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- *Technical devices at my school* (Technische Geräte in meiner Schule) worksheet
- *At the 3D printing shop* (In der 3D-Druckerei) worksheet
- *At the 3D printing shop* (In der 3D-Druckerei) answer key
- *3D printer* (3D Drucker) worksheet
- *3D Printing* (3D Druck) word bank
- *Now I know* (Ich kann schon) questionnaire

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Teaching materials

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Before the lecture/film		
Step	**Content**	**Materials**
1	Instructor welcomes children and invites them on a tour of the school. They are told to observe and make a mental note of which technical devices the students, teachers and administration use on a day-to-day basis. Once they are back in the classroom, the children gather in small groups. Instructor hands each group the *Technical devices at my school* (Technische Geräte in meiner Schule) worksheet. The children mark down the devices that they saw on the tour. The class discusses the results together.	*Technical devices at my school* (Technische Geräte in meiner Schule) worksheet
2	Instructor asks: *What devices do you work with in class and what devices do you use at home?* The children name the devices that they use as they think of them. Then the instructor asks the next question: *What do you think I use to prepare for our class?* After the children have shared their ideas, the instructor continues: *Let's look at an example: I need a picture of a car. What do I do? I turn on the computer, search for a car on the Internet and once I have found one that I like, I turn on the printer and print out the picture. Shall we do this together?* The instructor and the children go through the steps that the instructor just listed. Note: Instructor makes sure that a scanner, a computer/laptop and a printer are available in the classroom or arranges for the lecture to be held in a room where these three devices are available. Ideally the IT teacher also takes part.	Scanner; Computer/laptop; Printer
3	Instructor continues: *Now I have a new picture of a car for class. But what if I have a great picture at home that I would like to use, but I have to change something on it? For example, I might want to give the picture a title. I could do this by hand, but it looks much nicer if I do this with the computer. How would this work?* Note: Instructor brings a picture of a car from home and now brings this picture out. The children gather ideas of how to solve the problem. The instructor helps and they formulate the answer together: *I have to scan in the picture, work on it on the computer, and then print it out.* These steps are also carried out: the instructor and the children scan in the picture, work on it on the computer and print out the result.	Any picture of a car, which the instructor brings to class; Scanner; Computer/laptop; Printer

Teaching materials

| 4 | Instructor now takes out a toy car and asks: *Do you think that if I want this car to look a little different, I can do the same thing we just did with the car: I scan it in, I work on it on the computer and I print it out?*

The children answer the question: *No, that is not possible.*

You're right, says the instructor, *that is not possible with these devices. Why is that?*

The children formulate their ideas. Instructor builds on this: *It is not possible, because the picture is two-dimensional and the toy car is three-dimensional. What does that mean? Two-dimensional means it is flat, it is on a piece of paper, and three-dimensional means it has another dimension, you can touch it.*
The children have the opportunity to ask if there is something they do not understand or to ask another question.

With the next question, the instructor transitions to the film: *What do you think? Are there new, more modern devices with which one can scan in objects?* | Toy car |

During the lecture/film

Step	Content	Materials
5	Instructor invites the children to watch the film (Minute 1:14-5:52). During the film or afterwards the students work on the *At the 3D printing shop* worksheet. They match the names of the devices that are used to recreated a modified version of the model car to their pictures.	*At the 3D printing shop* (In der 3D-Druckerei) worksheet and answer key; Laptop and projector; Audio speakers
6	Instructor asks: *What is a 3D printer? What is different about it from a normal printer?* The children formulate their ideas and come to the solution: In its cartridges, the 3D printer has a special plastic instead of ink. The model auto is built layer by layer over the course of 15 hours with the plastic. Note: In order to test this or if the children do not know the answer, the class can watch the appropriate sequence again (starting at minute 3:19).	Laptop and projector; Audio speakers

After the lecture/film		
Step	**Content**	**Materials**
7	Instructor and children open the printer in the classroom and look at the ink cartridges. Then they can briefly look at the 3D printer in the film again. Note: It is particularly interesting for the students if the printer is a color printer that works with cartridges with different ink colors. This makes the differences from the 3D printer in the film especially clear.	Printer; Laptop and projector; Audio speakers
8	Instructor divides the children into 4 groups and says: *I will be handing out a worksheet and I want you to think about what one might do with the 3D printer if its cartridges are filled with a material other than plastic, with chocolate for example. Answer the questions and if you have other ideas write those down too.*	*3D printer* (3D-Drucker) worksheet
9	The results are hung on the board/wall and each group presents its ideas.	Magnets/blu-tack
10	Instructor and children end the unit with a reflection round, in which they discuss what they have learned. In order to reinforce the newly learned words and expressions, the instructor projects the content of the *3D Printing* (3D Druck) word bank. Each child creates a document with the title "My word bank sheet on 3D printing" on the computer. They record the newly learned words and expressions in this document and decorate the page with colors, pictures, etc. They print out the final product and save this in their portfolios in step 12. Note: This lecture should take place at a computer lab so that each child can work individually at a computer.	Word bank; Projector; Computer; Printer
11	Each child fills out the *Now I know* questionnaire to find out whether they have achieved the learning objectives. Instructor also gives feedback on student performance.	*Now I know* (Ich kann schon) questionnaire
12	The children hold onto the following in their portfolios: - *At the 3D printing shop* (In der 3D-Druckerei) worksheet - My word bank sheet *3D Printing* (3D-Druck) - *Now I know* (Ich kann schon) questionnaire	Portfolios

Teaching materials

Further ideas for subject matter or CLIL teaching (physics, mathematics, computer science, technology):

Form expert groups on the use of 3D printers in different fields. Possible fields include:

- Medicine
- Clothing
- Food
- Construction
- Traffic
- etc.

The groups carry out research on their fields and present their results in a "scientific" conference. (Resource, if needed: Film entitled "5 unglaubliche Anwendungsbereiche von 3D-Druckern" https://www.youtube.com/watch?v=omog28b8cYc - *please note that this film is in German*)

Suggestion for the children at the end of the learning scenario

At the very end, the children gather around a computer or the instructor projects a computer desktop onto a screen. They look at the home page of the German Digital Kinderuniversity together. The instructor explains to the children that they now have completed the *3D Printing* (3D-Druck) lecture in the *Technology* faculty together and draws their attention to the fact that there are many more interesting lectures in this faculty and in the *Humankind* and *Nature* faculties.

The instructor and the children click together on the At Home link and discover how the website works. As an example, the instructor logs in and goes to the lecture that they just worked through.

The instructor shows the children that the lecture begins with an introduction by Professor Einstein and Ms. Schlau and that their work is supported by Jowo and Christoph, the field researcher. Professor Einstein and Ms. Schlau also wrap up all the lectures and thereby frame the work on each theme.

The instructor explains to the children that they can re-watch the film at home and can even set the subtitles to German or English. That way, they can "catch" key words while watching and use these to collect points and solve three exercises and a bonus exercise on the film. The children can also get help from their parents or grandparents, from registering to solving the exercises. The whole family can have fun learning and everyone gradually becomes a professor at the Kinderuni.

Teaching materials