

MAKE IT WORK!



A teaching pack on repairing
electrical and electronic devices

BACKGROUND INFORMATION

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INTRODUCTION Repairing electrical and electronic devices¹ and thereby extending their lifespan makes you part of the circular economy. It is an effective way to contribute to a more sustainable future. This educational pack is presented to you by Djapo and Sharepair to raise awareness about this issue among children and adolescents and help them recognize opportunities to repair devices in their daily lives. We want to encourage pupils to become committed to choosing repair, both at school and beyond.

This document containing background information is intended for you as a teacher, and helps you to prepare the lessons. It familiarizes you with the basic principles of electrical and electronic repair by giving

you the what, why and how. The first part introduces the wider concepts of sustainability and the circular economy, and then focuses on repairing electrical and electronic devices. The second part covers Education for Sustainable Development and the didactic principles that underlie the pack's teaching materials. It clarifies the modular structure of the teaching pack and the intended learning process behind the steps required to engage pupils. It also contains tips on working with English as an Additional Language (EAL) pupils.

1 - The word 'device' is commonly used to refer to smaller electronic products such as smartphones or laptops. For larger domestic electrical products such as washing machines and fridges, the word 'appliance' is more common.

CONTENT-RELATED BACKGROUND INFORMATION

1.1 – Sustainability

Sustainable development means taking care of the earth and of humankind. The natural resources of the earth are the basis for what we need as human beings to survive. Everyone, regardless of where they live, has the same right to the natural resources they require to meet their basic needs. At the same time, natural resources are precious, and future generations need to be able to enjoy them equally. This is why it is necessary to treat them sustainably, including in commercial industries. This helps to realize a world in which everyone can enjoy the right to live in dignity on a healthy planet.

This harmonious equilibrium between the social, ecological and economic realms can be summarized by the three Ps of sustainable development. Sustainable stewardship means:

- > avoiding negative impact on other people, their way of life and their chances of a dignified existence (**People**);
- > avoiding negative impact on the carrying capacity of the planet (**Planet**);
- > contributing to social prosperity (**Prosperity**).

Two further Ps were added in the United Nations' 2030 Agenda for Sustainable Development to clarify the conditions required to work on sustainable development: **Partnership** and **Peace**.

After an intensive development process, the United Nations translated the three Ps of sustainable development into 17 Sustainable Development Goals or SDGs. The international framework of the SDGs has been proposed as a new global plan to make the planet a healthier, more just and more peaceful place for all. The framework reflects a shift from the classical 'North-South' divide to a more global perspective. All world leaders will have to make concrete efforts to realize these development goals by 2030. You can find more information about the SDG framework [here](#).



SUSTAINABLE DEVELOPMENT GOALS



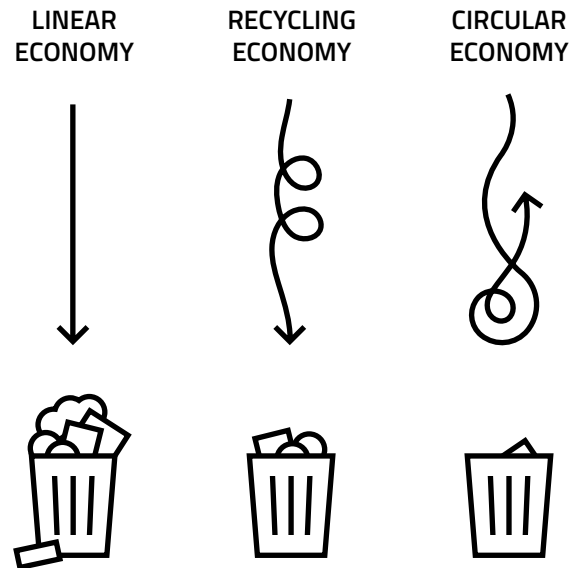
Source: <https://www.un.org/sustainabledevelopment/news/communications-material/>

1.2 – The circular economy and repair

The current global economic model cannot sufficiently guarantee that future generations will also be able to enjoy the earth's natural resources fully to meet their basic needs. The need for a different economic model is obvious, a model in which we use materials and products sustainably.

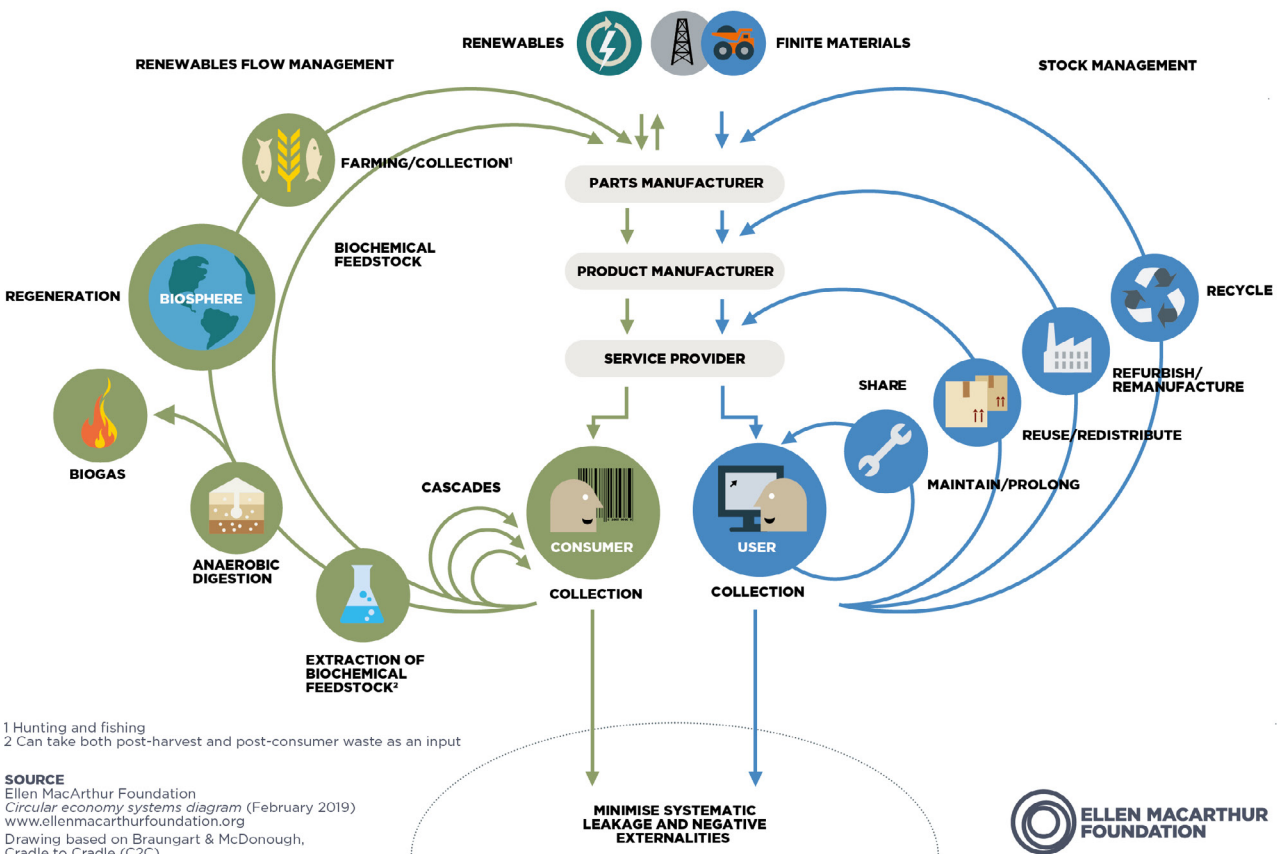
1.2.1. – What is a circular economy?

The **circular economy** is a model to keep materials and products in the economy while optimally retaining their value. Unlike a linear economy, in which raw materials from products ultimately disappear out of the material cycle, the circular economy is aimed at **retaining the value** of materials and products. In a circular economy, products (or the materials they contain) are specifically designed for constant reuse, for example through repair, sale at high second-hand value, or upgrade. Once this is no longer possible, the products are recycled as much as possible and, if necessary, broken down into their constituent materials. In this way, any extracted raw materials will remain present in the economy and the material cycle is closed, like in a natural ecosystem.



Source: <https://vlaanderen-circulair.be/nl/kennis>

The butterfly diagram of the circular economy below (developed by the Ellen MacArthur Foundation) visualizes the biological and technical cycles of the circular economy:



1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input

SOURCE
Ellen MacArthur Foundation
Circular economy systems diagram (February 2019)
www.ellenmacarthurfoundation.org
Drawing based on Braungart & McDonough,
Cradle to Cradle (C2C)



Source: <https://ellenmacarthurfoundation.org/circular-economy-diagram>

1.2.2 – Why is a circular economy important?

Resource scarcity

It is becoming increasingly difficult to extract raw materials and find new sources. As a result, excavation is going deeper and further, and this is having a huge **impact on the environment**, while also further driving up the **prices of scarce resources**. The European Commission keeps a list of critical raw materials that are economically important to us but are becoming difficult to source.

Climate disruption

Extracting and transporting raw materials and turning them into products (and after use, often recycling or incinerating them) costs a lot of energy, and therefore produces high **greenhouse gas emissions**.

Economic and social benefits

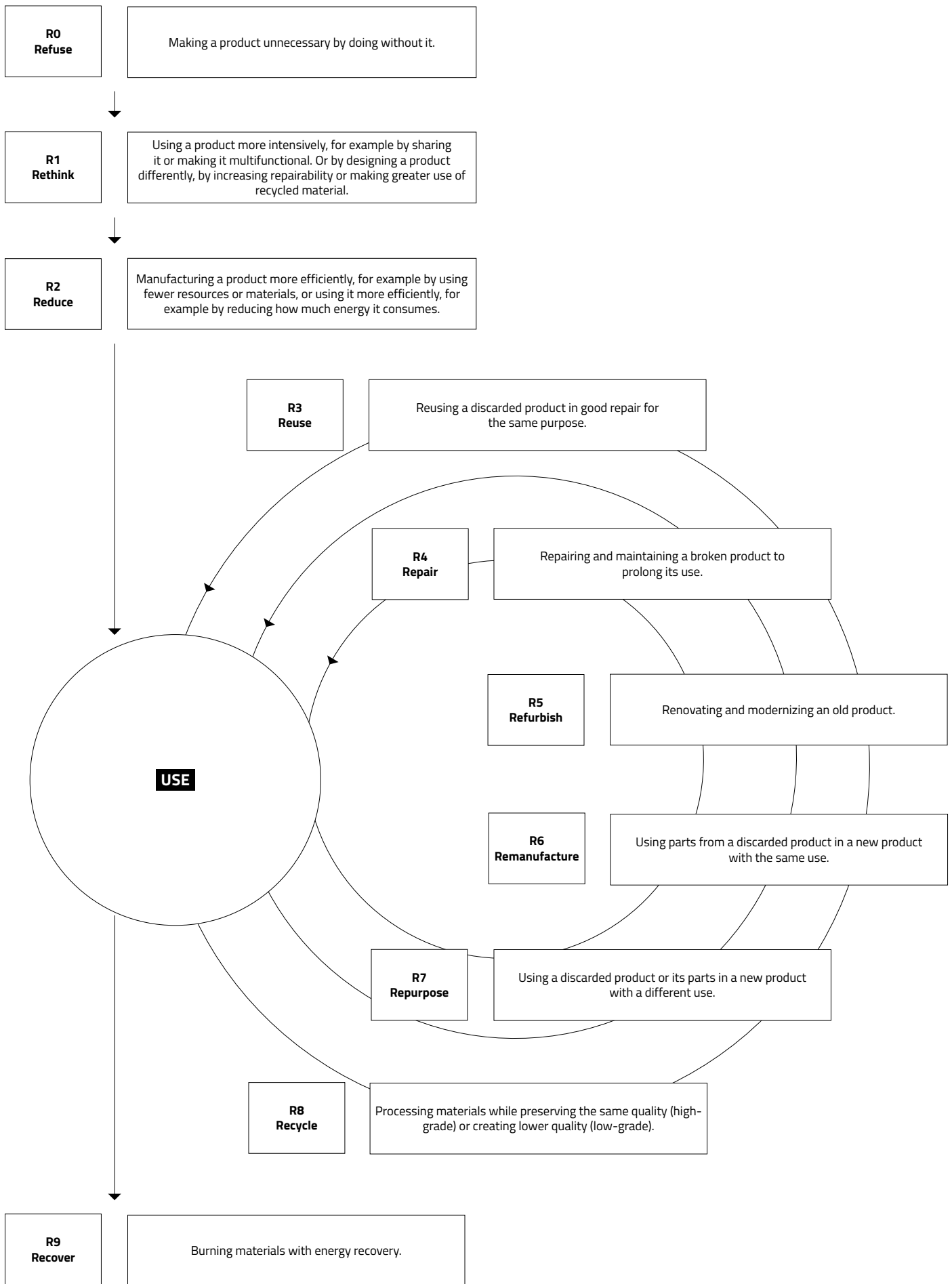
The transition to a circular economy in the EU would lead to an estimated growth in GDP of 0.5% by 2030 with 700,000 new jobs. This would create many new opportunities for innovative and creative craftspeople, creators, repairers, sorters, assemblers, repurposing staff, recyclers, carriers, designers, platform developers etc.

1.2.3 – How do you bring about a circular economy?

Changing the way we deal with products and materials is an important step in the transition from a linear to a circular economy. The 'R strategies' show how – and in what order of priority – products and materials should be treated to ensure that the raw materials in them retain as much of their value as possible, waste materials are reduced to a minimum and environmental pollution and greenhouse gas emissions are kept as low as possible.

First and foremost, products should be designed, manufactured and consumed in a manner that optimally extends their lifespan, makes them easy to repair and reuse and reduces the volume of waste materials. Secondly, reuse should be stimulated, for example by selling products second-hand and, if necessary, repairing them. Thirdly, any waste materials that are nevertheless generated should be recycled as much as possible and not be allowed to disappear out of the material cycle. If that is impossible, the waste products that are released should be applied in some useful way, for example for energy recovery or as a source of energy.





Based on <https://www.rvo.nl/onderwerpen/r-ladder>

1.3 – Repairing electrical and electronic devices

1.3.1 – Production, consumption and waste flow of electrical and electronic devices

Electrical devices are simple devices that run on electricity and can often be switched on using a power switch, such as blenders, heaters or simple coffee machines. They usually have a single function that is operated exclusively by electrical components such as a power supply, a cable and a motor.

Electronic devices are controllable devices that often have multiple functions, for example smartphones or coffee machines with settings for one or more cups. They are operated (at least partially) by electronic components such as a circuit board, a diode and a capacitor.

It is hard to imagine our lives without electrical and electronic devices. Across the world, people exchange information via their computers, make appointments via their smartphones and prepare food using blenders, ovens and toasters. Electrical and electronic devices make our lives a lot easier.

But producing these devices requires intensive mining of often rare, non-renewable resources, such as gold for smartphones. This kind of extraction is harmful both to the environment and to the quality of life of the frequently exploited people who mine the raw materials in unsafe, unhealthy conditions. These resources are usually located in the global South, where foreign private mining companies take advantage of low wages and inadequate government regulation of the mining industry. These mining companies disrupt local communities by acquiring concessions without the local population's consent, purchasing land at derisory prices and extracting raw materials with technologies that involve the use of toxic chemicals such as cyanide, which then enter the groundwater and pollute local ecosystems, agriculture and drinking water. Local resistance to these practices often leads to bloody mining conflicts and human rights violations.

Similarly, the production process from raw material to device has a negative impact on living environments and communities. Highly toxic chemicals are released during the production of complex electrical and electronic devices such as smartphones and laptops; these chemicals are often harmful for workers and end up in the groundwater and in drinking water. Moreover, producing devices often requires more energy than using them. Many newly manufactured devices therefore already have a considerable carbon footprint even before they are switched on for the first time by a consumer. And if you add to this the greenhouse gas emissions that result from transporting materials and devices across the globe, it is clear that every newly produced device has a strikingly negative impact on our climate.



VIDEO

The documentaries '[Death By Design](#)' and '[The E-waste Tragedy](#)' show the often dramatic impact that the production process and waste flow of electrical and electronic devices have on our living environment and communities.

After an intensive extraction and production process, many electrical and electronic devices end up being used only briefly. Electrical and electronic devices today stop working 20% faster than 20 years ago. Broken devices are usually not repaired by the producer once the warranty has expired, and the lifespan of the product then depends on its repairability and the consumer's decisions. Moreover, producers of electrical and electronic devices often make choices that actually reduce the lifespan of devices or make them harder to repair. They frequently do this to save costs or because product repairability and a long lifespan do not interest them. Producers may choose the cheapest design, without screws, or cheap parts that are likely to break more quickly. And they sometimes use different parts for every new model and choose to discontinue older parts, fail to guarantee that devices can be updated, etc. Some producers simply want to sell as many devices as possible and build software or malfunctions into their products by design to ensure that they will break faster. We call this 'planned obsolescence'. For example, there are printer manufacturers who programme their printers to show an insoluble error message after a certain period or a set number of prints.



After use, the raw materials in broken, worn or dated electrical and electronic devices usually do not end up in the material cycle because households typically keep old devices indefinitely in a drawer. Devices in households that are no longer used and whose raw materials are lost to the circular circuit are called 'dormant devices'. But even if they are collected, the materials from electrical and electronic devices are difficult and expensive to recover for recycling, as most devices contain very small quantities of many different raw materials that are not easy to separate from each other.

In the current linear economy, electrical and electronic devices make up the largest waste stream in the EU. Worldwide, this waste stream is growing three times faster than the world's population; it is the fastest growing waste stream. Less than 40% of the waste materials from these devices is currently being recycled in the EU, and only 17.4% worldwide. Devices that are not recycled are frequently exported illegally to countries in Africa and Asia where the often-toxic waste is dumped in landfill sites and burned. The chemicals released in the process constitute a health hazard for local residents, damage the environment and contribute to climate disruption through the accompanying high greenhouse gas emissions.

While the world population produces 7.3 kgs of e-waste per person annually, Europe produces 16.2 kgs of e-waste per person annually, with Belgium in sixth place in Europe. E-waste is the fastest growing waste stream, encompassing about 53,600,000 tonnes of electronic waste every year.

The production and waste stream of electrical and electronic devices is responsible not only for the exhaustion of raw materials, high greenhouse gas emissions and environmental pollution (Planet); they are also harming people's health and ways of life (People).



FURTHER READING

Read more about the various strategies manufacturers use to plan obsolescence, and why they do this, at <https://www.stopobsolescence.org/>.

1.3.2 – A closed circuit for electrical and electronic devices

Consumers choose to purchase, use and discard electrical and electronic devices, and individuals are consequently not powerless. You can decide not to buy the latest earbuds (Refuse), to share a washing machine with your neighbours (Share) or bring your old smartphone to a recycling depot (Recycle). Often the best way to keep utilizing the raw materials in a device and minimize its negative impact on human beings and the planet is to use it for as long as possible and repair it if it breaks (Repair). It is important to realize that, in some cases, there is a tipping point where the impact of continuing to use the device will be more negative than that of buying a new one. The production process of a new device can be traded off against the energy consumption of an old product, for example when a consumer would be better off buying a new washing machine that consumes much less energy and water than an older machine.

You can help reduce the extraction of valuable and rare resources and ensure that future generations will also be able to use them by repairing broken electrical and electronic devices rather than buying new ones. Keeping electrical and electronic devices – and the raw materials from which they are made – in use for as long as possible means getting the most out of the intensive extraction, production and transport they represent. It also limits new extraction, production and disposal. Using electrical and electronic devices for as long as possible and replacing them with new devices as little as possible means avoiding the greenhouse gas emissions that are required to produce a new device, thus limiting the contribution to climate disruption. Repairing a device yourself also means acquiring valuable skills, insight into the production of consumer goods and an appreciation of craftsmanship. And having a device repaired creates work for local repairers and stimulates a sense of community through local social repair initiatives such as Repair Cafés.



Repair Cafés

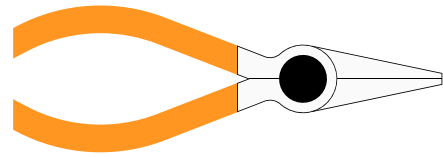
Repair Cafés are free meetings where people come to repair broken products together, from clothes and electrical devices to furniture, bicycles, computers, etc. Participants bring broken products with them and repair them under the assistance and guidance of expert volunteers. Repair Cafés teach or retrain people how to repair things and help reduce waste.

Repair Cafés are held in many cities and towns. It is very likely that the Repair Café in your area would be interested in organizing something with your school. Pupils, parents and teachers can get to know the Repair Café together and repair or learn how to repair their broken products. This could be a way for the Repair Café to reach a new audience and maybe recruit a few new volunteers. And who knows, it might inspire your pupils to organize a Repair Café themselves. You can find the Repair Cafés in your area on [this map](#).

Is there no Repair Café in your neighbourhood? Then organize one yourself! Read about how to do this [here](#).

Unfortunately, manufacturers of electrical and electronic devices in the current, linear economy normally do not make it easy for consumers to repair their broken products. A lot of electrical and electronic devices cannot be easily disassembled, official repair manuals are very rare and spare parts are expensive or difficult to source.

Other than choosing to buy products with a long lifespan that are repairable, there is little you can do on your own to end this negligence on the part of the sector. But in addition to consuming consciously, you can exert pressure on policymakers and manufacturers to implement a circular economic model that discourages planned obsolescence and facilitates and encourages repair. One way of doing this is by signing the [#Righttorepair](#) manifesto.



Repair score

To stimulate manufactures to make electrical and electronic devices more easily repairable and to encourage consumers to make conscious choices, policymakers could adopt a compulsory 'repair score' for electrical and electronic devices, a score that ranks their repairability. Similar systems have already been introduced in Belgium for energy efficiency (House Energy Rating) and for the nutritional value of food (Nutri-Score) (A, B, etc).

Such a score system could take its cue from the 'Indice de réparabilité' or repair index that was introduced in France in 2021. This index is based on 5 easily measurable and verifiable criteria: repair information, ease of disassembly, availability of replacement parts, price ratio between reserve components and a newly purchased product, and product-specific criteria.

<https://repair.eu/news/the-french-repair-index-challenges-and-opportunities/>
<https://www.indicereparabilite.fr/>

Urban mining

Instead of extracting new raw materials through mining, it is also possible to 'mine' raw materials and parts that have been discarded after use. This is called urban mining. Discarded electrical and electronic devices contain many precious metals and parts that can be used to repair other products. By recovering these raw materials and parts, we return them to the material cycle so that they can be used to make new products without having to extract new raw materials. Whether or not a resource can be recovered through urban mining depends on a number of factors, such as the availability of technologies and materials to be harvested and a trade-off between the costs of the often-complex recovery procedure and of mining.

1.3.3 – Repairing devices yourself or having them repaired

By repairing electrical and electronic devices, you can help prevent the exhaustion of raw materials, reduce global environmental pollution and climate disruption, improve people's quality of life and acquire valuable skills yourself. A recent study by [Vito](#) and [other academic studies](#) have shown that the costs for consumers who are more likely to have electrical and electronic devices repaired and less likely to replace them with new electrical and electronic devices are lower than for consumers who are more likely to replace broken devices with new ones.

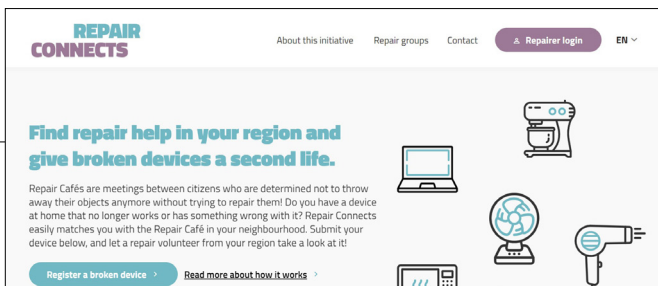
It can be difficult to repair a device or to have it repaired, and this is why Sharepair has developed a number of tools:

RepairConnects

RepairConnects is a broad platform that supports Repair Cafés and involves owners of broken devices in the repair process. People can use RepairConnects to register broken products before they attend a Repair Café to help make their visit even smoother. RepairConnects also has a facility to match owners of broken devices with repairers.

Repairers can log the devices they have repaired in RepairConnects, indicating the methods they used. This information can later be accessed by other repairers to find repair solutions. This data can also be used to measure the number of devices repaired and the impact – the reduction of waste from electrical and electronic devices realized, impact on climate, etc. The Right to Repair movement uses data on the most common problems, missing spare parts, etc. to influence policy and move repair higher up the priority list.

<https://www.repairconnects.org/en>

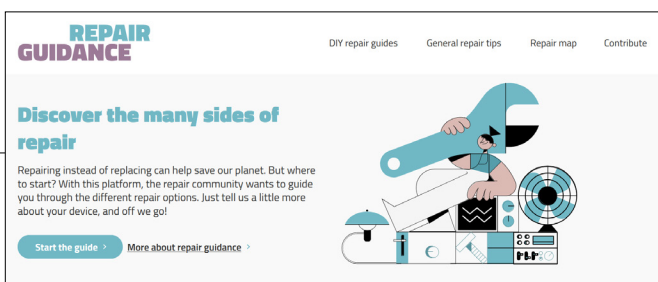


Guidance tool

The guidance tool advises owners of a broken device on how to repair it or have it repaired. The tool offers general information about repair options, such as your rights as a consumer within the warranty period, repairing devices yourself, repairing it in a Repair Café or having it repaired by a professional repairer, 3D printing for repair, etc.

If you want to repair the product yourself, the guidance tool also offers concrete tips for diagnosis and repair of a number of product categories such as blenders, toasters, laptops, etc.

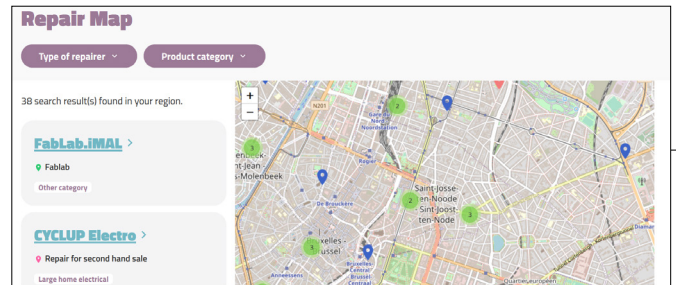
<https://www.guidance.sharerepair.org/en>



Repair Maps

Repair Cafés are not the only place where devices can be repaired. Repair Maps is an inventory of repair actors across the entire project region, ranging from professionals and Repair Cafés to fab labs and recycling centres. The goal is to offer a transregional overview of everyone who can help you with specific problems in your area.

<https://mapping.sharerepair.org/en>



3D print parts

If you cannot find a new or recovered spare part, then maybe 3D printing could be a solution! This platform provides useful background information (when 3D printing is an option, what things you need to keep in mind, where you can have it done, etc) and directs you to 3D designs to get started yourself.

<https://www.sharerepair.org/sharerepair-3d-printing>



DIDACTIC BACKGROUND INFORMATION

This chapter introduces you to the underlying vision of Education for Sustainable Development and the didactic principles on which the teaching pack is built.

The second part familiarizes you with the basic didactic concepts of the teaching material. This helps you understand its modular structure and the learning process behind the steps required to engage pupils.

2.1 – Education for Sustainable Development (ESD)

2.1.1 – The complexity of social problems

This educational pack is based on a vision of Education for Sustainable Development and on the ensuing principles. Discussing sustainable development (see the first part above) means addressing **complex** issues of sustainability and social problems. Climate change, the waste mountain – these are all multifaceted issues that have both **local and global components** that involve many actors.

There are as yet no clear, ready-made solutions for or answers to these challenges. Moreover, the waste problem, like other social challenges, is highly **dynamic**. Our knowledge of the issue is constantly expanding or changing. Any possible answers will therefore be subject to frequent revision.

Finally, there is seldom consensus about the values and norms that guide sustainability. The great social challenges of our time are called **wicked problems** for a reason. The values and norms that these problems touch on appear to be in constant conflict, and there is no consensus. For example, a solution that involves reducing the extraction of raw materials would benefit the ecology, but would conflict with the value we attach to our way of life.

2.1.2 – A rich learning context

Precisely because social challenges are complex, thinking about them can aid the development of children and young people. Because they are not clear-cut and need new, creative answers, they constitute a **rich, interesting learning context**.

Climate change, the swelling waste stream, the pressures on biodiversity and similar issues are all **authentic challenges** that intersect the daily lives of pupils. They invite pupils to engage in further **inquiry**, which allows them to use their knowledge and skills purposefully and practise them. In addition, social issues invite pupils to **interact and exchange perspectives**. Many aspects and possible solutions give rise to multiple and sometimes conflicting opinions, ideologies and values. This interaction with a diversity of perspectives can enrich and widen pupils' outlook and knowledge. Social issues can thus become a source of common inquiry and a learning process in which **ideas for change** can germinate.

This inquiry and learning process are particularly suited for the classroom and/or the school. A school that focuses on Education for Sustainable Development can become a **training ground** that offers a safe space where pupils gain experience with social issues. It gives them the opportunity to practise being active citizens of the world and make choices. They learn to think about what a sustainable society means to them and what choices it entails for them.

2.1.3 – Learning by action-oriented thinking

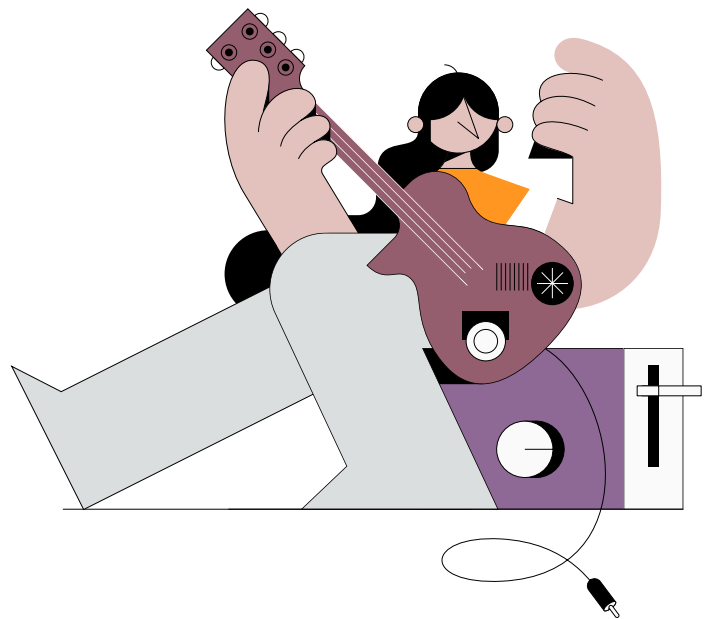
Developing this **capacity to choose** requires more than just knowledge. It is essential to be knowledgeable about the great and small aspects of any social issue, but in the context of Education for Sustainable Development, **knowledge building** is not just a goal. Knowledge is not something you either have or do not have, but it is something active and dynamic that you use and build up by using it.

Making choices concerning a social issue begins with brainwork: inquiring into causes and effects, comparing different views, coming up with ideas or criteria for action, critically examining proposed solutions, focusing on specific aspects of a problem, etc. This is only a small sample of the many different critical thinking skills or thinking processes that you can deploy purposefully.

Action-oriented thinking is characterized precisely by this **purposefulness**. Whenever pupils are confronted with some social challenge, this could be an opportunity for purposeful thinking to propose possible change or action. This could entail either direct or indirect change, for example a new perspective, a better understanding of the subject, or external action that leads to direct or indirect change.

Pupils who have the opportunity to deal with social issues at school develop **self-confidence** in their own ability to make choices and help shape society.

In the context of Education for Sustainable Development, pupils need a learning environment that focuses not only on knowledge, but also specifically on critical thinking skills, dialogue and cooperation. These elements are crucial to build pupils' awareness and their transformative capacity, and they form the didactic principles for this educational pack.



2.2 – Working with this teaching pack

The teaching pack contains **two consecutive lessons**.



In the **first lesson**, the pupils discover that mobile phones contain valuable **raw materials**. They explore the production chain from raw material to mobile phone. They discover that valuable and rare minerals are lost in a **stream of e-waste that is increasing** every year. They learn that repair is an option to avoid and/or reduce this waste flow.



In the **second lesson**, the pupils are introduced to various **characters** who all have their own relationship with mobile phones in their daily lives. The pupils place themselves in the position of these characters and examine their **points of view**. The pupils then express their own views on repairing mobile phones. Finally, they broaden their perspective on repair options for electrical and electronic devices and come up with relevant **ideas**.

In addition, the pack contains **three activity sheets**.



The pupils devise a campaign for repair (for language classes). The **campaign** is preceded by a survey.



The pupils prepare a **visit** to or from a **repairer**, or a visit to a Repair Café. The sheet contains sample questions for the teacher, assignments for the pupils to prepare the visit, as well as tips for reflecting on it afterwards.



During a mini workshop, the pupils disassemble a coffee machine to examine the flow of the water by identifying the component parts and reconstructing how they are connected. Then they reassemble the device. This type of assignment is called **reverse engineering**.

2.3 – Education for Sustainable Development in this teaching pack

The production, consumption and disposal of electrical and electronic devices is a complex global issue that affects almost everyone. The complexity of the issue is due to the fact that the whole chain touches on so many areas: the extraction of ever rarer raw materials and the associated pressure on ecosystems and social conditions, as well as ever-increasing production, consumption and waste stream.

Almost every young person will own or use a mobile phone or some other electrical or electronic device, so there is no doubt that this issue concerns every one of them. This means that, as a teacher, you are addressing an issue that every young person will recognize or relate to. Because of this sense of **involvement**, as well as the **complexity** of the issue, this is a great opportunity to create an interesting and challenging learning environment.

Reconsidering the complex chain from extraction to waste according to the model of the circular economy and stimulating young people to consciously choose repair or other sustainable actions with regard to electrical or electronic devices, requires a specific approach. It is not enough simply to transmit existing knowledge about the issue.

The teaching pack focuses on **doing, thinking and dialogue**.

The lessons challenge pupils by asking them to engage with **critical thinking questions** about the subject. This helps them not just to acquire insight, but to practice the critical thinking skills that can aid them to make **conscious choices** on sustainability issues. In the first lesson, for example, the pupils analyse the chain from raw material to mobile phone. By confronting them with critical thinking questions, the teacher challenges the pupils to reflect on the events and impact within the various stages in the chain.

Interaction with other perspectives, for example those of other pupils in class or fictitious characters, helps the pupils to confront their existing knowledge about mobile phones with other insights or ideas. In the second lesson, they are introduced to diverging perspectives on mobile phones. How do different characters, both here and across the world, regard the repair of mobile phones? What role do these devices play in their personal and professional lives?

The pupils compare possible opinions and listen to other arguments. The repair of electrical and electronic devices is a subject that different people view differently. This kind of dialogue offers pupils the chance to use, enrich and expand their knowledge.

The critical thinking exercises, dialogue with other pupils in class or interaction with other perspectives can help pupils to consciously choose to repair electrical and electronic devices.

To give the pupils **self-confidence** in their own impact on society, they are stimulated in the second lesson to come up with activities that will, directly or indirectly, contribute to the repair of electrical and electronic devices. This will make them **competent for action** and help them experience that their choices can make a difference.

The activity sheets offer opportunities to work actively on repair, either by disassembling a device, devising a campaign or closely observing a repairer at work.

Finally, conscious choices for repair also depend on personal characteristics, values, ideology etc. The teaching pack contains many opportunities to ask pupils about theirs and to reflect on their answers.

2.4 – Visual support

The lessons contain stock photos that can be used during class. If you prefer to use alternative images, you can find high-resolution stock photos for free on online image archives such as www.pixabay.com or www.pexels.com.

2.5 – EAL pupils

This teaching pack contains specific vocabulary relating to electrical and electronic devices and the circular economy. New terminology is often introduced by instructions, critical thinking questions, articles and videos. In addition, the pack contains group assignments. We have a few tips for working with EAL pupils and/or pupils with weak language skills:



TIP 1

Before class, print a word wall with images and display it visibly in the classroom. Go over key words with the pupils before you start an assignment or read an article, and make sure everyone understands what these words mean.



TIP 2

Ask the pupils to familiarize themselves with a text or video in small groups or beforehand at home. Form heterogenous groups or pairs to ensure that pupils with strong language skills read the text or help the other pupils.



TIP 3

Create visual references for class or group assignments on the blackboard using drawings, sketches, mind maps, pictograms etc. Write down arguments, ideas or key terms on the blackboard so that all pupils can understand the assignment.



TIP 4

Help pupils to give their own opinion or question each other's views by giving them a few examples of how to start a sentence.

- > In my opinion, ...
- > I think that ...
- > This makes me feel ..., because ...
- > I agree/don't agree, because ...
- > What do you think?
- > Do you agree? Why/why not?



TIP 5

Help pupils with their writing assignments by giving them a few examples of how to start a sentence, for ...

... writing a report:

- > This is about ... I knew ...
- > I have learned that ...
- > I also learned that ...
- > In addition, I found out that ...
- > Lastly, I learned that ...

... comparing similarities and differences:

- > The ... is just as ... as ...
- > The ... is similar to ..., because ...
- > The ... is not the same, because ...
- > The ... and the ... differ from each other, because ...
- > Lastly, they are both ...
- > Although a ... and a ... are different, there are similarities. For example, they both ...

... giving your opinion:

- > In my opinion, ... because ...
- > I think that ..., because ...
- > My view on ... is that ...
- > I have a number of arguments to back up my opinion. First, ... Second, ... Third, ...
- > I agree with ..., because ...
- > I don't agree with ..., because ...

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Editors

Sabine Anné, Bram Speleman

Design

Toast Confituur Studio

© 2023 / Djapo

Djapo vzw
Ortolanenstraat 6
3010 Kessel-Lo
Belgium
+(32) (0)460 95 71 01
info@djapo.be
www.djapo.be

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our partners, Repair&Share, Maakbaar Leuven and the municipalities of Apeldoorn and Roeselare for their expertise on the subject and their feedback.



België
partner in ontwikkeling



Apeldoorn

REPAIR
& SHARE



VLAAMS-
BRABANT



Vlaanderen
verbeelding werkt



leuven



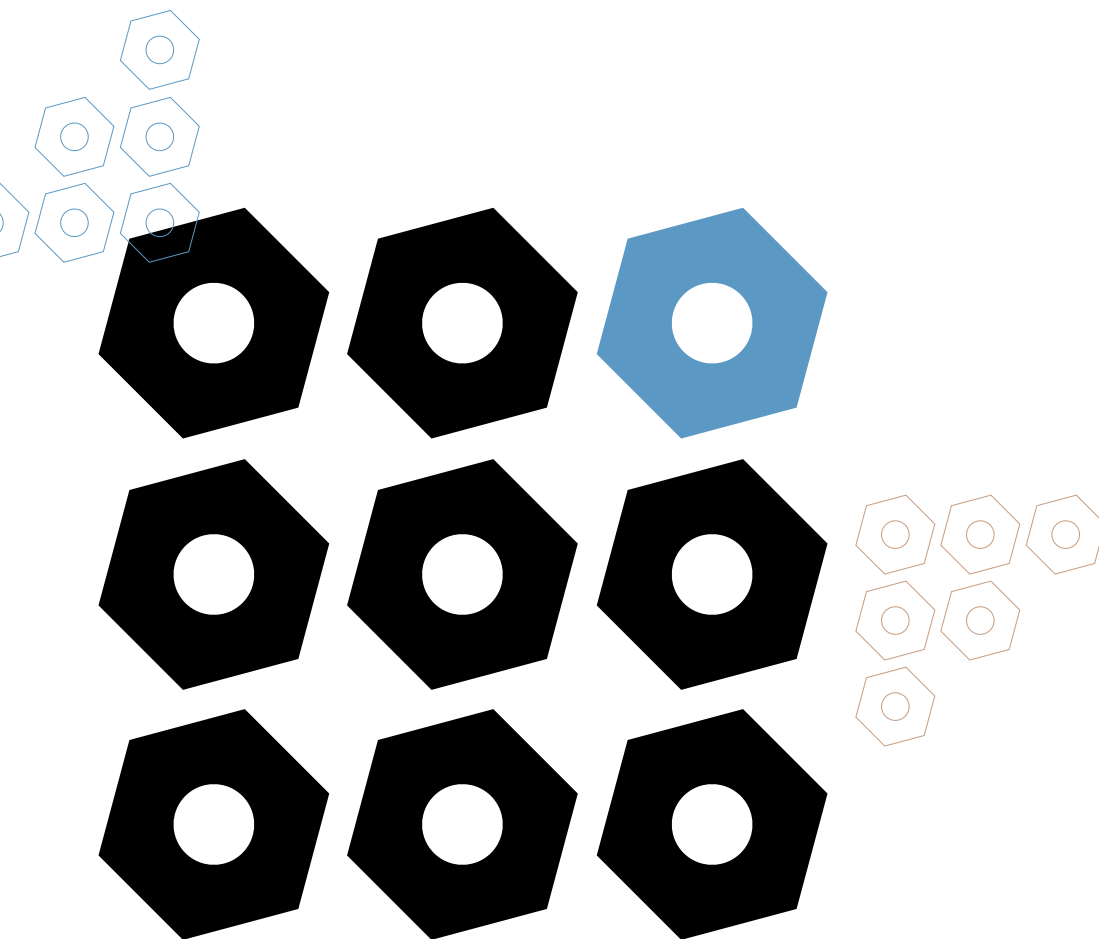
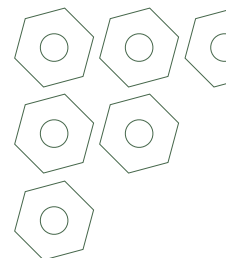
ROESELARE
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YOUR MOBILE PHONE'S A GOLD MINE!

TARGET AUDIENCE 10 to 12 years



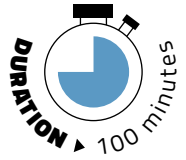
SHORT SUMMARY In this module, pupils discover that mobile phones contain valuable raw materials, and that these are lost in the stream of e-waste that is increasing significantly every year. They learn that repair is an option to avoid and/or reduce this waste stream.

REQUIRED PRIOR KNOWLEDGE Pupils know what raw materials are and are able to give a few examples.

MAKE IT WORK! LESSON 1



YOUR MOBILE PHONE'S A GOLD MINE!



MATERIALS REQUIRED

- › Bring a few broken or malfunctioning electrical and electronic devices, for example a broken bicycle light, a faulty hairdryer, a smartphone with a broken screen, a jammed toaster or printer, etc.
- › A disassembled old mobile phone or smartphone
- › Cards with texts 'From raw material to mobile phone' (appendix 1)
- › Cards with titles 'From raw material to mobile phone' (appendix 2)
- › Raw materials word cards (appendix 3)
- › Photo of a smartphone (broken or working) and e-waste mountain (appendices 4a, 4b, 4c)
- › Blank cards with a question mark (one for each student pair)
- › Optional: a few bits of string
- › A big flip chart
- › Red and green markers

PREPARATION

- › Read the background information attentively. This text gives you the what, why and how of the subject and the didactic knowledge and insights you need to work with this module.
- › Ask pupils in advance to bring a number of broken or faulty devices with them to class (see under Materials required). If you do this, give them a note to bring home for their parents to consent to the possible disassembling of the appliance during class, warning them that the devices may be returned in worse state. Also ask them to describe what is wrong with the device.
- › Consider bringing an old mobile phone yourself to disassemble. YouTube has several tutorials on this, both for older models and for smartphones. Use the search terms 'teardown + brand and model'.
- › Optional: place the bits of string beside the mobile phone.
- › Print the word cards (appendix) and cut them out.

BRIEF LESSON PLAN

1. Stimulus

Pupils observe and explore devices on a theme table.



2. Core

2.1 From raw material to mobile phone

- › Pupils watch a video on the raw materials in mobile phones.
- › Pupils name valuable raw materials in mobile phones.
- › Pupils explore the production chain of mobile phones.



2.2 The consequences of e-waste

- › Pupils watch a video on e-waste in Ghana.
- › Pupils summarize the content on the basis of question words.
- › Pupils explore the consequences of e-waste using the Siamese caterpillar.



2.3 The importance of repair

- › Pupils use a whiteboard diagram to explore how repair avoids or reduces the growth of e-waste.

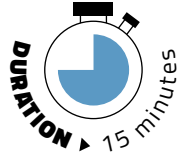


3. Conclusion

Pupils recap the lesson and write down on a post-it why repair is sensible.



LESSON PLAN



1 – STIMULUS

Place the old, malfunctioning or discarded electrical and electronic appliances – but not the disassembled smartphone – on a table. Ask the pupils to join you around the table.

What is the general word for these items?

- > Electrical and electronic devices

Ask the pupils to observe and/or pick up the devices and identify the problem (to the extent that this is visible) and/or show it to the group.

What electrical and electronic devices are there on the table?

Why aren't they in use anymore?

- > The battery of device X goes flat very fast.
- > The latest software doesn't run on the laptop.
- > The toaster doesn't get hot anymore.
- > There is a burning smell if you switch on the hairdryer.
- > etc.

Write down the problem on a post-it and stick this on the device.

What do you do with a broken device?

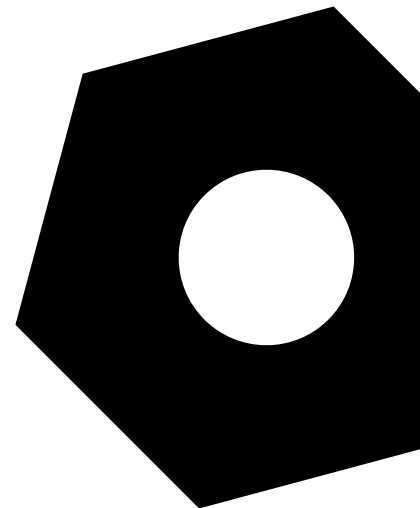
- > Bring it to the recycling centre
- > Bring it to a charity shop
- > Throw it away
- > Repair it
- > Keep it somewhere at home
- > etc.

What type of electronic device do people buy/replace very often?

- > Smartphones

Show the class a broken or used smartphone and the disassembled version. Ask the pupils to take a brief look at the loose parts. Explain to them that they will be learning about the materials and the production of the parts.

Ask the pupils to return to their seats.



2.1 – From raw material to mobile phone

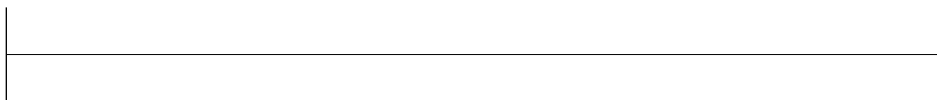
Tell the pupils that they will discover during this lesson that a huge number of electrical and electronic devices are turned into waste, and what this means for people and the environment. Explain that you could examine many types of devices, but that they will be focusing on one of the most-used and most-discarded electronic devices: smartphones.

Ask pupils if they know what materials mobile phones are made of. Consider writing down a few raw materials on the whiteboard.

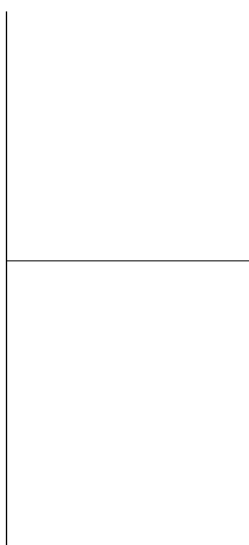
Then show them a clip from a video that explains what valuable and rare raw materials smartphones contain.

Ask the pupils to watch and listen carefully. Then divide them into pairs, give each pair the question they are to keep in mind while watching the video, and an empty sheet with a question mark for them to write their answer(s) on.

What raw materials do mobile phones contain?



Summarize the video in class and write down the different parts of a mobile phone on the whiteboard. Hang the word cards with the raw materials beside this on the whiteboard.



VIDEO

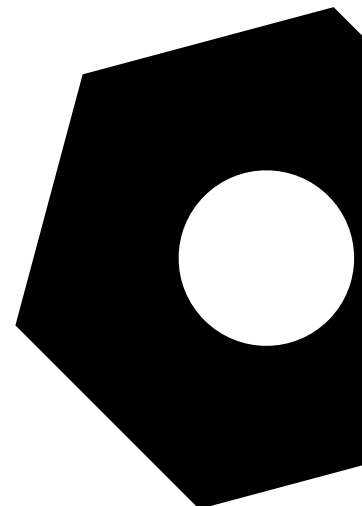
Show the class part of the video 'What's a smartphone made of?' (TED-Ed from 0 to 0m 42s, including a transcription) or What is a Smartphone made of? (Mining2Me from 0 to 0m 27s)

The TED-Ed video shifts focus after this to the ecological and social impact of the production and disposal of smartphones. This information is not necessary at this stage of the lesson, but you could consider showing it at a later point or after the second lesson of this pack.



TIP

Alternatively, visually link raw materials to the corresponding parts of a mobile phone on the table by arranging a piece of string from the old, broken or disassembled mobile phone to the word card with the raw material in question.

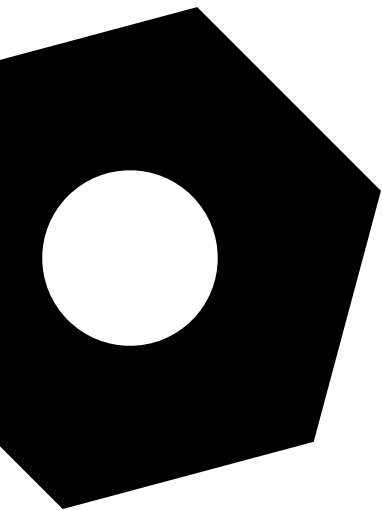


What raw materials are the parts of a mobile phone made of?

> Gold, silver, tin, copper, etc.

What valuable raw materials have you heard of before?

Gold, tin, silver, etc.



Where do these raw materials come from?

These raw materials come from various types of mines across the world.

Explain that you are now going to explore together how smartphones are made.

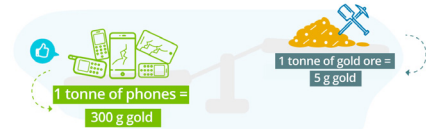
Divide the pupils into groups of six. Give each group six cards with information about the production chain, from raw material to mobile phone (appendix 1). Ask every pupil to read their card silently, and then place the cards in the right order, matching the titles (appendix 2).

Write down the titles of the chain on the whiteboard. Complete the chain in class by writing several key terms under or near the titles.

TIP

Include information about the cost of gold and the number of grams of gold per mobile phone in your mathematics lesson.

How many phones would you need to make up a kilo of gold? How many loaves of bread, trousers, etc. would you be able to buy with a kilo of gold?



© Recupel

Read more on this topic in '[Your old phone is full of untapped precious metals](#)'.

TIP

Find the various stages and corresponding images to show in class on [The Restart Project](#) website.

What information belongs to stage ...? What is this about?
 Discuss briefly in your own words.

Land and people	Mining	Making parts	Production	Waste	Recycling
<ul style="list-style-type: none"> > Cobalt > Mines > Unsafe > Low wages > Residents removed 	<ul style="list-style-type: none"> > Mining > Harmful > People and animals > Shortage of drinking water 	<ul style="list-style-type: none"> > Processing > Health hazard > Graphite in China 	<ul style="list-style-type: none"> > More than 2 billion/year > China and Vietnam > Dangerous work > Fairphone 	<ul style="list-style-type: none"> > 318 stadiums > 16 kg pp > Design > Waste mountain 	<ul style="list-style-type: none"> > Battery > Complex > A lot of energy > Improved techniques

What stage or information surprised you? Why?

Then explain briefly that you have been talking about mobile phones, but that the same applies to other electrical and electronic devices.

Can you think of examples of any other devices?

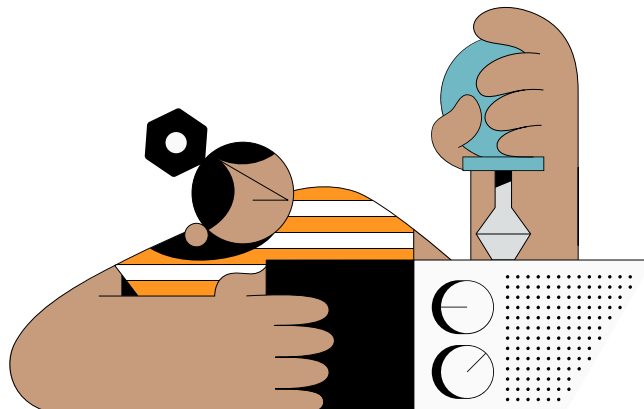
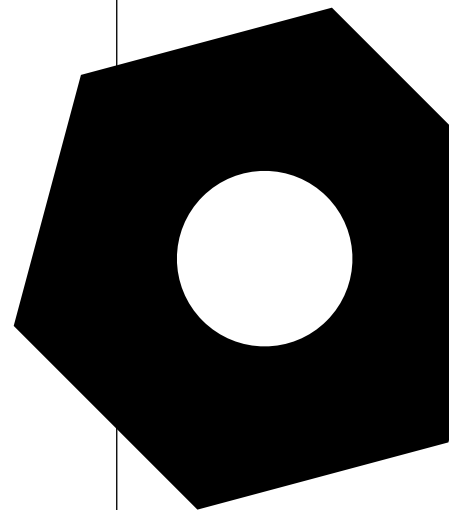
These devices contain other, but equally valuable and rare materials that are extracted from mines across the world. The demand for these raw materials continues to grow, for instance for lithium, which is used in the batteries of electric vehicles.

Are all broken or unused mobile phones thrown away? Explain.
 Not all, but still too many electrical and electronic devices are thrown away.

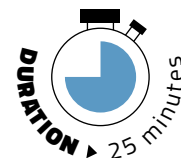
Where do they go when they are thrown away? What happens when people across the world throw away many old, unused or broken mobile phones?

- > In the recycling centre, in the rubbish bin, kept at home, dump sites (fly tipping), incinerator, etc. The volume of waste grows and a waste mountain is created.
- > New raw materials have to be mined.

What do you call waste that is made up of electrical devices?
 E-waste



2.2 – The consequences of e-waste



2.2.1 – E-waste in Africa

Explain that you are going to watch a video on e-waste together. Write the question words 'what', 'where', 'how', 'who', 'when' on the whiteboard and assign them to a number of pupils. Make sure that no two neighbours have the same question word.

Then watch a clip from the video on dumping e-waste in Africa. Ask every pupil to come up with a question about the video and write it down. The question must be related to the problem of electronic or electrical waste.



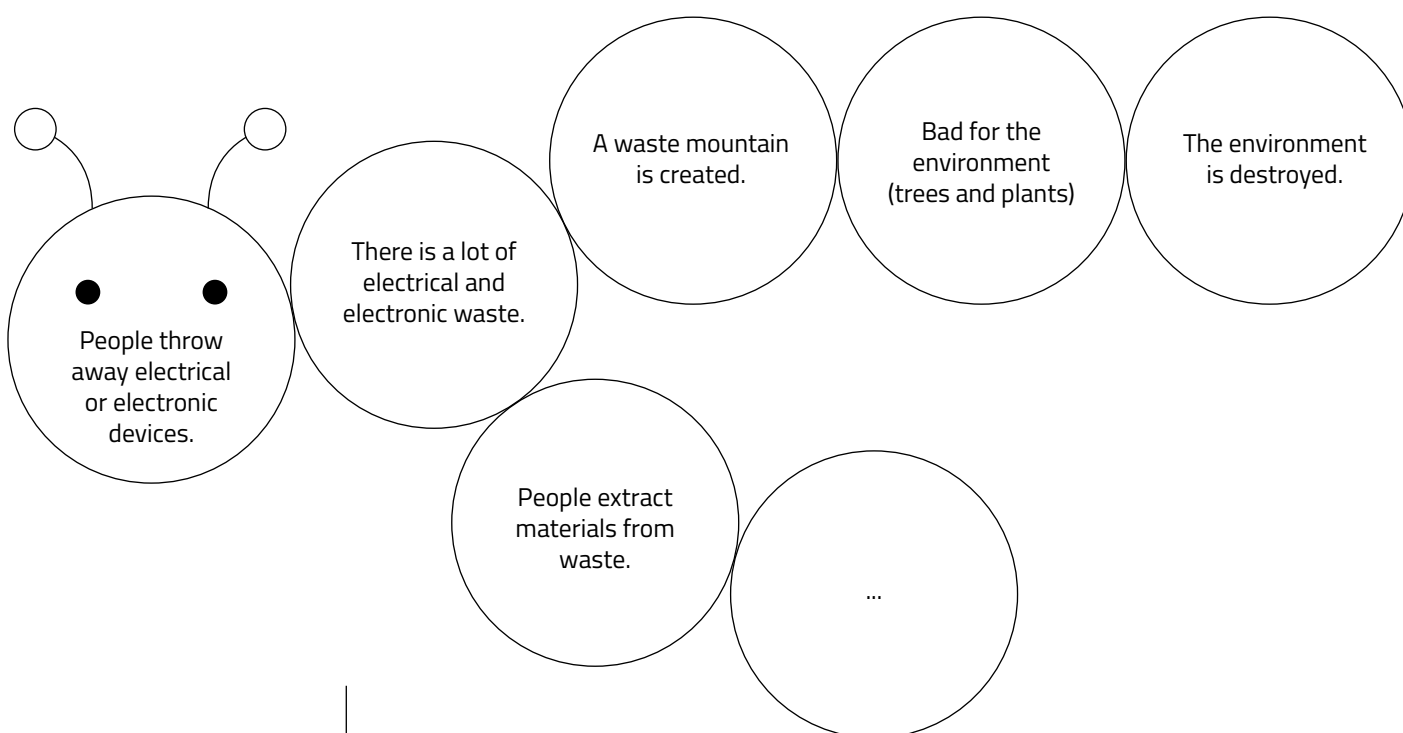
VIDEO

Video on e-waste in Africa
(Making a living from toxic electronic waste in Ghana - BBC).
Select a few clips from this video to watch together.

After watching one or more clips, every pupil writes down a question individually. Then the pupils pair up and exchange their questions with their partner: one pupil asks the question, the other responds. Afterwards, they choose a third question word together and think of a new question.

Go over the question words. Invite one or more pupils to ask a corresponding question and another pupil to respond. Ask a number of pupils to summarize the video on the basis of questions and answers.

Then examine the consequences of the growing e-waste mountain together, using the 'Siamese caterpillar'.



2.2.2 – Examining the consequences using the Siamese caterpillar¹ (© Djapo)

Write the initial situation on the left of a flip chart. Draw the head of a caterpillar around it.

The initial situation is: 'People throw away electrical and electronic devices.' Then ask: 'What happens when people throw away electrical and electronic devices?' Write the consequence to the right of the caterpillar's head and draw a circle around it.

Repeat this step a few times: think of a consequence of the previous consequence. Thinking of consequences amounts to examining the chain reaction that the situation has (or may) set in motion.

Go over the chain of consequences in the caterpillar together. Check whether there are any second or other consequences that you can think of for any circle. Write down the second consequence above or below the circle and draw another circle around it. Reflect on the consequence in the new circle and create a second branch, turning the caterpillar into a 'Siamese caterpillar'. Carry out the same procedure for one or more other consequences elsewhere in the caterpillar.

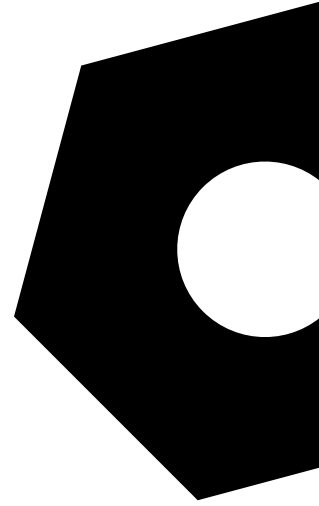
Colour or mark the positive consequences in green, and the negative consequences in red.

Which consequences are negative and which are positive? Explain. Which consequences are more frequent: the negative or the positive?

Reflect

- > Which consequences had you expected? Which had you not expected? Which consequences affect you? Why?
- > What broken electrical or electronic device have you, or someone else in your family, ever thrown away? What would you like to happen to this device?

Explain that there are several ways of reducing or avoiding electrical and electronic waste.



TIP

- > Keep this flip chart so that the pupils can review it at the end of the lesson. This flip chart also contains subject matter for the second lesson of this pack, or can be a stimulus for further inquiry. You could make a new caterpillar after the second lesson, for example, and examine the consequences of the situation 'Electrical and electronic devices are normally repaired'.
- > If there are too many branches, consider drawing a new caterpillar starting with a branch of the first caterpillar. Or ask the pupils to make a caterpillar of consequences themselves in pairs or groups.
- > You are practising 'examining consequences'. Regularly repeat the term 'consequence' and the accompanying question 'What if ... ?' Explicitly mention the steps that must be taken between two circles, by saying 'If ... then ...', or ask the pupils to repeat this sentence. You could also consider approaching the issue from the other end once or twice, by asking 'Why is this?' and identifying the response as a cause. This helps the pupils to reflect explicitly on their thinking process.

¹ - The Siamese caterpillar formula is part of Djapo's Systems Thinking method. Systems thinking helps students to explore our complex world by consciously looking for connections. It helps them develop a nuanced perspective on the world, and to remain alert to the various points of view in any story. This helps them to defer judgement before adopting an opinion, and to gain greater insight into complex themes. For more information about systems thinking, visit www.djapo.be

2.3 – The importance of repair

Show the devices to the pupils again.

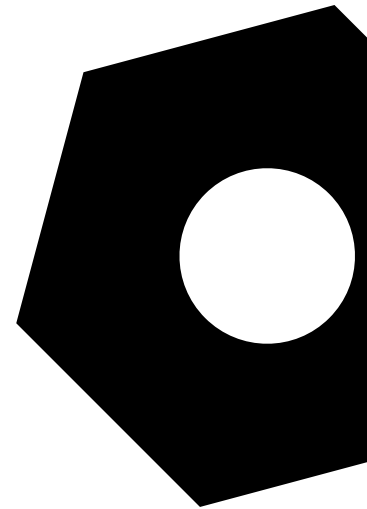
Place the disassembled mobile phone, an old, unused mobile phone and another broken electronic device in the centre. Move the other broken devices to one side of the table.

What happens often to old mobile phones and other devices that aren't used anymore or that are broken?

They are thrown away. Worldwide, millions of mobile phones and smartphones are thrown away every year without being recycled.

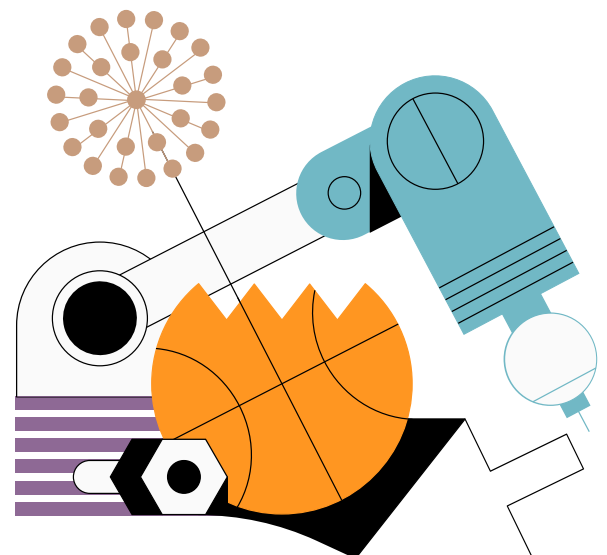
- > What do you think of the huge e-waste mountain that is created every year and that keeps growing?
- > Why are mobile phones so valuable?

Point at the old mobile phone in the middle. You could consider adding the raw materials word cards.



Take the printed photos (appendices 4a, 4b, 4c) of the smartphone, broken smartphone and the waste mountain or prepare them for display on screen. Hang or display a photo of a broken smartphone in the middle of the whiteboard. Hang the word cards with the raw materials underneath, and a photo of a waste mountain to the left. Write 'e-waste' above it. Hang or display a photo of a smartphone to the right of this.

Study the diagram together with the pupils to explore why repair is an important option.



1 – Why is there a waste mountain?

There is a waste mountain because so many old or broken electrical and electronic appliances are thrown out.

Draw a red arrow to the left, from the broken mobile phone to the mountain.

How can we ensure that old, broken mobile phones, etc., don't end up on this waste mountain?

2 – One option is to take the raw materials out of the mobile phones and recycle them.

Draw a green arrow to the right, from the broken mobile phone to the working mobile phone.

What can you do with a device that is broken, isn't working or working properly anymore? We want to prevent mobile phones ending up on a waste mountain.

Draw an X over the mountain of waste.

3 – You can repair a mobile phone or other device, or have it repaired.

So how can we reduce or avoid the waste mountain?

- > By recycling or repairing broken mobile phones and other electronic devices
- > By buying a second-hand mobile phone or by selling our own
- > By donating it to a charity shop or to a good cause (collection campaign)
- > By giving it to someone else in your family
- > Buying a refurbished mobile phone or tablet is another option.

Write these words below the mobile phone in the middle.

What does 'refurbished' mean?

Refurbished means that an older model of mobile phone has been checked and old parts have been replaced by new ones, such as the battery or the screen etc. The supplier of a refurbished mobile phone also gives a warranty.

What other things can you do to reduce the size of the waste mountain of mobile phones or electronic devices? The waste mountain is made up of a huge pile of mobile phones that used to work. Or of coffee machines or hairdryers etc. that used to work. How do you reduce the number of electrical or electronic devices?

- > By buying fewer or no devices or asking for fewer or none as presents: by refusing them.
- > By reusing them, for instance by buying them second-hand from someone. You could share a device by using a tablet or game console together with your brother or sister. You could also share a device you don't use very often with a neighbour, for example lawn mowers, raclette sets, etc.

Write the children's ideas to the left of the old mobile phone. Explain to them that if fewer devices (including mobile phones) have to be made, fewer will be thrown out. Tell them that dumping electrical or electronic waste is the last available option you have.



TIP

The children may mention arguments against, or thresholds for sharing or passing on mobile phones, etc., such as quality warranty, privacy. This could be the beginning of an interesting conversation: what is more important when you are buying a smartphone: the price, quality, sustainability, the status that a new model gives, privacy, etc.?

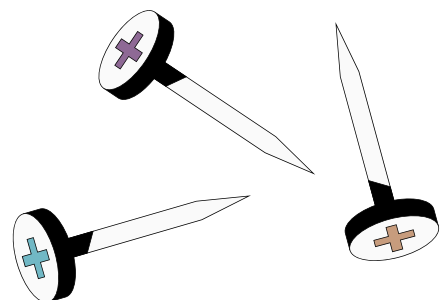
Additional information on removing personal data

If you are donating your old or broken mobile phone, laptop or other electronic device to a second-hand shop, you should wipe all personal data and/or restore the device to factory settings. Some second-hand shops and other organizations will use special programs to wipe all personal data themselves.

But recycling should always be a last resort because it is such an energy-intensive process and most of the materials (including most critical raw materials such as gallium, tantalum etc.) are not recovered.

Read more on:

- > Recycle.more.co.uk
- > [Recycle your electricals](#)



3 – CONCLUSION

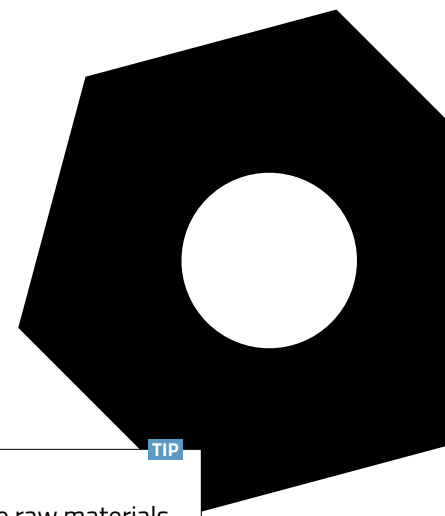


Give every pupil a post-it. Ask them to write their initials on it as well as an answer to the following question: *why is repairing mobile phones (and other electrical and electronic devices) important?*

Ask them to write legibly so that a fellow pupil can read their thoughts or opinion (see Stimulus in lesson 2). Ask them to briefly share their opinions on this.

What is your view on repairing mobile phones or other devices?

Collect the post-its and identify subsequently what insights the pupils are taking from the lesson. Keep the post-its to jog their memories of these insights again during the second lesson.



TIP

You could limit the raw materials word cards to gold, tin, cobalt and lithium, for example.

BACKGROUND INFORMATION

Electrical devices are simple devices that run on electricity and can often be **switched on** using a power switch, such as blenders, heaters or simple coffee machines. They usually have a **single function** that is operated exclusively by electrical components such as a power supply, a cable and a motor.

Electronic devices are **controllable** devices that often have **multiple functions**, for example smartphones or coffee machines with settings for one or more cups. They are operated (at least partially) by electronic components such as a **circuit board**, a diode and a capacitor.

ADDITIONAL ACTIVITY

If you want to delve more deeply into the impact on working or living conditions for the people who mine raw materials, or residents in the vicinity of mines, then visit the website of [ABC News](#). Read more information about child labour in the Democratic Republic of Congo [on the website of Unicef](#).

You could extend this lesson with one or more extra activities:

- › Activity 1 – A repair survey or campaign
- › Activity 2 – Having a repairer over/visiting a repairer
- › Activity 3 – Roll up your sleeves! Mini workshop: the flow of water in a coffee machine.

Ask the pupils to look up the countries or continents where mining takes place in an atlas.

FROM RAW MATERIAL TO MOBILE PHONE

TEXT SHEETS

Cut out the text sheets and give one to every pupil. Create groups of six pupils, ensuring that every pupil has a different sheet.

A smartphone or mobile phone contains various raw materials that come from mines under the ground. One of these materials is cobalt. Cobalt is used in batteries. Most of the cobalt used in batteries comes from Democratic Republic of Congo in Central Africa.

In some places, children are forced to work in mines. Sometimes, the owners of the mines remove the local residents from their land.

The mines create jobs for the population, but the work is not always safe and often poorly paid.

Extracting or mining raw materials can be harmful both to ground water and to the soil. Mining changes the environment in which people and animals live. Mining sometimes pollutes drinking water and crops.

Lithium is used in the batteries of mobile phones. It is mainly recovered from water under the salt flats in Argentina, Bolivia and Chile. The water is pumped into basins and left to evaporate in the sun. This makes it difficult for local residents and animals to find drinking water.

Raw materials are used to make parts for mobile phones, for example the screen, the battery or the casing.

To make these parts, the manufacturer must first clean the raw materials, heat them and then assemble them. Some of these materials are bad for people's health, and producing them can therefore be dirty and dangerous.

The batteries of mobile phones often contain the raw material graphite. Working with graphite is a dusty business. If the workers cannot dig safely for graphite, their work damages their health.

People near a graphite mine in North-East China discovered that they were falling ill more often and that the trees had stopped growing.

Smartphones that cannot be repaired will become electronic waste.

According to the UN, we discard 53 billion tonnes of electronic waste worldwide per year. That is enough to fill a big sports stadium 318 times over. Europeans throw out the most devices: 16 kilos per person per year.

We could prevent this waste by designing devices better. For instance, manufacturers could make them easy to take apart without breaking them.

If we make devices easy to repair, reuse or recycle them, they will end up less frequently on the waste mountain. Fairphone is one example of a phone that can be repaired easily.

Approximately 2 billion smartphones are made in factories every year: sixty per second. These phones are mainly made in China, but also in other countries such as Vietnam.

Mobile phone parts are usually assembled manually. In some factories, workers have to work in unsafe conditions and for longer periods than permitted by law.

Fairphone is a smartphone manufacturer that provides a safer, pleasant working environment and a fair wage.

Recycling raw materials from old or broken phones means that they can be used again. The good news is that we are increasingly able to recycle raw materials in batteries.

Recovering raw materials from electronic devices is complicated and costs a lot of energy. Companies worldwide are working on new and better technologies to recycle phones.

Source: <https://materialsmatter.eu/>
This website was created as part of the REFER project, with the support of the European Institute of Innovation and Technology, in a European partnership in which The Restart Project is a participant. <https://therestartproject.org/about/>

FROM RAW MATERIAL TO MOBILE PHONE

WORD CARDS

Land and people

Mining

Making parts

Production

Waste

Recycling

FROM RAW MATERIAL TO MOBILE PHONE

RAW MATERIALS WORD CARDS

Valuable and rare resources

Gold

Tin

Silver

Palladium

Lithium

Neodymium

Lead

Copper

THE IMPORTANCE OF REPAIR

IMAGE FOR WHITEBOARD DIAGRAM



THE IMPORTANCE OF REPAIR

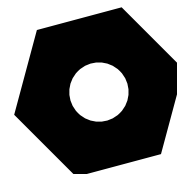
IMAGE FOR WHITEBOARD DIAGRAM



THE IMPORTANCE OF REPAIR

IMAGE FOR WHITEBOARD DIAGRAM





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Editors

Sabine Anné

Design

Toast Confituur Studio

© 2023 / Djapo

Djapo vzw
Ortolanenstraat 6
3010 Kessel-Lo
Belgium
+(32) (0)460 95 71 01
info@djapo.be
www.djapo.be

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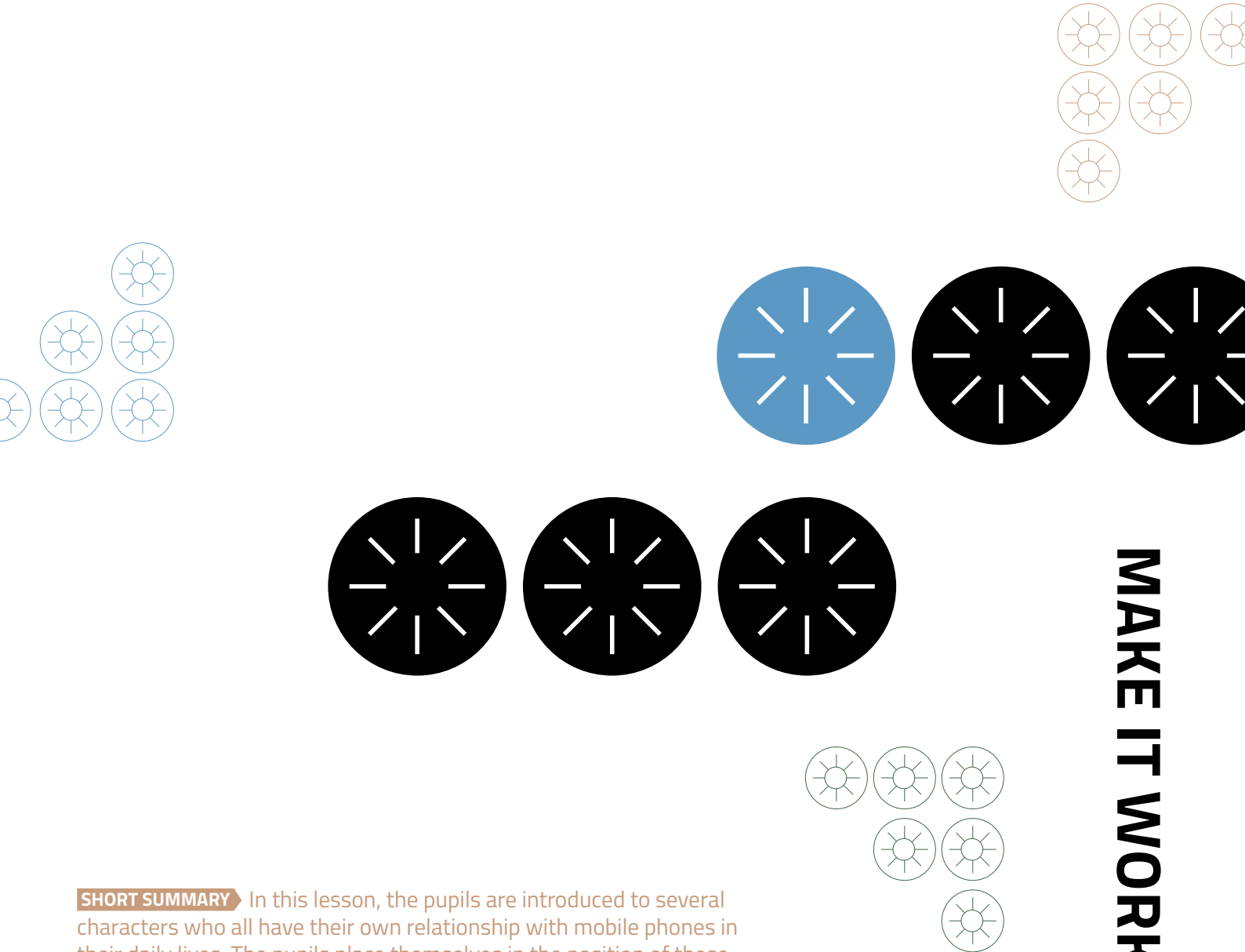
ROESELARE
le y voor jou



elijn
Ostinghes-Loozele-le-Neuve

REPAIR-MINDED

TARGET AUDIENCE 10 to 12 years



SHORT SUMMARY In this lesson, the pupils are introduced to several characters who all have their own relationship with mobile phones in their daily lives. The pupils place themselves in the position of these characters and examine their points of view. They then express their own views on repairing mobile phones. Finally, they broaden their perspective on repair options for electrical and electronic devices and come up with ideas for this.

REQUIRED PRIOR KNOWLEDGE The pupils know that the growing e-waste mountain is harmful for people and the environment. Electronic and electrical waste contains many valuable and rare raw materials. Repair is a sensible choice to avoid or reduce the growing waste mountain.

MAKE IT WORK! LESSON 2



MATERIALS REQUIRED

- › Appendix 1: sheets with characters (A different world)
- › Appendix 2: wheel of feelings
- › Appendix 3: word cards with 'with-the-aid-of' words and devices (Repair-minded)
- › A bowl for the 'with-the-aid-of' words
- › A marker for every pupil or a sticker sheet with dots (Dots)

PREPARATION

- › Read the background information attentively. This text gives you the what, why and how of the subject and the didactic knowledge and insights you need to work with this module.
- › Print the cards with characters (appendix 1) and cut them out.
- › Print the wheel of feelings, if possible on A3 paper (appendix 2)
- › Print the 'with-the-aid-of' words (appendix 3) and cut them out. Put them in a bowl. Consider adding your own words on blank cards.

BRIEF LESSON PLAN

1. Stimulus

Activate prior knowledge by using the post-its.



2. Core

2.1 A different world

- › The pupils are introduced to the characters.
- › The pupils move around the class and exchange opinions about smartphones in pairs.
- › Review and reflection.



2.2 Wheel of feelings

- › The pupils express their own feelings/opinion about repairing smartphones.



2.3 Repair-minded

- › The pupils choose a broken appliance and draw a 'with-the-aid-of' word from the bowl.
- › The pupils come up with an idea about repairing this appliance.
- › The pupils present their ideas to each other.



2.4 Dots

- › The pupils choose two ideas that are feasible.



3. Conclusion

Review and reflection



LESSON PLAN



1 – STIMULUS

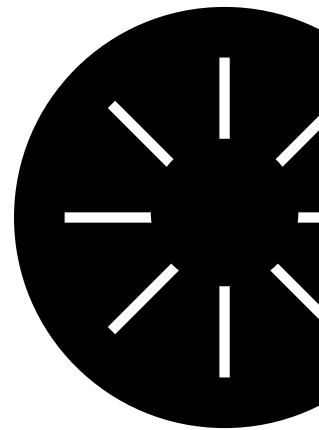
Hand out the post-its the pupils wrote at the end of the first lesson with their answers to the question: 'Why is repairing mobile phones (and other electrical and electronic devices) important?'

Every pupil gets another pupil's post-it. Ask them to split up into pairs and discuss the answers with each other.

Then discuss the answers in class and summarize.

- > If you throw these devices away, this creates more e-waste.
- > Waste from electrical and electronic devices is harmful for people and the environment.
- > If you repair electrical and electronic devices, no valuable raw materials are lost.
- > If you repair electrical and electronic devices, there is no need to mine for new raw materials.
- > Etc.

Conclude by observing that repair is an interesting choice if you have a broken electrical or electronic device. Tell the pupils that they will be exploring and suggesting different opinions on the use of, and ideas about the repair of electrical and electronic devices.



2.1 – A different world¹ © Djapo

What do different groups of people think about the use or production of smartphones?

Explain that this is the central question in this assignment. Write it on the whiteboard.

Place a smartphone in the middle of a table or show a picture of one on the whiteboard. Mention that it could also have been a laptop or any other appliance, but that the pupils will be thinking about smartphones today.

Give each pupil a sheet with one of the characters, each of whom has their own relationship to mobile phones. Give the pupils a moment to read the sheet. Then go over them. You could consider asking the pupils to invent other characters; in that case, write down the additional characters on a blank card.

What other people are involved in some way with this smartphone?

The pupils move around the class. At a sign from you, they stand together in pairs or groups of three, and discuss the following two guiding questions, which you write on the whiteboard. They should think and respond in character.

1. What is your relationship to smartphones?
2. What do you think about repairing smartphones?

¹ - The *A different world* formula is part of Djapo's Systems thinking method. Systems thinking helps pupils to explore our complex world by consciously looking for connections. It helps them develop a nuanced perspective on the world, and to remain alert to the various points of view in any story. This helps them to defer judgement before adopting an opinion, and to gain greater insight into complex themes. For more information about systems thinking, visit www.djapo.be

1. The battery of Hakim's mobile phone is broken. Buying a new battery is expensive, but buying a new mobile phone even more so. He doesn't have this kind of pocket money (yet). Hakim can't make up his mind whether he should have his mobile phone repaired or not.

2. Hakim's father receives the latest smartphone model from his boss every two years. He can do what he likes with his old smartphone.

3. Amina has a business of her own where she repairs smartphones and tablets. She's really good at changing batteries and repairing screens.

4. Peter works in a phone shop. The more smartphones he sells, the better his chances of getting a bonus.

5. Julia's parents both have a Fairphone. That is a smartphone made with respect for people and the environment. Moreover, users can easily replace parts, repair them or have them repaired.

6. Joshua collects valuable minerals from electrical waste on the waste mountain in Ghana. He uses the money to buy food for his family. The air around the mountain and the materials he works with are very unhealthy.

7. Mike is 10 years old and works in a mine every day to earn money for his family. He digs for cobalt. This raw material is needed to produce smartphones.

8. Robert has been passionate about technology since he was a boy. Every first Sunday of the month, he volunteers in a Repair Café where he repairs appliances. He often replaces smartphone screens or batteries.

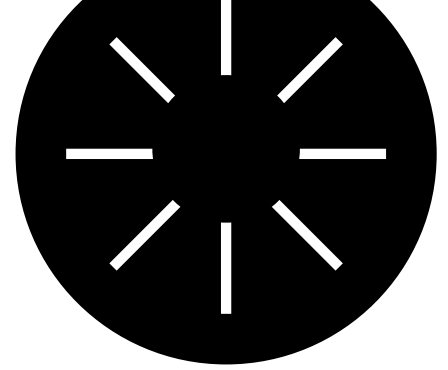
9. Sophie manages a company that grinds electrical and electronic devices into tiny shreds, recycling valuable raw materials from mobile phones for example. These materials are then resold to other companies.

Ask the pupils to return to their places. Briefly review the assignment.

What do the characters think about smartphones? Which characters do you think have the same opinion and which characters have different opinions? Why? Are there characters that might have conflicting views about smartphones? Explain.

Reflect

Do you recognize any of the situations we have just discussed? Have you experienced this yourself, or seen or read about it somewhere? Have your views on repairing smartphones changed after this assignment? If so, how?



2.2 – Wheel of feelings © Djapo

Tell the pupils that they can now express their own opinion or feelings about repairing smartphones. Show them the wheel of feelings (projected or a print version).

What are your feelings or thoughts about repairing smartphones?

The pupils write their names on a post-it. Then they write down why they think what they think or feel what they feel. They stick the post-it to the emoticon that best expresses their feeling.

Review the assignment briefly.

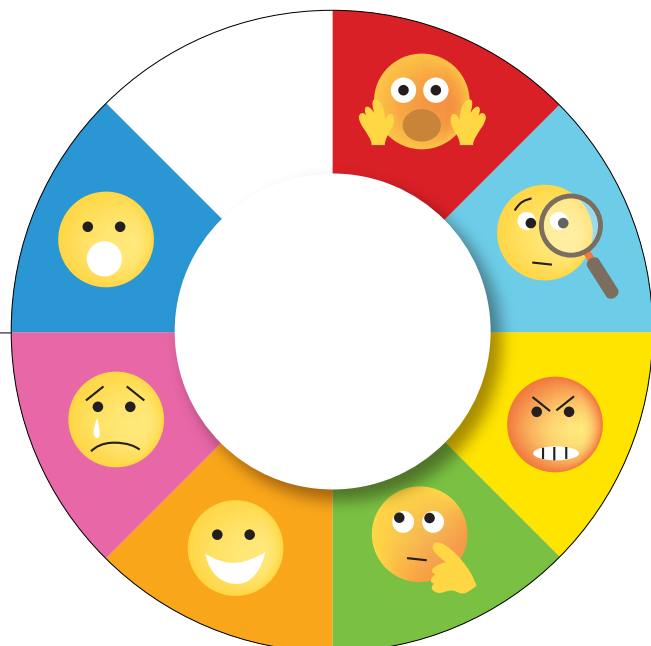
How do most of the pupils feel about this?

Enquire briefly about the reasons behind their opinion or feeling about the issue.



TIP

If any pupils have chosen the emoticon 'I want to investigate this further', or 'I have questions about this', let them write those questions down somewhere. You could consider discussing these questions later, during another lesson or assignment.





2.3 – Repair-minded

Ask the pupils to suggest ideas about how, where, when, etc. you can repair broken devices or have them repaired. Point to the table with the broken electrical and electronic devices with post-its on them explaining what the problem is. Take the bowl of 'with-the-aid-of' words.

Consider doing this assignment with the whole class first. As an example, choose 'a toaster' and the 'with-the-aid-of' word 'local area' from the bowl.

The orientation question is: 'How do you have this device repaired using the 'with-the-aid-of' word?

> How do you have the broken **toaster** repaired **locally**?

Possible ideas:

- > We'll try to find someone **locally** who can disassemble the **toaster**.
- > We're going to see if there is an electrical appliance stall at the **local** market.
- > We're going to ask for information in the **local shop** on whether the **toaster** can be repaired.

Tell the pupils their task is to suggest similar 'repair sentences'. Check to see that everyone has understood the assignment.

Divide the pupils into groups of four to six. Give every group a piece of paper. Appoint one pupil as spokesperson. At your signal, every group chooses a device and draws a card with a 'with-the-aid-of' word from the bowl. The pupils then suggest ideas on how to repair this device; these ideas must contain the 'with-the-aid-of' word so that a 'repair sentence' can be created.

The spokesperson writes down the device and the ideas on repair in a mind map. If possible, give the group access to the internet for further inspiration online.

Ask the spokesperson to write down the ideas legibly, because other pupils will have to read and evaluate them after the assignment.

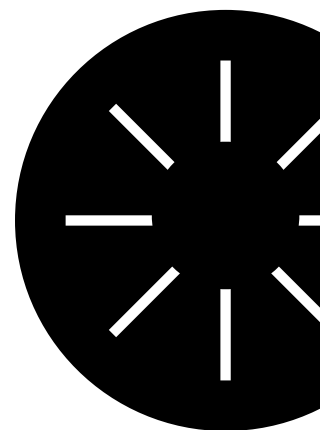
Move around the classroom to help the pupils with their flow of ideas.

What device have you chosen? What is wrong with it? Who can repair this or what would you need to repair it? Where or when? How can you find out about this? Who could help you with this? Where else would you find this device? Etc.

If there is enough time, repeat this with another device and 'with-the-aid-of' word.

At the end, ask every group to choose one idea that they are going to present to the class. The spokesperson draws or describes this idea on a new sheet of paper.

Let every group briefly present its chosen idea orally to the class. Collect the 'repair sentences' and hang or place them visibly in the class.



2.4 – Dots²

Tell the pupils they are going to choose ideas by placing a dot beside the idea of their choice using a marker. You could also use dot stickers from a sticker sheet for this. Give every pupil a marker.

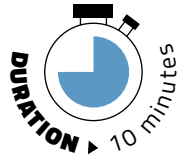
Explain the rules.

- > Choose two ideas that you think are good and practicable, i.e., that you think are good ideas that can be carried out, either by you or someone else.
- > Choose an idea, not the friend who came up with it.
- > Only choose ideas presented by other groups.

Review.

- > Which idea has the most dots? Why did you choose this idea?
- > Which other ideas have many dots?
- > Which ideas have fewer dots? Why?
- > Which ideas are innovative but difficult to put into practice?
- > Do you have any tips about how these ideas could be made more practicable?
- > What ideas would you like to try yourself?

2 ~ Inspired by ontwerpendlerenindeklas.nl



TIP

If there is time left after the assignment, watch one or more videos or clips about Repair Cafés or about repairing electrical and electronic devices.

Club de Reparadores Montevideo
Inside a London Repair Café

Find other suitable videos by searching for 'repair café', on YouTube for example.

3 – CONCLUSION



Reflect on the lesson together.

- > How would you describe what you've learned today in two sentences?
- > Have your knowledge and/or your ideas about repairing electrical devices changed compared to before these lessons? How?
- > What did you find most interesting to think or learn about? Why?
- > If an electrical or electronic device in your home were to break in the near future, what tips would you give your parents?

ADDITIONAL ACTIVITY

Check with the pupils whether one or more of the repair proposals can be put into practice. Ask them to draw up an action plan or do this together with them. Link this to an assignment on finding specific information from different sources.

You can extend this lesson with one or more additional activities:

- > Activity 1 – A repair survey or campaign
- > Activity 2 – Having a repairer over/visiting a repairer
- > Activity 3 – Roll up your sleeves! Mini workshop: the flow of water in a coffee machine.



DIFFERENTIATION

Read the character word cards together with pupils who have weak language skills before the lesson. You can also ask the pupils to read the word cards in pairs. Check to see that they understand all the words. Or ask them to choose a card that they are sure to understand.

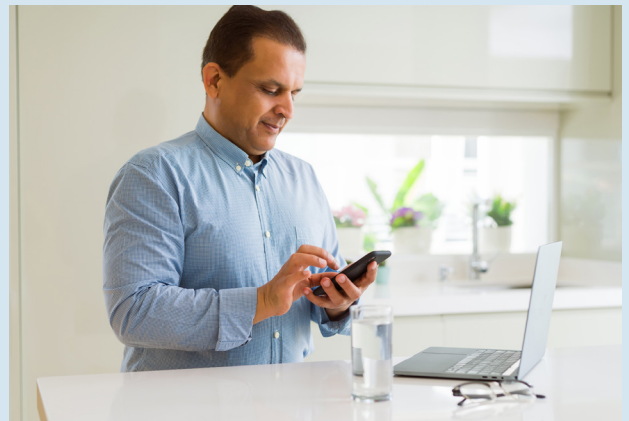
A DIFFERENT WORLD

CHARACTERS

Cut out the sheets. Give one to every pupil.



The battery of Hakim's mobile phone is broken. Buying a new battery is expensive, but buying a new mobile phone even more so. He doesn't have this kind of pocket money (yet). Hakim can't make up his mind whether he should have his mobile phone repaired or not.



Hakim's father receives the latest smartphone model from his boss every two years. He can do what he likes with his old smartphone.



Amina has a business of her own where she repairs smartphones and tablets. She's really good at changing batteries and repairing screens.



Peter works in a phone shop. The more smartphones he sells, the better his chances of getting a bonus.



Julia's parents both have a Fairphone. That is a smartphone made with respect for people and the environment. Moreover, users can easily replace parts, repair them or have them repaired.



Joshua collects valuable minerals from electrical waste on the waste mountain in Ghana. He uses the money to buy food for his family. The air around the mountain and the materials he works with are very unhealthy.



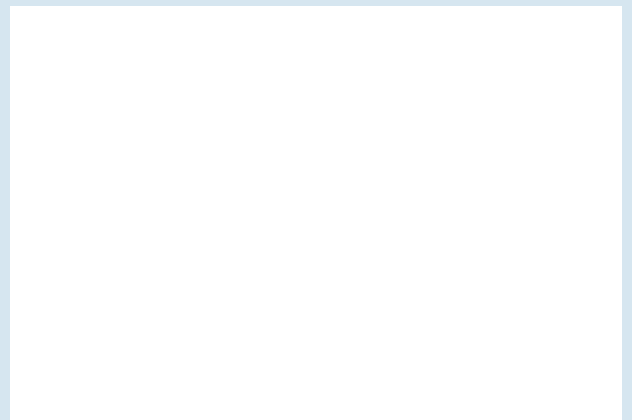
Mike is 10 years old and works in a mine every day to earn money for his family. He digs for cobalt. This raw material is needed to produce smartphones.



Robert has been passionate about technology since he was a boy. Every first Sunday of the month, he volunteers at a Repair Café where he repairs appliances. He often replaces smartphone screens or batteries.

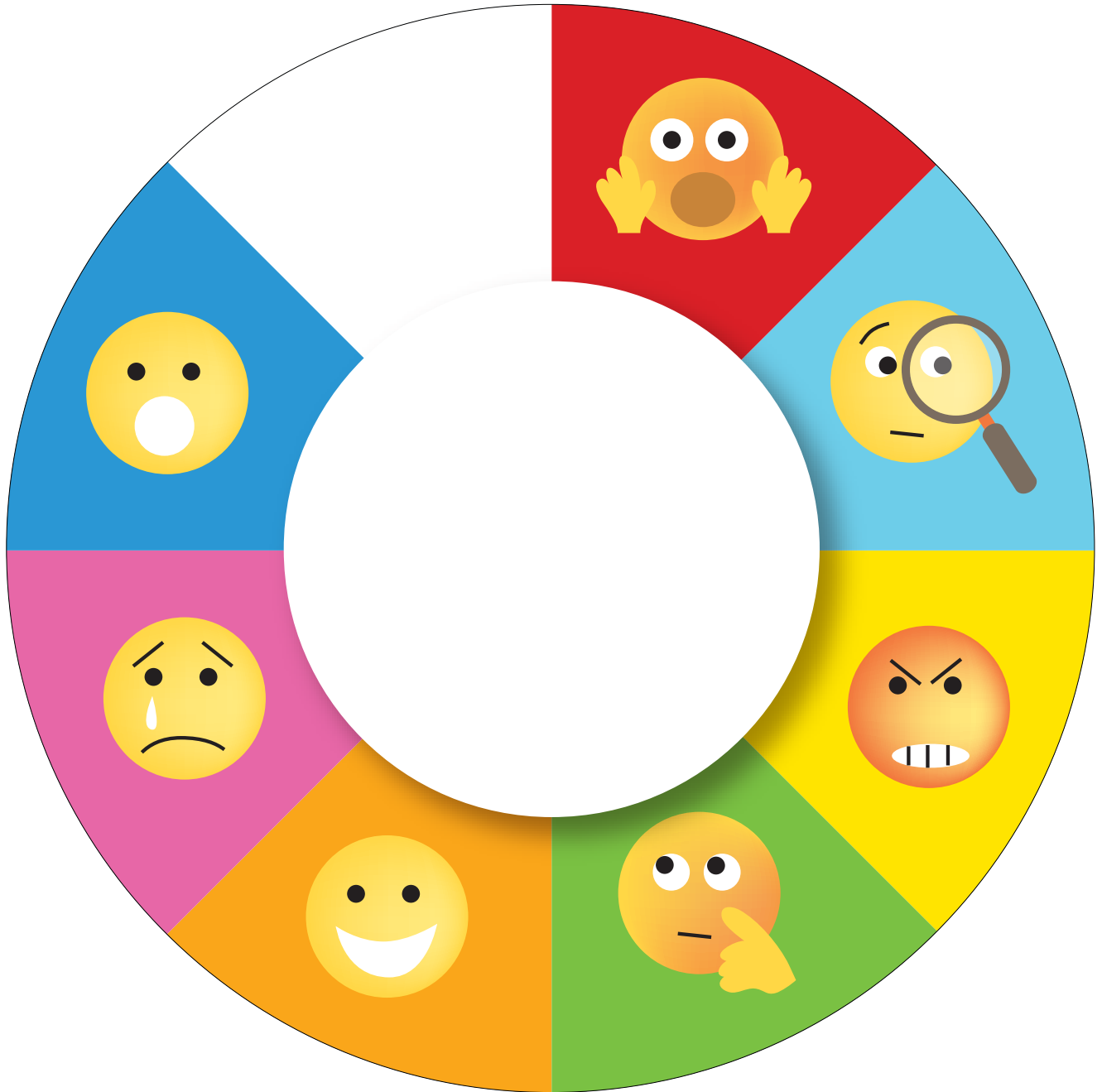


Sophie manages a company that grinds electrical and electronic devices into tiny shreds, recycling valuable raw materials from mobile phones for example. These materials are then resold to other companies.



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WHEEL OF FEELINGS

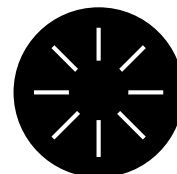


REPAIR-MINDED

'WITH-THE-AID-OF' WORDS AND DEVICES

Cut out the words. Place them in a bowl.

Local area	Market	Street	TV screen	Blender	Tablet
Grand-parents	Parents	Friends	Mobile phone	Vacuum cleaner	Waffle iron
City	Shop	Library	Toaster	Sandwich grill	Clock radio
Relatives	Letter	School	Nightlight	Hairdryer	Printer
Parents	Game	Competition	Headphones	Electric toothbrush	Phone charger
Poster	Torch	Book	Laptop	Record player	Microwave
Phone	Job	Internet	Desk lamp	Deep fryer	Wireless speaker
Shopping street	Repair Café	Mayor	DVD player	Dustbuster	Game console
Window drawing	Sticker	Company
Factory	Screwdriver	School rules			
Teacher	Manager				



ACKNOWLEDGMENTS

Editors

Sabine Anné

Design

Toast Confituur Studio

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Djapo vzw
Ortolanenstraat 6
3010 Kessel-Lo
Belgium
+(32) (0)460 95 71 01
info@djapo.be
www.djapo.be

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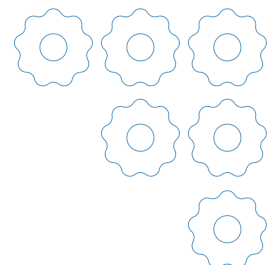
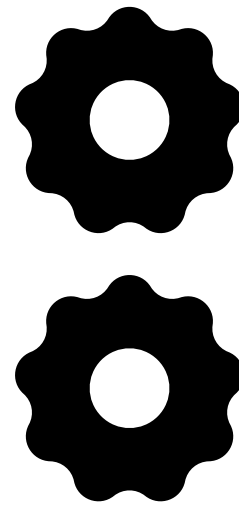
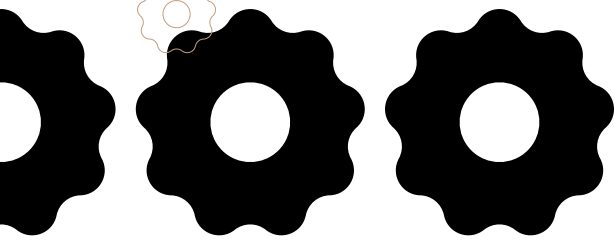
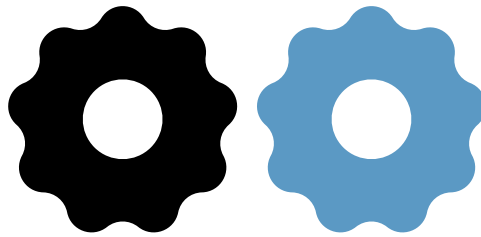
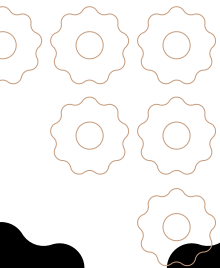
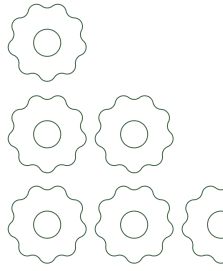


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Ostinghes-Loozele-le-Neuve

ACTIVITY 1

A REPAIR SURVEY OR CAMPAIGN

TARGET AUDIENCE 10 to 12 years



This sheet is part of the Sharepair primary education teaching pack on repairing electrical and electronic devices. It offers didactic tips to help pupils conduct a survey on or campaign for the repair of devices. The activities described here can be carried out at various stages of the lesson plan: as stimulus, introduction or additional activity.

PREPARATION

- > The background information in this document contains the discipline-specific and didactic knowledge and insights you need to prepare this activity.
- > Optionally, you could do assignment 2.3 from lesson 2 on the importance of repair together.

MAKE IT WORK! ACTIVITY 1



1 – Survey

Ask the pupils to prepare the campaign by carrying out a survey among one or more target groups, such as children, parents, the neighbourhood, shopkeepers, etc. First determine what the objective of the survey is. For example:

- > What does target group X think about repairing electrical and electronic appliances? What appliances has target group X ever repaired? Etc.

The pupils then suggest additional questions, either independently or with your assistance. You could help them by providing key words: the number of devices or dormant devices, knowledge about repair, information about repairers, opinions about repair vs. purchase, etc.

Ask them to present the results of the survey to the class and compare results. Display the findings of the survey visibly in the classroom and/or school.



TIP

- > Find further inspiration for a survey by looking at [The Big Repair Project](#).
- > Ask the pupils to work with scores rather than open questions in the survey. This will allow them to measure the impact of their campaign afterwards. Show them a few examples of surveys and discuss the form they should take.
- > Train ICT skills by asking the pupils to draw up a form using a digital tool.
- > Ask the pupils to calculate the means and/or display the results in a diagram during a maths lesson.

2 - Campaign 1

Discuss the results of the survey.

Which target group knows that repairing electrical and electronic devices is useful/possible?

What arguments did the respondents give? What devices have they had repaired? Where? Are there people who repair devices themselves? Who?

Then ask the pupils to set up and carry out a campaign from start to finish. Use the communication model for this.

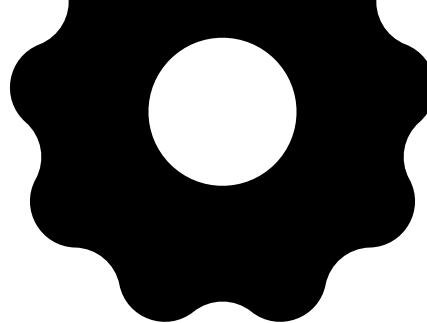


If you are choosing the campaign on the 'right to repair', go to 3.



Ask the pupils to set up and carry out their campaign on the basis of the communication model.

- > **Sender:** Who is sending the message?
- > **Receiver:** Who do you want to reach?
- > **Message:** What is it about? What do you want to say?
- > **Situation:** What is the situation in which you are telling your message?
- > **Objective:** Do you want to inform or persuade?
- > **Medium:** What channels could you use or do you wish to use to reach the receiver? In what form?



3 - Campaign 2 'Right to Repair'

Ask the pupils to set up and carry out a campaign for the 'right to repair'.

Watch the video '[Right to Repair](#)' together. Beforehand, give the pupils a number of questions to keep in mind while they watch the video.

Who is this animation film about? What parties are involved when it comes to the 'right to repair'? What message does the video try to convey? Why can't all devices be repaired yet? Is the 'right to repair' a sensible right? Why?

If you asked them to carry out a survey beforehand, they could use the results or figures from their findings in the campaign.

Ask the pupils to come up with ideas for a campaign, or give them an options menu: poster, stop motion video, article, video report, interview, work of art, demonstration at the school gates, testimonies or social media campaign, for example in a TikTok video. Ask the pupils to tag any social media posts or campaigns with #RighttoRepair.



TIP

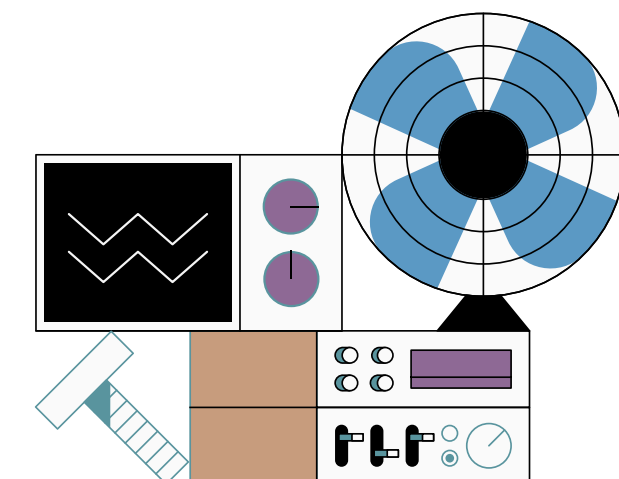
Divide the pupils into groups. Ask every group to draw a card with a different audience for their campaign: primary school pupils, parents, teachers, the city council, etc.

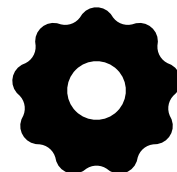
4 - Impact of the campaign

After the campaign, invite the pupils to carry out the survey (1) again, to check with the respondents to what extent the campaign was successful.

Ask them to compare results. Also compare the results of the various campaigns carried out by the class.

Are the results different compared to before the campaign? To what extent? What did the respondents say: have they changed their mind about repair or not? If so, how? Which campaign was more successful? Which campaign was less successful? How can you explain this?





ACKNOWLEDGMENTS

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Design

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Djapo vzw
Ortolanenstraat 6
3010 Kessel-Lo
Belgium
+(32) (0)460 95 71 01
info@djapo.be
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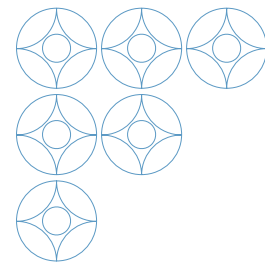
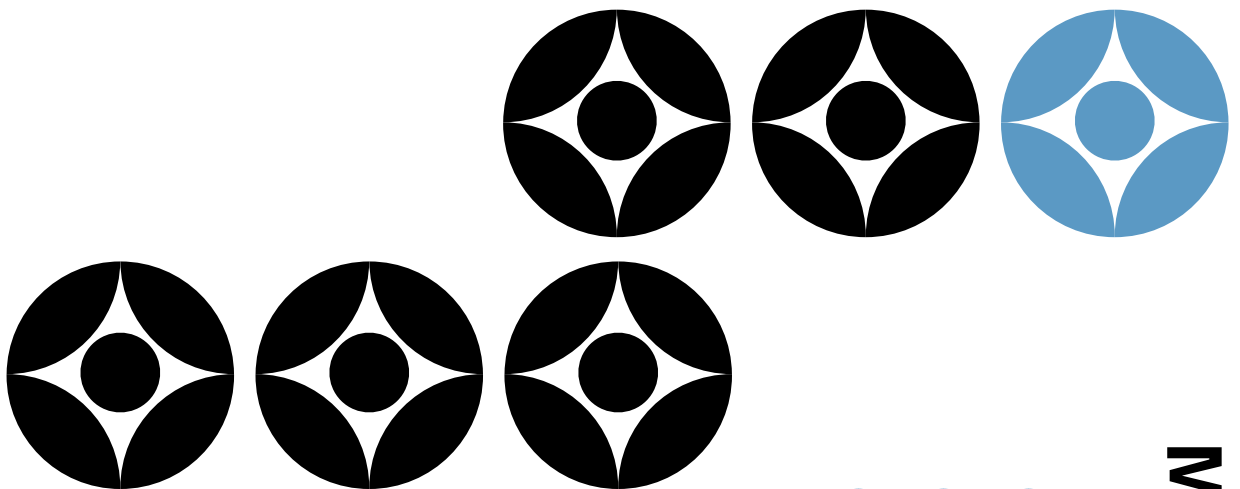
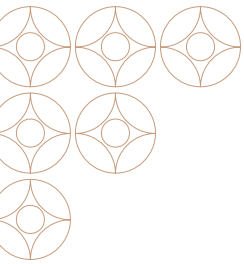
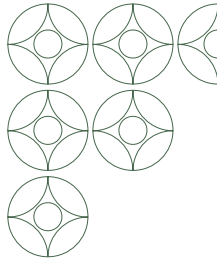


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Ostinghes-Loozele-De-Nieve

ACTIVITY 2

HAVING A REPAIRER OVER / VISITING A REPAIRER

TARGET AUDIENCE 10 to 12 years



PREPARATION

- › The background information in this document contains the discipline-specific and didactic knowledge and insights you need to prepare this activity.
- › Optionally, you could do assignment 2.3 from lesson 2 on the importance of repair together.
- › Find a repairer:
 - › a relative of a pupil, a repairer from a local Repair Café, or a repairer from a consumer electronics shop in the locality of the school.
 - › Some charity shops might have repair workshops for electrical and electronic devices.
 - › Consult <https://mapping.sharepair.org/> for a network of repairers and Repair Cafés in your area.
- › Ask the pupils to bring one or more devices that need to be repaired from home.
- › Optionally: register your device in advance through Repair Connects.

This sheet is part of the Sharepair primary education teaching pack on repairing electrical and electronic devices. It offers didactic tips for preparing or reflecting on a visit to or from a repairer. The activities described here can be carried out at various stages of the lesson plan: as stimulus, introduction or additional activity.



- › Read or listen to stories from repairers on ['Lindfield-repair-cafe-hopes-to-inspire-future-repairers'](#) or ['Friends of the earth'](#).

MAKE IT WORK! ACTIVITY 2



1 – Visit from a repairer

Invite a repairer to come to class: ask them to demonstrate how to repair a broken device in class. You could ask the pupils to collect a number of similar broken devices first.

Preparation

- > Ask the pupils to prepare questions for the repairer. What would they like to know? You could send these questions to the repairer in advance.
- > Watch a few videos together with the pupils that feature repairers at work, for example on YouTube.
- > Discuss the pupils' own experiences with and opinions on repairing electrical and electronic devices in a class conversation.
- > Give them a repairer's testimony to read. Integrate this into a reading comprehension lesson. Find inspiration [here](#).

Follow-up

Ask the pupils to:

- > make an action plan for a simple repair and send it to a repairer for comments.
- > conduct a survey on repair.
- > put ideas for repairing devices into a flow chart: what options are there at school, in the neighbourhood of the school, at home, etc.

2 - Visiting a repairer

Preparation

Enquire whether the pupils can do something to contribute to the repair during the demonstration, for example unscrew something or hand tools to the repairer, etc. Ask the pupils about any experiences they have had with repairing electrical or electronic devices or with charity shops.

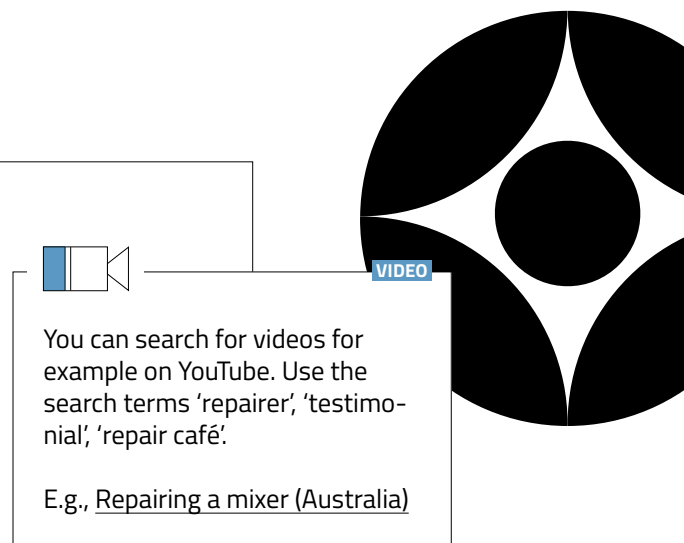
Stimulate the pupils by showing them videos that feature repairers telling their stories or repairers at work.

Then choose things to look out for; you could do this together with the pupils. Ask the pupils to draw up corresponding observation questions: what would they like to find out? What do they find interesting?

- > Practical aspects of the workshop (furnishings, material, work flow, planning, etc.)
- > Appliances under repair
- > Safety
- > Staff
- > etc.

Divide the pupils into groups and ask each group to prepare and carry out one assignment:

- > a photo report.
- > an interview with the repairer or repairers.
- > an interview with the manager of the charity shop.
- > a short interview with, or survey of other customers.



Help the pupils prepare the assignment.

What do you want to tell/show viewers or readers of your report? What images do you need to do this? How are you going to divide the tasks: take pictures, write the text, ask questions, write down answers, etc.? How are you going to do this without disturbing the class during the visit?

Reflection afterwards

- > Reflect on the visit afterwards. Ask pupils to share their feelings and opinions, for example with the help of the wheel of feelings.
- > Ask the pupils, in groups or in pairs, to present their own photo report to their own class and other classes.
- > Ask the pupils to complete the interviews and present these to the class in pairs.
- > Ask the pupils to propose for more repair-related activities in the class or at school. Have them make posters outlining the proposals and hang them on the school notice board, so that a vote can be taken.



ACKNOWLEDGMENTS

Editors

Sabine Anné

Design

Toast Confituur Studio

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Djapo vzw
Ortolanenstraat 6
3010 Kessel-Lo
Belgium
+(32) (0)460 95 71 01
info@djapo.be
www.djapo.be

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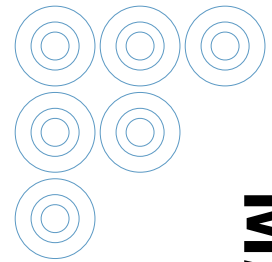
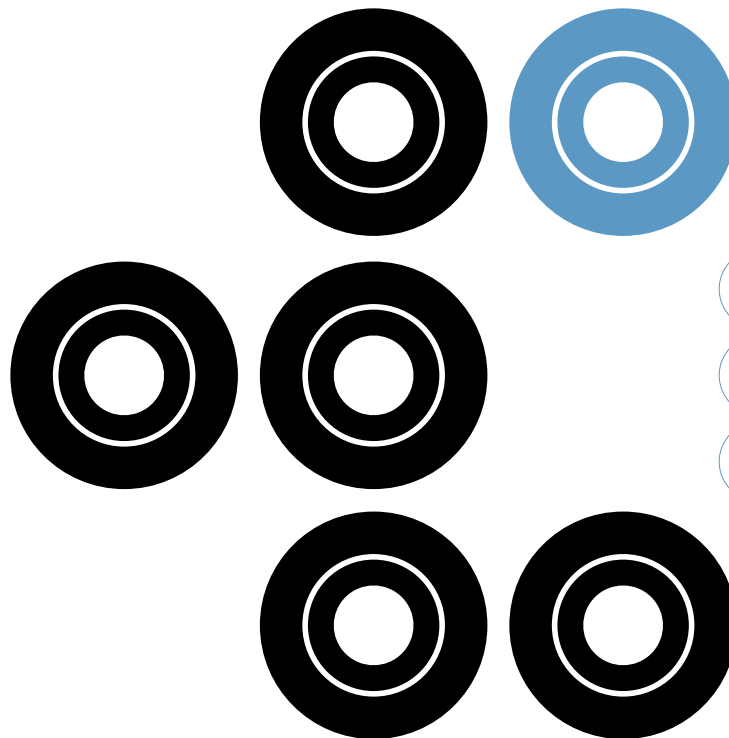
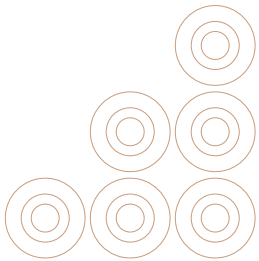
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ACTIVITY 3

ROLL UP YOUR SLEEVES!

MINI-WORKSHOP

TARGET AUDIENCE 10 to 12 years



PREPARATION

- > The 'background information in this document contains the discipline-specific and didactic knowledge and insights you need to prepare this activity.
- > Optionally, you could do assignment 2.3 from lesson 2 on the importance of repairing together.
- > Find a repairer to give a workshop:
 - > a relative of a pupil, a repairer from a local Repair Café, or a repairer from a consumer electronics shop in the locality of the school.
 - > Some charity shops might have repair workshops for electrical and electronic devices.
 - > Consult <https://mapping.sharepair.org/> for a network of repairers and [Repair Cafés](#) in your area.

This activity is part of the Sharepair primary education teaching pack on repairing electrical and electronic devices. It offers didactic tips for a mini-workshop to investigate the flow of water in a coffee machine. The activities described here can be carried out at various stages of the lesson plan: as stimulus, introduction or additional activity.

MAKE IT WORK! ACTIVITY 3

Before the lesson, watch a few interesting videos on the way coffee machines work. Consider choosing clips and/or prepare a few observation questions in advance. Pause the video at certain points and ask what the pupils have observed.

- > What is inside a coffee maker?
- > How do drip coffee machines work?
- > How it works: coffee maker

MATERIALS REQUIRED



- > A working coffee machine (for example from the staff room)
- > Option: a number of old (working or broken) coffee machines with a filter
- > Small box to collect screws
- > Small torch (smartphone)
- > Tools: to be determined in consultation with the expert

Consider asking someone with the technical skills and tools required to supervise the mini-workshop.

This sheet provides brief information for a mini-workshop that introduces pupils to the flow of water through a coffee machine. The same formula can be applied to examine the parts of other appliances and how they work. Talk to a repairer about the options.

FUN FACT

Disassembling an appliance, studying the parts and their function and then reassembling the appliance is called reverse engineering.

1 – Mini-workshop: plan

Divide the pupils into groups of at most six. Every group then examines a traditional coffee machine under the guidance of an expert. Ask the groups to attend the mini-workshop in sequence while the other groups work on some other assignment.

1.1 – The appliance and its function

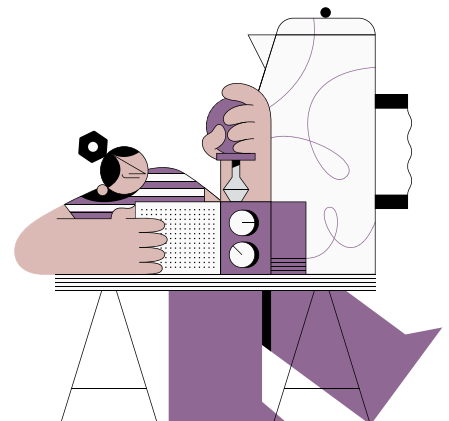
What purpose does this appliance serve? What parts can you see? What do you think these parts do? What parts are still inside the device? What is the coffee made of? What should this appliance be able to do?

The expert talks to the pupils about the various coffee brewing processes that occur in a coffee machine. They explain what an average coffee machine should be able to do: collect water, heat it, move the hot water through the coffee filter, keep the brewed coffee hot, etc.



TIP

Consult sheet 1 (campaign and survey) or sheet 2 (preparing a visit by or to a repairer) for inspiration for other assignments.



1.2 – The flow of water (top)

Ask the pupils to unscrew a coffee machine under the expert's guidance. Begin with the water reservoir and the filter holder. Ask the pupils to examine how the water flows through the coffee machine here.

What parts does the water pass? How does the water exit and how is it moved back up to the filter holder? What part of the flow of water can we not see here? What happens between the hole and the tube that we can see in the reservoir?

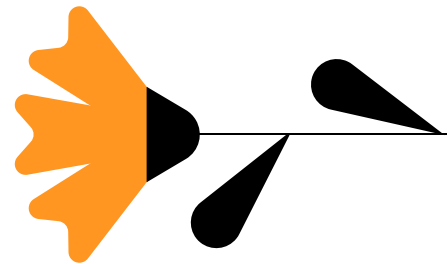
Discuss beforehand with the expert what things the pupils can do safely themselves.

1.3 – The flow of water (bottom)

The expert unscrews the bottom plate. Discuss in advance whether the pupils can independently unscrew the bottom plates of other coffee machines. Then they examine the parts that have now become visible together.

What parts can you see here? Where does the water flow? What do you think these parts are for?

The expert then explains in greater detail how the coffee machine works, while the children examine the parts. If possible, the expert removes several parts from the device and displays them on the table.



1.4 – Repair options

The expert asks the pupils to look at the parts and the flow of water and to consider potential defects, both in the top and the bottom part of the machine.

What do you think could go wrong? What could entirely or partially impede the flow of water? What other parts could break?

The expert then tells the pupils about a number of cases of broken coffee machines that they have been able to repair or that they have seen.

Finally, the expert and the pupils reassemble the coffee machine together.

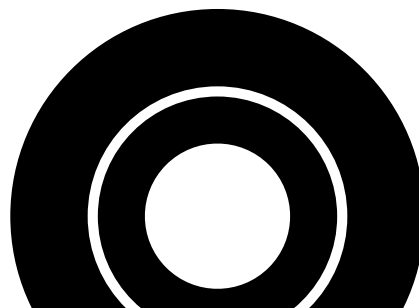


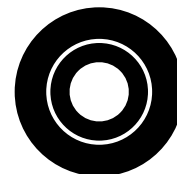
TIP

Ask the pupils to draw up an action plan for disassembling and reassembling the coffee machine.

2 – Reflection

What did you think of this activity? What did you like, not like so much or not like at all about it? What appliance would you like to disassemble and repair? Why? How important is it to know how a device functions? What if an appliance doesn't work anymore, does it make sense to disassemble it? Why or why not?





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