

DIRECTORS

Digital data-dRiven
EduCaTion fOR kids



Open Educational Resources

for Teaching Data Literacy

to ISCED Level 1 Pupils



Digital and data literacy are crucial today, especially for younger generations. The **DIRECTORS (DIgital data-dRiven EduCaTion fOR kids)** focuses on **promoting data literacy in primary education** through innovative teaching methods and materials. The project is implemented by the University of Zagreb in Croatia and the Delft University of Technology in the Netherlands, as part of the Erasmus+ programme co-funded by the European Commission.

As part of the DIRECTORS project, we developed **three workshops** for lower primary education (ISCED level 1), each consisting of two sessions. The workshops are structured around three levels of data literacy, with each level tailored to the age and prior knowledge of the pupils. Workshop 1: **Data in Our Hands (and Mobile Devices)** introduces basic data skills; Workshop 2: **Geospatial Data (and Maps) in Our Hands** targets intermediate skills; Workshop 3: **Data Sources** encourages the development of advanced data literacy.

Each workshop includes two sessions, and each session consists of two 45-minute school periods. The activities are carefully designed to offer pupils hands-on experience through “learning by doing,” enabling them to apply the acquired concepts in real-world contexts and covering the **entire data cycle** – from (1) data collection carried out by the pupils in their own environment, through (2) data processing in a “child-readable” format with error checking and cleaning if needed, (3) data analysis by asking questions and drawing insights, (4) data visualization to support clear communication and spatial thinking, to (5) critical reflection and interpretation, drawing conclusions both from the data and about the data itself.

In the first session of each workshop, pupils engage with the material offline, using manual methods. In the second session, the same content is transferred to an online environment using digital technologies. The workshops are based on an interactive and practical approach that actively involves pupils in working on concrete tasks.





young children
ISCED level 1



DATA COLLECTION
*by children from the
real-world environment*



DATA PROCESSING
*"children-readable form",
checked for possible errors,
and cleaned if necessary*



DATA ANALYSIS
*ask questions, extract
insights form data*



DATA VISUALISATION
*depict data in a clear manner,
encourage spatial thinking*



CRITICAL THINKING
*drawing **CONCLUSIONS**
from the data and about the data*





Workshop 1

Data in Our Hands (and Mobile Devices)

Ivana Bosnić, Frederika Welle Donker, Bastiaan van Loenen, Ana Kuveždić Divjak

You are viewing the educational materials for implementing **Workshop 1: Data in Our Hands (and Mobile Devices)**, **Session 2: Collecting and Analysing Mobile Device Usage Data**. All materials are also available on the website of the DIRECTORS project: www.kidsdirectors.eu.

Workshop 1: Data in Our Hands (and Mobile Devices) will introduce the pupils to the **world of real-life data**, from data collection to processing and critically evaluating results. Pupils will explore real-world data by looking at their own use of mobile devices – for example, their favourite games or video channels, the amount of time spent on a particular app, and so on.

During the *first session*, they will estimate their use of mobile devices and create data cards with their estimates and favourite apps. They will then learn how to group, categorize, and clean data and how to visualize it in a word cloud.

In the *second session*, pupils will learn how to collect, adapt, and enter actual mobile phone data into a dataset. They will investigate similarities and differences between the entire class's data and their own data and compare their estimates to the data they've collected. They will also learn how to visualize real-world data, why it's important for data to be entered accurately, and how to preserve privacy when adding personal information to a shared dataset.

Digital data dRiven EduCaTion fOR kidS | Open Educational Resources for Teaching Data Literacy to

ISCED Level 1 pupils | Workshop 1: Data in Our Hands (and Mobile Devices) by Ivana Bosnić,

Frederika Welle Donker, Bastiaan van Loenen, Ana Kuveždić Divjak is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) 



WORKSHOP 1

Data in Our Hands (and Mobile Devices)

Session 2: Collecting and Analysing Mobile Device Usage Data



1. Required Materials and Preparatory Activities

- ✦ A computer with internet access and a projector or smartboard.
- ✦ Slides – prepared for the presentation (available on the project website).
- ✦ Online form for pupils to enter their mobile phone usage data – a template is available on our website and should be adapted as needed.
- ✦ Laptops/tablets/phones – available to pupils during the lesson for filling in the form, if applicable (depending on the type of homework given in the previous session).
- ✦ Digital board or A0 poster and sticky notes – for discussion about phone sensors, if applicable.
- ✦ Before the session, pupils – with help from their parents – should have enabled the app that tracks phone/tablet usage, following the instructions given in the first session.
- ✦ Before the session, pupils should complete their homework from the first session, depending on the version:
 - ☆ complete the online survey before the workshop, or
 - ☆ bring their completed homework (from the usage tracking instructions), or
 - ☆ be prepared to find their usage data in the classroom.

If possible, it would be helpful to involve two persons, especially when cleaning data and preparing visualisation. If only one teacher is present, this activity can be simplified, depending on available time and teacher's skills.

2. Basic Information About the Topic

Pupils will learn about data by using information already collected by their mobile phones or other electronic devices: **data related to their mobile phone usage**. This topic was chosen because the data is widely available, easy to collect, is varied and includes several variables (such as total time spent using the device, time spent on each individual app, screen-on time, etc.). The aim is not to discuss the pros and cons of using a mobile phone or tablet, but to focus on how pupils can evaluate their own data on usage and compare their estimates with those of their peers. Instead, we will focus on collecting, analysing, and visualising data from mobile devices. We will use real data collected by the mobile device, in contrast to the first session, where we used the pupils' own estimates.

3. Lesson Organisation

The table below outlines the structure of the lesson, with approximate durations for each activity. Since the activities are flexible, in some cases multiple **options or variations** are offered. Certain activities may also include additional elements (marked as "EXTRA"), such as extended discussion points. The estimated duration of each activity is shown as a range. The actual time needed may vary depending on the pupils' age and prior knowledge.

Activity	Duration (minute)	Method	Description 
Introduction & Overview of Available Mobile Devices and Homework	5-10	Whole-class discussion	Introduction to the topic with icebreaker questions. Overview of how many mobile phones or completed homework assignments are available. Division into pairs/groups for the next activity.
Discussion – What Does Your Phone Measure?	5-15	Whole-class discussion	Discussion about how mobile phones collect different types of data.
Data Collection and Upload	10-15	Individual work	Pupils gather mobile usage data using their homework and enter the data.
Data Cleaning and Visualisation	10-15	Teamwork	Creating data visualisations based on the information entered by pupils.
Data Analysis – Let's Compare!	10-20	Whole-class discussion	Discussion of the results obtained.
Discussion	10-15	Whole-class discussion	Discussion about data analysis in general.

Activity	Duration (minute)	Method	Description
Conclusion and Reflection	5-10	Whole-class discussion / Individual work	Pupils summarize what they did and learned? The teacher gives his conclusion: What have we learned today? Has the teacher learned anything new?
Total	60-95		

4. Learning Outcomes

4.1 Learning Outcomes – Teacher Language

By the end of this lesson, the pupil will be able to:

- ✦ Choose the data sources needed to investigate a posed problem.
- ✦ Prepare and input the data for analysis.
- ✦ Categorize the data obtained.
- ✦ Analyse the data based on visualizations.
- ✦ Analyse the data over various factors.
- ✦ Describe that data can change over time.
- ✦ Compare the data of different users.
- ✦ Compare the measured data with the initial data estimation.
- ✦ Discuss the questions of anonymization and privacy.
- ✦ Illustrate the possibility of low-quality or incorrect data.
- ✦ Ask investigative questions that can be answered with real-life data.
- ✦ Predict the possible answers to problem-based questions.
- ✦ Make conclusions about the problem-based questions based on the obtained data.

4.2 Learning Outcomes – Pupil Language

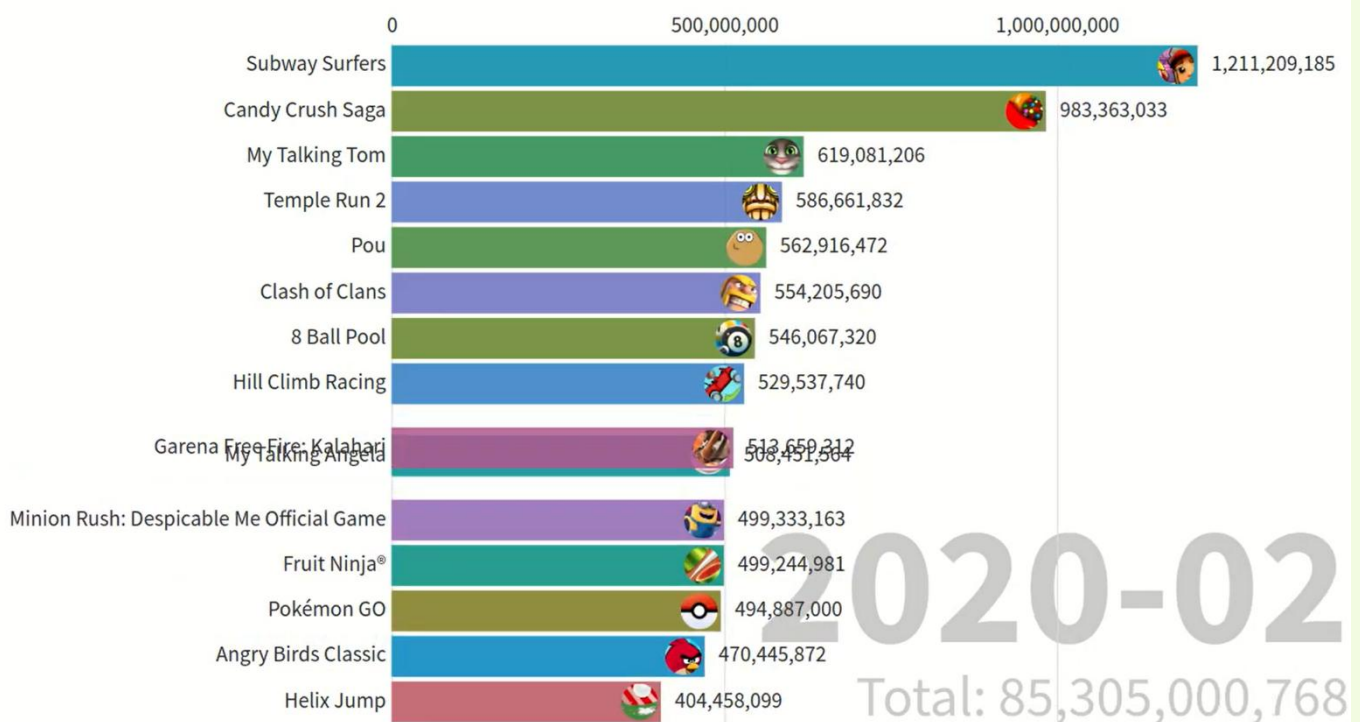
You will explore what kind of data your phone collects and how this data can be shown in a visual way (this is called „data visualisation“). You will be able to compare your classmates' data in different ways and compare your real-life data with your own earlier estimates (this is called „data analysis“). You'll see that data needs to be cleaned to get an accurate picture. For example, a small spelling difference in the data can make a big difference in the analysis (this is called „data quality“).

5. Fun Facts

Using these fun facts is optional – their inclusion depends on the pupils' age and the teaching context. You can include them as you see fit, choose just a few, or skip them entirely. It's recommended to use those that are most relatable to the pupils' own experiences and surroundings.

- ✦ Did you know that people almost always think they spend less time checking their mobile phones than they actually do?
 - ✦ A short animated history of the most downloaded games on the *Google Play* platform
 - ☆ Interesting for the data visualisation and animation method
- <https://youtu.be/gYucHINoDnI>

Android games with the highest number of installs 2012 - 2020



6. Activity Flow

6.1 Introduction

✦ Introduction to the topic:

- a. "Can you remember what we did last time?"
- b. "Do you remember what „data“ means?"
- c. "We asked you to estimate your mobile/tablet use and record that data on your data cards."
- d. "And for homework, we asked you to enable apps on your mobile device so that you could see how much you actually use it. Hands up – who did that?"

Ask pupils who didn't raise their hands for the reason. Did they manage to write down the data but forgot to bring the homework? Maybe they weren't allowed to bring their phone to school? If they don't have a device or any data, ask them to pair up with a classmate who has their device enabled or has written down the data.

✦ Explain what pupils will be doing in this lesson (if applicable, show a slide with the learning goals in pupil-friendly language):

- e. we'll see whether their estimates were close to the actual data they collected,
- f. we'll visualise the collected data in different ways,
- g. we'll see how the way data is entered into a form can make a big difference in the analysis,
- h. we'll learn how to use visualisations to answer questions you might have – for example, are mobile phones used more or less during the weekend?

6.2 Discussion – What Does Your Phone Measure?

✦ Ask pupils if they can think of examples of **what their mobile phone can measure** (e.g. different types of usage, time, temperature, noise). You can do this in a few different ways:

Option 1: Simply have a discussion about the possible data that can be collected.

Option 2: Use a prepared editable slide in the presentation to write down pupils' answers. You can also write them on a classroom analogue or digital board.

Option 3: Ask pupils to write their own suggestions on the board or on small pieces of paper.



✦ Briefly discuss the following:

- a. Can we categorise this data, for example, app names, usage times, time of day/day of the week?
- b. What type are these values: are they words, numbers, can data values be anything you want, or do you have to follow certain rules or choose from a set of predefined values?



6.3 Data Collection and Upload

PLEASE NOTE: Depending on the version of the homework you chose at the end of the first session, some of the steps (data collection or data uploading) may already have been completed.

6.3.1 Data Collection

Instructions for collecting data from mobile phones are available in the document that pupils were supposed to receive at the end of the first session. You can download it from our website.

Each pupil takes their homework and reviews their data, **performing a brief mini analysis of the collected data.**

1. Ask the children again who brought their completed homework.
 - a. Children without homework can work in pairs.
2. Depending on the pupils' prior knowledge, explain the purpose of these apps: they run in the background without interrupting phone use. Pupils can recall how they use their phones by entering the collected data, such as:
 - a. how many times an app was opened,
 - b. time spent in the app,
 - c. how many times the phone was unlocked or picked up.All this data is stored, so you can compare how you use your phone over time and see if there are differences in usage patterns.
3. Let the pupils take a few minutes to review their own data from their homework card.
- 4. Return to each pupil the data card they filled out during the first session.**
5. Ask the pupils to find answers to the questions on the data card:
 - a. What were your predictions/estimates?
 - b. How did your predictions compare to the data from the homework?
 - c. Are there questions you cannot answer (*for example, the most-watched channel – tracking apps often don't distinguish between channels you watched*)?
 - d. Is there anything else you would like to know that the tracking app currently doesn't provide?

Pupils may ask questions about different data on different days: when they created their data cards, there were different circumstances or contexts; use this as a teaching moment to explain that data changes over time.

6.3.2 Data Input for Analysis

At this stage, each pupil **enters their mobile phone usage data into a pre-prepared shared online form** using a school computer/tablet.

1. Introduce the pupils to the data entry process for analysis. Show them the pre-prepared online form they will use to enter data from their phone apps for analysis and visualization of results.

PLEASE NOTE: For younger pupils, it's recommended to open the form on the computer in advance to reduce the number of tasks they need to focus on.

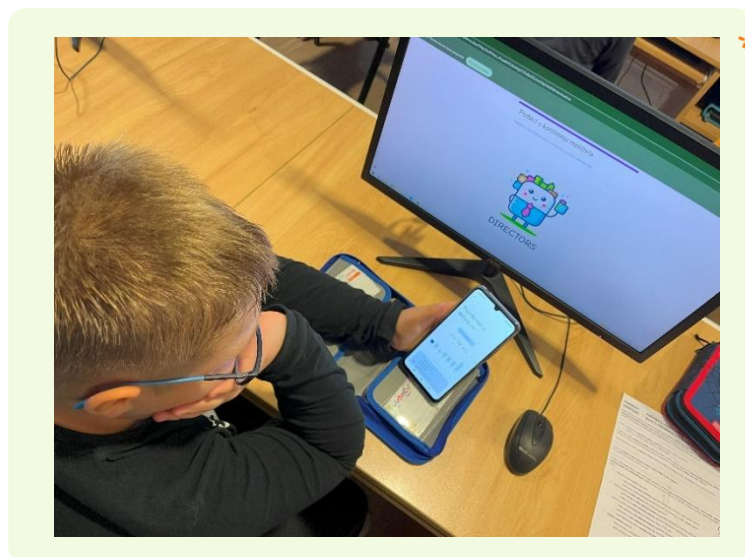
2. Each pupil needs to enter their data into the form only once. Explain that they must be very careful when entering data, otherwise the next steps in data processing will be incorrect.
3. This task is anonymous but contains a few demographic questions:
 - a. Gender
 - b. Number of people in your household, including yourself
 - c. Do you have any restrictions on using a mobile phone?
 - d. If yes, describe them: when and how are you allowed to use your phone?
4. Other questions in the online form:

PLEASE NOTE – OPTIONS: The question categories should be adapted to the categories you want to use – categories pupils worked with when filling out data cards in the first session and categories pupils worked with in the homework.

- a. Mobile phones / video games:
 - i. what is your favourite game?
 - ii. how many minutes per day do you play games?
 - iii. how many times per day do you pick up your device to play games?
- b. YouTube/video channels:
 - i. what is your favourite channel?
 - ii. how many minutes per day do you watch the videos?

- iii. how many times per day do you pick up your device to watch the videos?
- c. Chatting on the device:
 - i. what is your favourite chat app?
 - ii. how many minutes per day do you chat?
 - iii. how many times per day do you pick up your device to check for chat updates?
- d. Global mobile phone usage:
 - i. what is your favourite app that is not a game, YouTube or a chat app?
 - ii. how many minutes per day do you use your device?
 - iii. how many times per day do you pick up your device?

PLEASE NOTE: Visit our website for up-to-date instructions on how to more easily create the survey as a *Google Form*.



PLEASE NOTE – OPTIONS: It is best to prepare the online form with all questions related to the four categories and hide the questions that will not be used in this session. If a pupil does not have a mobile phone or another device (*e.g., if there are not enough school computers for entering data from the homework*), they can work together with a peer. (*Additionally, if needed, pupils can analyse and enter data from the teacher's phone or use some pre-prepared dummy data. Clearly mark these responses so they do not stand out from the others.*)

6.4 Data Cleaning and Visualisation

6.4.1 Data Preparation

This activity is based on demonstrating different ways of presenting data:

- ✦ Raw data (*table*),
- ✦ Visualised raw data (*charts*),
- ✦ Visualised cleaned data (*charts*).

The teacher has several options for carrying out this activity, depending on when pupils enter their data and how much time is available for data cleaning.

If using the *Google Forms*, **the app will automatically generate charts from the pupils' (uncleaned) responses**. To clean the data, you need to make a copy of the response spreadsheet. Once the responses have been cleaned, the teacher should manually create the charts. This may take time, depending on the teacher's skills. For this, there are two options:

Option 1: The teacher only discusses data cleaning orally (e.g. shows the cells that need to be cleaned, explains the process), but does not actually create new charts.

Option 2: The teacher goes through the entire process and creates charts based on the copied and cleaned data table.



Regarding the moment when pupils enter their data, there are two possibilities:

Option 1: Data is entered into the form as part of the homework.

1. The teacher first shows the raw, unprocessed data, as entered through the online form.
2. Then, the teacher shows visualisations of the unprocessed data, previously prepared.
3. Finally, the teacher shows visualisations of the cleaned data, previously prepared.

Option 2: Data is entered into the form during the lesson.

1. While responses are coming into the online form, the teacher should review the data and be ready to clean it (cells to be cleaned can be marked in a different colour "on the fly").
2. When all pupils have finished entering their data, the teacher first displays the raw data, as entered through the online form.
3. Then, the teacher shows visualisations of the unprocessed data.
4. The teacher leads a discussion on data cleaning and visualisation, while a second teacher (if available) works on a copy of the data, cleans it, and prepares it for a cleaner visualisation and analysis.
5. Finally, the teacher shows cleaned data visualisations, previously prepared.



In both cases, the first version of the visualisation presented to the pupils will be without prior cleaning. This will demonstrate that raw data can be “messy” and difficult to visualise.

Using pre-prepared visualisations, and depending on the pupils’ prior knowledge, explain how bar charts and pie charts work.



6.4.2 Discussion on Raw and Cleaned Data

- ✦ Explain to the pupils: Now all the pupils’ data has been combined – this is a whole new world compared to our small individual data sets. What can we see now? How is this different from our homework? The same numbers appear here and there...
- ✦ Show the raw table. While each pupil was able to enter their own numbers or names, which seemed reasonable at the time, we now see nothing but a big mess of data.
- ✦ Explain that data analysis and visualisation can help us to “see through this forest of data” with our own eyes.

Display the charts generated by the form tool, now filled with data, and start combining this with discussion in the “analysis” section.

6.5 Data Analysis – Let's Compare!

Data visualisation goes hand in hand with data analysis. We need to find out what the data is telling us – just like a special kind of detective following clues.

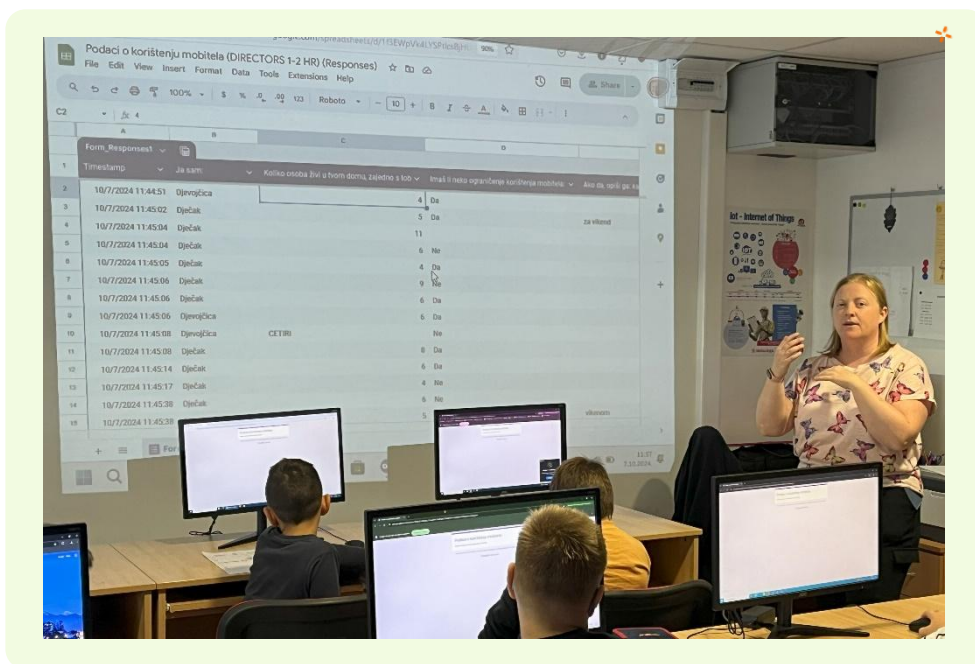
PLEASE NOTE: As previously mentioned, it is a good idea to carry out these analyses using a copy of the data from the online form, in a spreadsheet application of your choice (*MS Office, LibreOffice Calc, Typeform, Google Forms/Sheets...*). The discussion about the analysis process can be done in two ways:

Option 1: The analysis can be prepared in advance without explanation.

Option 2: If time and the teacher's skills allow, it would be even better for pupils to observe the analysis process as it happens and to discuss it during the process.



During the analysis, use the auxiliary options/tools of your application to speed up the process: automatic filtering, categorising/grouping options, sorting, etc.



Depending on the available time, choose one or more of the suggested analyses:

- ✦ Categorising apps (by type, e.g., games, videos, chat apps, etc.).
 - ☆ Categorise by app type, for example:
 - For games: is it a logic game, arcade, educational, strategy, card game; for individuals or multiplayer; short or long, etc.
 - For videos: what kind of videos – music, challenges, jokes, tutorials, etc.
 - For chat apps: which app (*WhatsApp, Telegram, Snapchat, Viber, JustTalk*, etc.), for what purposes.
 - For other apps, ask pupils to categorise them according to their own definitions.
 - ☆ For categorisation, you need to add some new data to the spreadsheet (this process is called "data augmentation") – add a new column with the category.
- ✦ Basic charts of available data.
 - ☆ Introduce minimum, maximum, and average values.

- ✦ Differences in time spent per app and number of unlocks, etc.
- ✦ Differences in favourite games/channels/groups.
- ✦ Comparison by gender.
- ✦ Comparison by household size:
 - ☆ ≤ 3 – small,
 - ☆ 4–5 – average,
 - ☆ ≥ 6 – large.
 - ☆ Differences shown in favourite games/channels/groups.
- ✦ Social life on the phone.
- ✦ Time spent in chat groups, number of openings.
 - ☆ Discuss: Type of usage? Informational, social?

EXTRA: Just comment on the following:

- ✦ Discuss possible differences in mobile phone usage throughout the day or across days of the week.
 - ☆ What happens during the weekend?
 - ☆ How do parental restrictions affect the data?

EXTRA: Print out the prepared set of visualisations for each pupil or prepare a PDF and share it electronically with the pupils.

EXTRA: Encourage pupils to compare their own data and the group's analysed data with their parents' data or with data from other friends.

6.6 Discussion

Discuss the following questions with the pupils:

- ✦ Can you explain the differences between the estimates made on the data cards and the actual usage recorded by the mobile phones?
- ✦ Which visualisation was better, the uncleaned or the cleaned version?
- ✦ How did the visualisation help us get answers?
- ✦ How did the analysis help us get answers?
- ✦ What have we learned?
- ✦ Did we expect these results?
- ✦ Did you expect such a comparison of your own phone usage with the group?
- ✦ What about incorrectly entered data? Does it affect the analysis and visualisation? (*Show examples.*)

- ✦ Do we know who is who in this table? Can we identify who completed the form based on the grouped/summarised data?
- ✦ Anonymisation – what is it and why is it important?

6.7 Conclusion and Reflection



End the session with the following questions:

- ✦ What did you learn today? What did you enjoy the most, and what you didn't like?
- ✦ What would you tell your parents about what you did today?
- ✦ What did we find out today?
Allow pupils to share their own conclusions. If needed, use follow-up questions like:
Were you surprised by such a big difference between your estimated and actual phone usage? Has your phone usage changed in the past year?
- ✦ Did we expect these results?
- ✦ Let pupils respond with their own thoughts. If needed, ask: Why do you think there are differences?
- ✦ The teacher can briefly summarise what they've learned today – were there any surprises?





University of
Zagreb
Faculty of Geodesy



UNIVERSITY OF ZAGREB
Faculty of Electrical
Engineering and
Computing

The **DIRECTORS (Digital data-dRiven EduCaTion for kidS)** project is carried out by partners from Delft University of Technology (The Netherlands) and the University of Zagreb (Croatia) as part of the Erasmus+ programme, co-funded by the European Commission.

Our goal is to **promote data literacy in primary education** through new teaching methods and materials. We aim to support the updating of existing curricula related to data education, with the goal of enhancing digital and data skills among **teachers and pupils**.

These open educational resources are the result of the DIRECTORS project's commitment to strengthening data literacy among young primary school pupils, offering **practical and age-appropriate** open content designed for both teachers and learners.

Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

[Erasmus+ Project 2023-1-NL01-KA210-SCH-000157821 Digital data-dRiven EduCaTion for kidS]



Co-funded by
the European Union

