged 9-16 years old surveyed watched videos, listened to music, visited social networks, and communicated with friends and family daily (Smahel et al, 2020).

Time Spent in Applications by Gender

Adolescents' online activities may differ based on gender. Not surprisingly, boys and girls engage in different activities on their devices, such as computers, tablets, and mobile phones. Boys, for example, may use technology more often for entertainment, such as watching videos

or playing games, while girls may use it more often to keep in touch with their friends and family (Smahel et al., 2020). Figure 2 shows the average daily time spent on different types of mobile apps separately for girls and boys.

Figure 2: Comparison of average daily time spent on the phone by adolescents by gender (in minutes per day).



Key Findings:

- On average, girls spent more time on their mobile phones per day than boys (by 25 minutes).
- On average, **boys spent more time playing games** (15 minutes longer than girls), **and girls spent more time on social media** (37 minutes longer than boys).
- For the other app categories, differences in usage between girls and boys were small.

According to our results, girls spent more time on the phone than boys, which is consistent with the findings of previous studies (e.g., Smahel et al., 2020). Girls also used social networking sites more compared to boys, while boys played games more compared to girls. The same results were found in the EU Kids Online survey, where the percentage of Czech boys playing games daily was almost three times higher than the percentage of girls (Smahel et al., 2020).

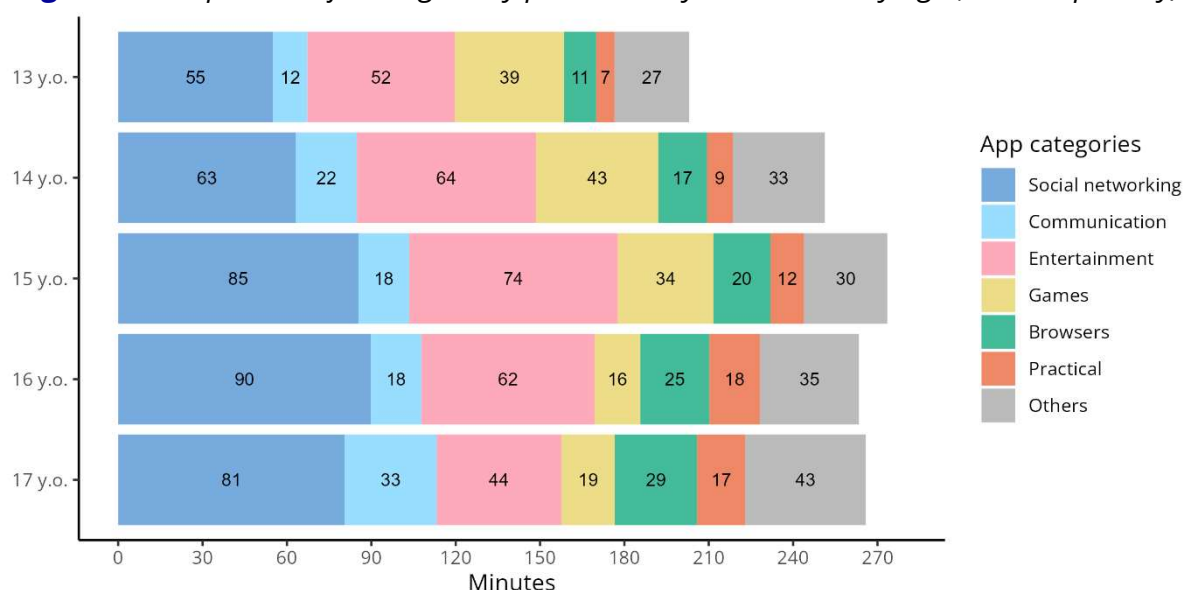
It is known from other research that boys are more likely to build intimacy with others by engaging in a shared activity (McNelles & Connolly, 1999), which may include playing online games. Thus, they use gaming more often to socialize and connect with their friends, whereas girls are more likely to use social networking sites for this purpose. Boys and girls did not differ in other activities on smartphones in our research.

Time Spent in Applications by Age

As adolescents grow up, what they are interested in and what they do changes. Their online activities and, where appropriate, the types of apps they use

on their phone may vary based on their age. Figure 3 shows the average number of minutes spent on certain types of apps on adolescents' smartphones by age.

Figure 3: Comparison of average daily phone use by adolescents by age (minutes per day).



Key Findings:

- Between the ages of 13 and 15, average daily time on the phone among our participants is on an upward trend. At later ages, the differences are less pronounced. **On average, 13-year-olds spent the least amount of time on the phone, at about 3 hours and 24 minutes per day (203 minutes).**
- **Social networking sites** were most used by 16-year-olds, who spent an average of **almost an hour and a half a day (90 minutes)** on them. However, from age 15 onwards, social networking use was similar in terms of time.
- Most time in **entertainment apps** was spent by **15-year-olds**, with **a daily average of more than an hour (74 minutes)** on the phone.
- On average, **14-year-olds** in our study spent the most time on their phones **gaming, about three-quarters of an hour (43 minutes).**
- **Seventeen-year-old participants** spent the most time using **communicators**. This is **about half an hour a day (33 minutes).**

In general, studies agree that the time spent in front of screens also increases as adolescents age (Smahel et al., 2020; Patočková et al., 2022). For example, a study by the Institute of Sociology of the Czech Academy of Sciences found that more than half of all adolescents surveyed in the 8th and 9th grades of primary school (around 15 years old) used a mobile phone, computer, or tablet for more than 3 hours a day, excluding time spent preparing for school. In the younger age group, about a third of children spent this amount of time using a mobile phone. In our research, time spent with a smartphone increased with age, but only up to the age of 15. After that, there were no significant changes in average time. It is

possible, however, that time spent with devices other than a mobile phone (e.g., a computer) may have varied across ages, which we did not assess in our study.

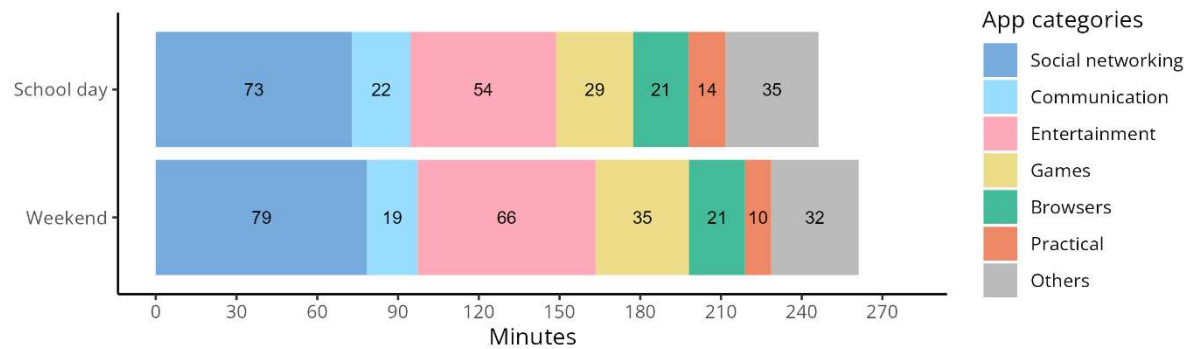
Time spent on social networking sites and the usage of communication apps also increased with age in our research. This may be explained by the fact that, the older adolescents get, the more they tend to separate themselves from parental influence and spend more time with their peers, with whom they form closer relationships (Subrahmanyam & Smahel, 2011). To do this, they may use these apps to be more in touch with their peers.

Time Spent in Applications During the Week: Weekdays vs. Weekend

In this section, we compare the average time spent using the phone during the school week and the weekend. We hypothesized that usage might differ because adolescents do not have as

many obligations during the weekend as during the week and may spend more free time on the phone. Details of usage can be found in Figure 4.

Figure 4: Comparison of average daily phone usage on weekdays and weekends (in minutes per day).



Key Findings:

- Adolescents spent slightly more time on the phone on the weekend than during the week, although **the difference is only 14 minutes** (4 hours and 8 minutes vs. 4 hours and 22 minutes).

The average time spent on smartphones on weekdays did not differ much from weekend days. However, differences can be observed for social networking and entertainment, and gaming apps. For example, apps such as YouTube, Netflix, and Spotify were used by the participants for an average of 12 minutes longer on weekends than on weekdays. Social networking and gaming apps were also used on average five minutes more on the weekend than during the week. However, the difference is small, suggesting that adolescents engage in these activities on their smartphones both on school days and on the

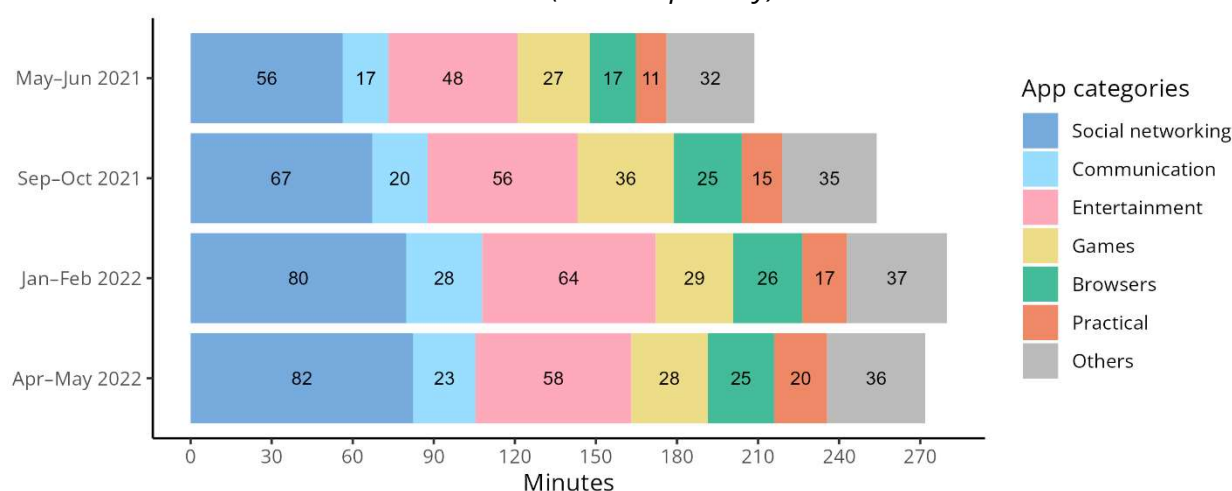
weekend, when they have more free time. Other studies show that heavy social networking use occurs at a much higher rate on weekends than on weekdays (You et al., 2023), and that adolescents play online games at a significantly higher rate on weekends than on weekdays (Smith et al., 2015). The fact that the differences are not as visible in our research may simply be due to the fact that we objectively measured only time spent on mobile apps. Adolescents may have used social networking sites or played online games on their computers or laptops during the weekend.

Time Spent in Applications During the Year

Data collection from adolescents took place four times during one year. In the following section, we compared how

average phone use changed over the year. The results are shown in Figure 5.

Figure 5: Comparison of average daily phone usage in minutes by the wave of data collection (minutes per day).



Key Findings:

- On average, adolescents spent the least amount of time on their phones in the first wave of data collection, which took place during May and June.
- **We saw a significant increase in social networking use** during the first half of the survey, from an average of 56 minutes per day in the first wave (May-June 2021) to 82 minutes in the last wave (April-May 2022).
- The time adolescents spent having fun on their phones increased by about 10 minutes per day over the year.

Although studies on this topic are lacking, it would seem that adolescents are more likely to use their mobile phones in the winter months than in the spring or summer. This may be because they will, for example, meet more of their friends and classmates face-to-face in warmer weather, or engage in outdoor activities that require good weather. According to a survey conducted by the Czech Academy of Sciences, the most frequent leisure activities of the children interviewed were cycling, football, and inline skating, which depend more on good weather (Patočková et al., 2022). However, the results of our research show that the time spent on phones was essentially the same in the winter and

spring months (in the third and fourth waves of data collection, the difference is about 10 minutes). This may be because adolescents' leisure activities do not influence time on phones. Adolescents are also engaged in activities that can be done at any time of the year, and these are more likely to be activities that children do, for example, as part of year-round clubs - exercise and strengthening, swimming, floorball, volleyball, and athletics (Patočková et al., 2022).

The increase in the time spent with smartphones over the year could be due to an increase in the time spent on specific types of apps. For example, our adolescents experienced an increase in

the average daily time spent on certain social networks during the year. For example, time spent on the Snapchat app increased by 56% from the first to the fourth data collection. For TikTok, it

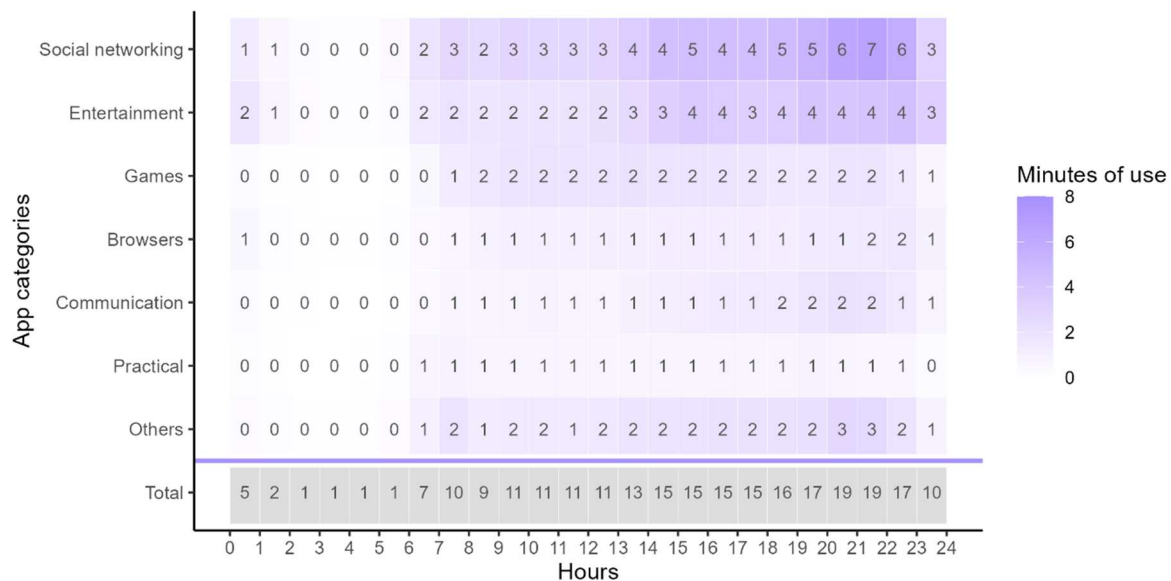
was a 34% increase. On the other hand, time spent on Facebook in the first collection decreased by 14% by the fourth collection. Similar results were reached by Voegels et al. (2022).

When Do Adolescents Use the Phone Most Often?

Previous studies mostly focused on how much time adolescents spend in front of large screens each day, but we knew less about the time of day. This raises the following questions: Do they use their phones at school? How much time do

they spend on it in the afternoon? Does activity vary by time of day? The answers to these questions are given below. Figure 6 shows the average time spent on the most used app categories during the day in minutes per hour.

Figure 6: Overview of average app usage per day by category (in minutes per hour).



Note: Each colored box with a number always indicates the average number of minutes spent on a particular activity in a given hour range. The darker the box is, the more minutes in that hour were spent using that particular application category. For example, the first box in the top left tells us that in the 60 minutes between midnight and 1 a.m., adolescents spent an average of 1 minute on social media. When interpreting the graph, it is important to keep in mind that the average values are always strongly influenced by outliers (e.g., the considerable inclusion of users who did not use a given app category at all in a given hour). The minutes in applications within one hour (i.e., one column) are not mutually exclusive. This means that between midnight and 1 a.m., they spent on average 1 minute on social networks, another 2 minutes on entertainment apps, and 1 minute on web browsers. The differences in the sum of the numbers in each column are due to the rounding of the numbers in the different colored boxes.

Key Findings:

- **During the morning hours** (from about 8 a.m. to 2 p.m.), **adolescents spent an average of about 9 to 11 minutes on the phone** in each hour between 8 a.m. and noon.
- During the evening hours (7 to 11 p.m.), the average time spent on the phone per hour ranged from 17 to 19 minutes.
- **Adolescents spent the most time on social media and entertainment in the evening hours between 6 and 11 p.m.** Thus, the intensity of phone use at bedtime was higher than at other times of the day.
- **At night** (between 1 and 6 a.m.), **adolescents hardly used the phone.** However, some adolescents probably went to bed late, because the average use between midnight and 1 a.m. is 5 minutes.

In general, it can be observed that according to objective data, adolescents spent the most time on their phones in the afternoon and especially in the evening (between 3 and 11 p.m.). Adolescents spent the most time on their phones between 9 and 10 p.m., when

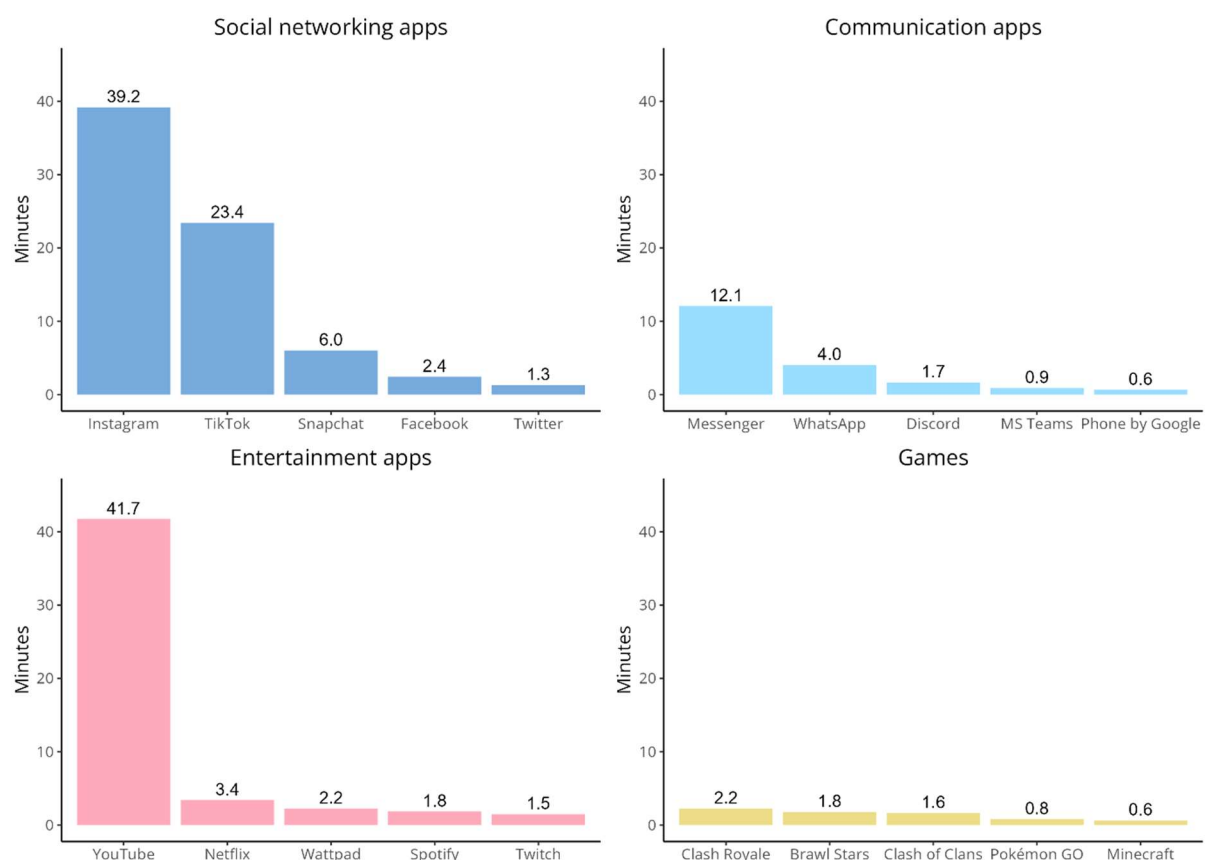
their average number of minutes on the phone was 19 minutes. Of these, 7 minutes were spent on social networks, 4 minutes on entertainment apps, such as YouTube, Netflix, and Spotify, and 2 minutes on games.

In What Apps Do Adolescents Spend the Most Time?

Adolescents spent most of their time on social networks, apps that allow communication, and apps designed for entertainment or gaming. We looked in detail at the most used apps within each category. Although we can observe trends for the different groups of apps

common to all adolescents, the apps used within the categories may differ for individual adolescents. Figure 7 shows the top five most used applications within the four most used categories. Time is given in average minutes per day.

Figure 7: Overview of the five most used apps per day by category (in minutes per day).



Key findings:

- **The most used social networks** among adolescents in our research were **Instagram (39 min on average), TikTok, Snapchat, Facebook, and Twitter.**
- Of the **communication apps**, adolescents most used **Facebook Messenger (average 12 min per day), WhatsApp, and Discord.**
- In the **entertainment apps** category, **adolescents spent the most time on YouTube, with an average of 42 minutes per day.** Other apps represent different types of entertainment: movies and series are available on Netflix, short stories written by users on Wattpad, Spotify allows listening to music and podcasts, and Twitch allows watching video game streams. However, there were no significant differences in these apps.
- The most used games were **Clash Royale, Brawls Stars, Clash of Clans, Pokémon GO, and Minecraft.** However, average minutes of use are very low - there are a huge number of games overall, and no one game dominates over the others.

The most popular applications from the categories of social networking or communication applications are not surprising. According to a 2022 Pew Research Center survey, the use of Instagram, TikTok, and Snapchat was among the most frequent among American teenagers aged 13 to 17 (Voegels et al., 2022). Instagram was used by 92% of all adolescents in our sample and was used an average of 39 minutes per day. TikTok was used by 60% of all participants in our study and averaged 23 minutes per day. A similar trend is shown in the survey of the Institute of Sociology of the Czech Academy of Sciences, where Instagram was the most popular social network and was used several times a week by more than half of the surveyed boys and girls. TikTok was used several times a week by 58% of all girls and 40% of all boys surveyed (Patočková et al., 2022).

The Facebook app was used by 67% of all adolescents in our survey, and on average they used it for about 2 minutes

a day, which is a significant drop compared to Instagram or TikTok. However, the low number of minutes spent per day on Facebook may also be due to the fact that smartphones provide two separate applications for Facebook, one as a social network and Facebook Messenger for communication with others. These features are not separated when accessing Facebook on the website. Regarding the smartphone apps, Facebook Messenger was slightly more popular than Facebook itself, and participants used it for an average of 12 minutes per day. Thus, we can clearly say that Facebook is not the most popular social network among adolescents, as confirmed by previous research (Voegels et al., 2022; Patočková et al., 2022), but they still use Facebook Messenger to communicate with others.

The most popular app overall was YouTube, which adolescents used for an average of 42 minutes a day, significantly more than other apps in the same category, such as Netflix and Spotify.

YouTube was also the most used app among American adolescents, according to the Pew Research Center. It was used by 95% of all respondents, and up to 20% of them reported using it almost constantly (Voegels et al., 2022). The fact that it is a very popular app is also supported by the research of the

Academy of Sciences of the Czech Republic, where 77% of all girls and boys used YouTube several times a week (Patočková et al., 2022).

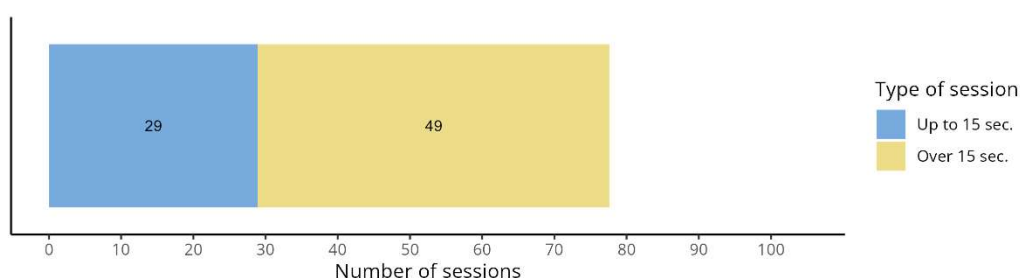
Only 2% of our respondents did not use any social network on their mobile phones during all four data collections.

How Many Times a Day Do Adolescents Use Their Phones?

Among the popular statements made by parents and the media is that today's young people spend every moment with their phones and never let them out of their hands. In this part of the report, we will look at how often young people are on their phones, or rather, how many times a day they unlock the phone's screen. First, we will look in more detail at how often adolescents use their phones in short sessions, like when they just quickly read a message, check the

time, or check the number of new notifications (i.e., checking within 15 seconds), and how often they use their phone for more than 15 seconds. We also look at whether adolescents use the phone more without any external impulse from the phone (i.e., using the phone without notifications) or whether they react to an incoming notification or message (i.e., using it in response to a notification). The results are shown in Figures 8, 9, and 10.

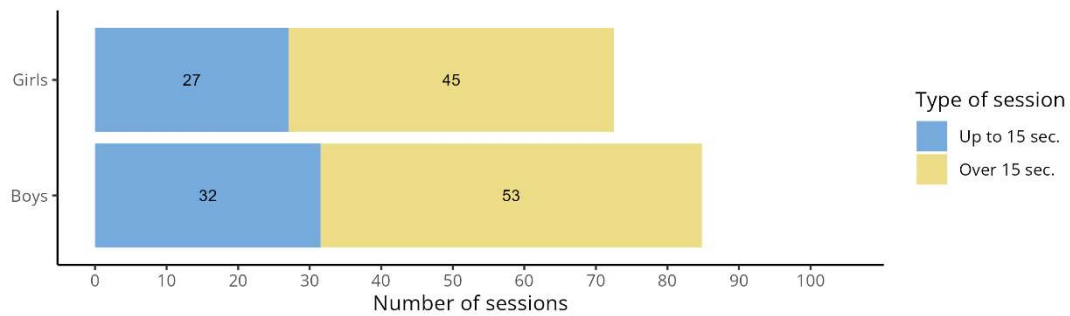
Figure 8: Average number of sessions per day by the duration of session.



Key Findings:

- On average, **adolescents used the phone 78 times a day.**
- On average, **interactions with the phone longer than 15 seconds were more prevalent.**

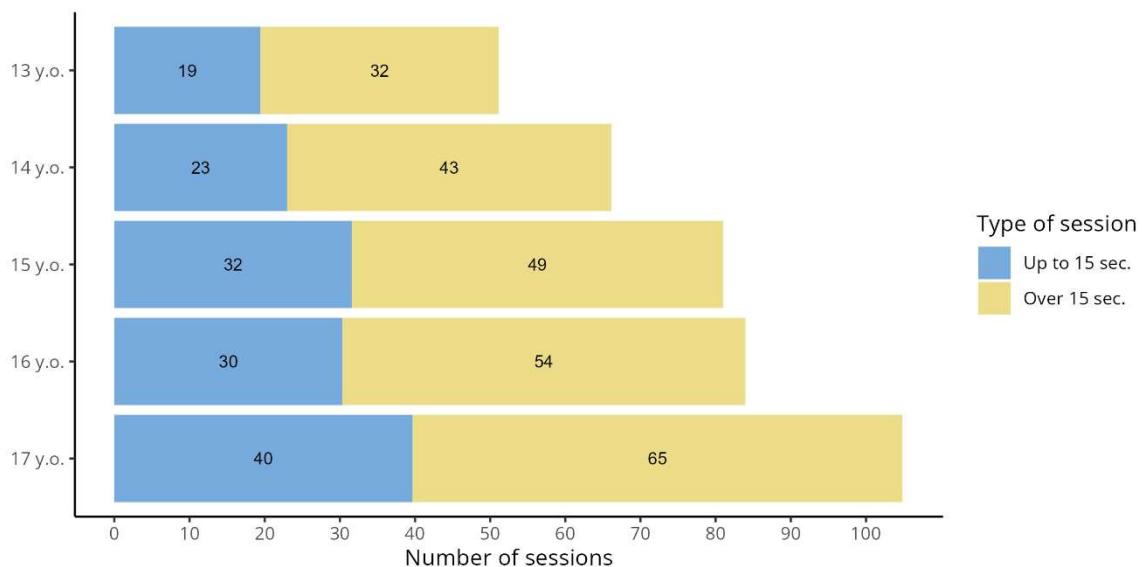
Figure 9: Average number of sessions by the duration of the session and the participants' gender.



Key Findings:

- On average, girls turned on their phone screen more often than boys, but the difference is small.
- Both girls and boys tended to use their phones for longer periods of time.

Figure 10: Average number of sessions by the duration of a session and the age of participant.



Key Findings:

- **The frequency of phone use increased with age.** Thirteen-year-old adolescents turned on their phones the least 51 times a day and 17-year-olds turned on their phones the most, almost twice as much (105 times a day).
- Regardless of age, adolescents were more likely to interact with the phone for more than 15 seconds.

The average number of sessions increased with age, but the ratio of short interactions up to 15 seconds and longer

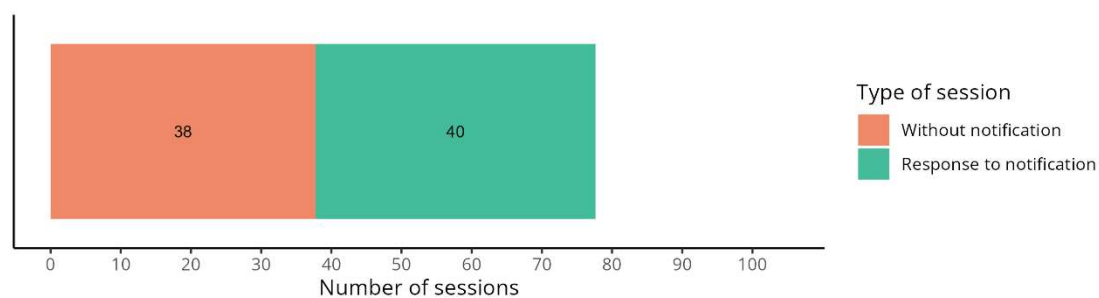
interactions of more than 15 seconds did not differ much. Short phone use for all age groups accounted for 35-39% of all

sessions with the phone. Thus, although older adolescents generally turned on the smartphone screen more than younger adolescents, either in terms of briefly checking messages or the time or the number of notifications, the proportion of shorter and longer interactions with the phone did not change.

Interestingly, 15-year-old adolescents spent, on average, the most time with

their phones compared to other age groups (see Figure 3), yet their frequency of sessions was lower than that of older adolescents (by about 20 percent). This may indicate that 15-year-old adolescents were more likely to use the phone for longer periods of time during individual interactions. In Figures 11, 12, and 13, we show how often adolescents turned on the phone screen based on an incoming notification and how often without a notification.

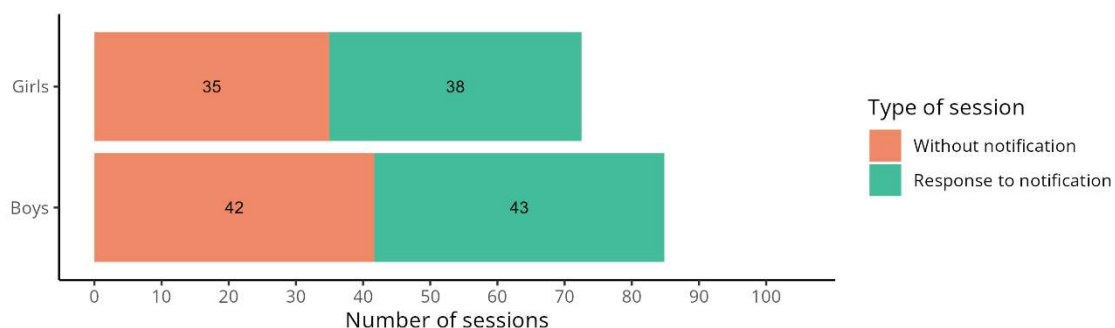
Figure 11: Average number of sessions per day both without and in response to notifications.



Key Findings:

- Adolescents were almost as likely to turn on the phone screen in response to a notification (e.g., sound alert, vibration) as without a notification.

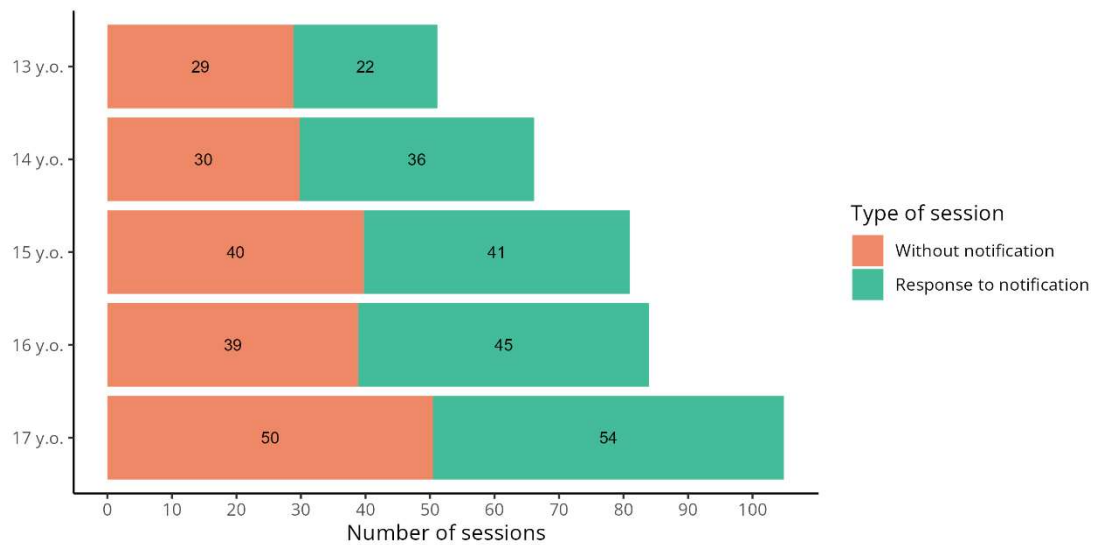
Figure 12: Average number of session uses by type of use and gender of adolescent.



Key Findings:

- Regardless of gender, adolescents used their phones both in response to a notification and without a notification in about the same number of cases.

Figure 13: Average number of session uses by type of use and age of adolescent.



Key Findings:

- Even across age, the proportions of both categories remain similar. Only 13-year-olds are unique in that they are more likely to turn on their phone screen without a notification than in response to a notification.

Adolescents used the phone in response to a notification to the same extent as without a notification (i.e., without responding to an incoming message or notification). The proportion of these two types of sessions did not differ much depending on gender or age. Looking at which types of phone use tended to be shorter or longer, short sessions up to 15 seconds were often not preceded by a

notification or message (65% of all short sessions were without prior notification). In contrast, 69% of interactions with the phone longer than 15 seconds were in response to a previous incoming notification or message. Thus, our results suggest that, if the adolescent received a notification, message, or other alert on their phone, they were more likely to use the phone for longer than 15 seconds.

Conclusion

This report summarizes basic research findings about smartphone use by Czech adolescents, analyzing objective data from the phones of 197 adolescents. The report shows how much time adolescents spent using their phones, what they did on their phones, and how phone use varied by age, gender, time of day, weekday or weekend, throughout the year, and type of use.

Adolescents spend a lot of time on their phones

The adolescents in our study spent a relatively large amount of time using their phones, on average 4 hours and 11 minutes per day, and turned on their phone screen an average of 78 times per day. We do not believe that this amount of time can be considered risky. Excessive phone use and its negative effects may be a problem, but these are not constituted by the time spent on the phone, but rather by the way the phone is used. In this report, however, we have not addressed the impact of mobile phone time on adolescents.

Adolescents use the phone most in the afternoon and evening

Participants spent most of their time on the phone in the afternoon and evening. Media use in the late evening may lead to sleep disturbance and reduced sleep quality. Participants in our research used their phones at the time immediately

before sleep and later than the recommended bedtime. For this age group, the recommended sleep time is 8 to 10 hours, with the wake-up time determined by school attendance for most of the week. In this respect, the role of parents and the establishment of rules for evening phone use is important, especially for younger adolescents. With older adolescents, parents can at least discuss the importance of sleep and the adolescents themselves can adjust the rules for evening and nighttime use of the phone.

Adolescents use the phone primarily for entertainment and to interact with peers

The prevalence of phone use in the afternoon and evening suggests that it is an important leisure activity for adolescents. The fact that the adolescents in our research used their devices most often for entertainment, but also for interacting with others, is indicative of this leisure aspect. They spend most of their time on social networking sites (primarily Instagram and TikTok) or using apps that provide access to entertainment content (e.g., YouTube) and playing games. However, it should be noted that watching videos on YouTube or Instagram can be educational, which is not the case in our research. These findings are in line with existing evidence on adolescents' use of

technology (cf. Smahel et al., 2020). The fact that adolescents use smartphones extensively for entertainment and communication with other people in their free time is not in itself worrying. Consuming media for entertainment is a source for pleasurable experience and it can lead to improved well-being (Dienlin & Johannes, 2020). On the other hand, in this context, the risk associated with spending too much time on the phone is that the entertainment on the phone replaces other leisure activities that are important for the development and the well-being of the adolescents, such as physical activity.

The use of social networks, which adolescents in our research spent the most time with, also carries both risks and benefits. The specific effects on users can vary depending on many factors, including the specific activity that adolescents engage in when using individual apps. Adolescents may use them to actively engage in meaningful or even supportive interactions with peers and loved ones but also to passively view entertainment content that is presented to the user in a way that holds their attention for as long as possible. Available research suggests that, while active use may be beneficial (e.g., perceived support from friends; Kim, 2014), passive use is associated with adverse effects (e.g., a higher incidence of depressive symptoms; Thorisdottir et al., 2019). The fact that adolescents can engage in various activities on their phones is one reason that forms of parental mediation, such as limiting

screen time, should be used on a limited basis. In this situation, a parent who takes a restrictive approach to the regulation of phone use may also limit the related benefits. Indeed, research shows that restrictive mediation reduces children's digital skills and abilities, which parents should avoid (Mascheroni et al., 2020). Therefore, researchers recommend the use of active mediation and possibly the shared use of technology. These parental mediations include parents talking to their children about their online activities, discussing and jointly undertaking online activities, providing guidance on how to use the Internet, and explaining how to deal with unpleasant situations online (Dedkova & Smahel, 2020).

In this report, we have shown that adolescents spend quite a lot of time on their mobile phones, mostly in the evening. They mostly use their mobile phones for entertainment, communication, and gaming. However, it is the content of these activities that is important, not just the amount of time spent on the phone. Parents and teachers can encourage the meaningful use of digital technologies and reduce potential risks by talking to their adolescents about what they are doing on their mobile phones.

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Appendix

Appendix 1 – Smartphone App Categorization

While some scholars create categorization schemes specific to their research (e.g., Bae, 2019; LiKamWa et al., 2013), others follow the categorization scheme of apps on the Google Play platform (Asselbergs et al., 2016). However, even this categorization is not reliable, because app developers themselves can determine the classification of their apps. Thus, apps may appear in categories where they do not necessarily belong (Frey et al., 2017; Li et al., 2022). Another problem is that apps often have many functions and thus can fall into multiple categories. This situation makes data comparability across studies difficult. A solution has been proposed by Schoedel et al. (2022), who developed the first systematic and detailed categorization, on which we base this research.

For the purposes of our research, which is specific in that smartphones are used by adolescents (and thus use different apps than the adults for whom Schoedel et al. created the scheme), we modified their scheme as follows:

- In the Entertainment category, we merged audio and visual entertainment, book-reading apps, magazine apps, and so on.
- We merged system apps and apps to set up and optimize the phone into the category Phone Maintenance.
- We have merged the apps for ordering food and for shopping into the Shopping category.
- In the category called Practical Applications, we have included applications for career development, financial management, time planning, transport and orientation, and file management tools.
- Applications for creating and editing photos and videos, along with other creative applications, are included in the Creativity category.
- We included Spiritual apps under Other because they were rarely used among adolescents.

In categorizing the applications, we were guided, like Schoedel et al. (2022), by the so-called primary purpose of the application. According to the main functionality in the description on Google Play, we then classified the app into one of 15 categories. If an app did not have a description on Google Play, we used the Internet browser to search for additional information about it. Each app could only be classified in one category. The resulting categorization is shown in Table A1.

To correctly categorize the 1,551 applications, we trained two coders to independently classify the applications according to the categorization manual.

Subsequently, two authors of the categorization manual resolved disagreements between the coders.

Table A1: Complete application categorization scheme.

Name of Category	Description and Examples
1. Entertainment	Includes apps with entertainment content, specifically audio (playing music, podcasts, audiobooks, radio); video (playing videos, streaming movies, TV); reading apps for entertainment (readers of books, comics, magazines or blog articles; not news, which are in the News category). Representative apps: YouTube, Netflix, Wattpad - Read & Write Stories, Twitch.
2. Communicators	Includes applications specifically designed for communication behavior (i.e., traditional calling, SMS applications, web-based instant-messengers, emails, video calls). Applications that have communication functionality as a secondary element have their own category (i.e., Social Media, Dating). Representative apps: Messenger, WhatsApp, Discord - Talk, Chat & Hang Out.
3. Creativity	Includes apps for creative learning, such as drawing, playing instruments, singing, creative writing, recording sounds, and creating and editing photos and videos. The category does not include photo and video sharing apps (such as Instagram), which are in the Social Media category. Representative apps: Camera, CapCut - Video Editor, Oppo Camera.
4. Dating	Includes apps specifically designed for dating - from finding potential partners, to communicating, to arranging meetings. This category does not include apps for general communication, which have their own category (Communication). Representative apps: Tinder, Grindr.
5. Practical Applications	Includes time management applications (clocks, timers, stopwatches, calendars); tools (notepads, to-do lists); file management - printing, scanning, opening, editing, downloading, calculators, and programming; device management (smart home, Bluetooth); and services that cannot be classified in the Shopping category, like parcel service), weather (local and international weather forecasts), wayfinding and transport (taxi service apps, route planning, vehicle departures, maps and navigation), financial management (banking apps and price comparisons), and career and school (grade display, career presentation, job search, job networking, guidance). Representative apps: Bachelors OnLine, Google Drive, Google Photos, IDOS, Google Maps, Gallery 3D, Mi Home.
6. Shopping	Includes a wide range of apps related to shopping for food and other items: apps for selling and buying things offline and online; store apps; loyalty apps; and food and grocery ordering. It does not include apps for calorie counting and meal planning, which are in the Health category. Representative apps: Vinted - SecondHand shopping, SHEIN - Summer Vacay, Avon ON.
7. Games	Includes gaming apps like games, mobile games, and gambling and betting. Representative apps: Clash Royale, Clash of Clans.
8. Health	Includes apps related to the user's monitoring of their own health, like exercising, improving or monitoring physical and mental health, sleep apps, diet, calorie counting, meal planning, and recipe search. Representative apps: Hevy - Gym Log Workout Tracker, Calorie Tables, Diet, Calm.

9. Browsers	Includes web browsing applications, like applications from specific search engines. Representative apps: Google Chrome, Google, Samsung Internet Browser.
10. Knowledge	Includes applications to acquire knowledge, skills, and information about specific topics, like language learning. The category does not include web browsers and search engines, which are in the Browsers category. The Knowledge category also does not include news applications, which are in the News category. Representative apps: Duolingo language lessons, PhotoMath, Google Classroom.
11. News	Includes applications that are explicitly designed for searching and consuming news, like digital newspapers and news sites, including sports scores and business news. Representative apps: LiveSport, Seznam Zpravy, iDnes.cz.
12. Security	Includes applications that enhance user security, both online and offline, such as applications for hiding user identity (VPN), antivirus protection, and tracking your journey home. Representative apps: DuckDuckGo Privacy Browser, AVAST Antivirus and Security, AVG antivirus - Mobile Protection, Password Management.
13. Phone Maintenance	Includes phone setup applications (personalizing your phone, monitoring phone time or battery consumption, optimizing features) and system applications that are necessary to ensure the basic functionality of the smartphone and applications, which often run in the background. Representative apps: Samsung App UI Home, com.huawei.android.launcher.
14. Social Networking	Includes applications for sharing, viewing, and interacting (liking, commenting) with content (text, photos, videos) of an online community. The category is diverse, because social media have secondary functions that fall into categories such as Communication, Shopping, and Dating, and provide content from Entertainment, Knowledge, and News; however, apps in this category are specific to their primary purpose of sharing content. Representative apps: Facebook, Instagram, TikTok, Snapchat.
15. Others	Only exceptional cases could not be classified in any of the above categories. Representative apps: IRTIS App, Czech Bible app, Co-Star Personalized Astrology.