# inTruST Learning Scenario

## Title: Noise pollution in everyday school life

## Picture:



## Link to YouTube links video:

https://youtu.be/OA0JilWcHeo




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## Research Questions/Tasks

Questions that could be answered by the students:

- What are the noise levels like in different lessons?
- To what extent does the sound level depend on one's position in a room?
- Are there areas in the school where it is too loud? (e.g. gymnasium, break hall)
- How loud is it in the school bus in the different rows?
- Are limit values exceeded in my free time?

Possible follow-up questions:

- How can I protect myself against excessive volume?
- What can be done about excessive noise?

## Short Description (max. 500 words)

The human ear gets used to constant environmental noise very easily. However, even a low sound level can cause stress for our brains. High volumes can directly damage our hearing. The aim of these lessons is to sensitise pupils to this. Based on the transmitter-receiver model, the aim is to localise transmitters and their sound levels in everyday life. Everyday student life means: own room, hobby, way to school, school, etc.

Considerations on how to obtain useful measurement results with their own smartphone will be at the beginning of the research series. The comparability of the measurements must be discussed.

By taking their own measurements, the pupils should realise where disturbing noise sources are and how the volume changes with distance from the transmitters. Noise maps of different areas should be created. Noise protection measures should also be included in the considerations and measurements.

In order to answer the research question, students will pair up in groups in order to plan and carry out experiments. Once they are able to answer the research question by analyzing their data, they present their findings to the whole class and make suggestions for improvements to areas that are too loud.

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## Information about the Implementation

Students' age: 11-12 Students' language: German

Number of lessons: 8 Duration of one lesson: 50 min

For which subject(s) is the activity usable?

Physics ☒ Chemistry ☐ Biology ☐ Science ☐ Maths ☐

Art ☐ Technology & Design ☐ Other:

Level of Inquiry (see information in the Appendix):

1- Confirmatory ☐ 2- Structured ☐ 3- Guided ☒ 4- Open ☐

Select the Science and Engineering Practices that are the focus of the designed unit:
*(Detailed information on the practices can be found here (Next Generation Science Standards).)*

| | | | |
|---|---|---|---|
| 1 |  | Asking questions and defining problems | ☒ |
| 2 |  | Developing and using models | ☐ |
| 3 |  | Planning and carrying out investigations | ☒ |
| 4 |  | Analysing and interpreting data | ☒ |
| 5 |  | Using mathematics and computational thinking | ☐ |
| 6 |  | Constructing explanations and designing solutions | ☐ |
| 7 |  | Engaging in argument from evidence | ☐ |
| 8 |  | Obtaining, evaluating and communicating information | ☒ |

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## Information about the Units of Learning

Which topic of the curriculum is covered?

Austrian curriculum, 2rd grade, lower secondary:

Generation and propagation of sound, noise hazards

Description of the learning objectives?

Pupils can

- explain the physical conditions for seeing bodies/objects and hearing tones/sounds using a transmitter/receiver model and apply them to various everyday situations (including road safety)
- handle light and sound sources responsibly in order to avoid endangering sensory organs.

## Materials and other resources

Which resources and materials (hardware, software) are needed?

- Smartphone
- Smartphoneapp for measuring decibels
- Sound level meter for calibrating the Smartphone apps

## Previous knowledge of the students

The transmitter-receiver model and the basics of sound propagation are known. The terms pitch and sound level have also been worked out in advance using everyday examples. A table of the official hearing and pain thresholds should have been researched in order to get an initial feel for these values.

The basic principles of inquiry-based-learning should already have been communicated to the students. It is fundamentally important that the research cycle is already known. The steps from the question to the presentation should be clear to the students.

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# Description of the lesson plan (simplified version for teachers)

This item describes the topics addressed during the unit of learning, its educational purposes and how to carry out the lessons in more detail.

1. Generate interest in the issue of noise:
   Interpretate newspaper article about the noise made by toys: “Spielsachen oft zu laut für Kinderohren” (Appendix 1). Discuss in small groups whether you can think of any areas that are too noisy.

2. Explore noise maps online and analyze the area around the school and your student´s home. Worksheet: “Lärmkarten” (Appendix 2). Presentation of the noise map's custom color coding (Appendix 3)

3. Calibrate student´s own smartphone using an app and a calibrated sound level meter. Lesson: Worksheet: “Mein Smartphone wird zum Schallpegelmesser” (Appendix 4)

4. Start of the research cycle. Worksheet “Forschendes Lernen – Lärm” (Appendix 5)
   Repeat the steps of the research cycle → create groups → present the objectives of the following lessons → present and precise the research question(s)

5. The students formulate hypotheses and plan their research process (which materials they are going to need, what they are going to measure, how they are going to document their results). Test run for investigations

6. Carry out and document investigation
   Notes: If the measurements are carried out at home, the experiment time at school is omitted. This leaves more time for the other steps.

7. Find answers to the research question(s) and compare their findings to their hypotheses. prepare presentation. Are there any surprises? Which areas are particularly loud? Why? Could there have been errors in the measurement? What else could we measure in the future? Prepare the presentation.

8. Present the findings. Put forward proposals for measures that could reduce the noise levels measured.

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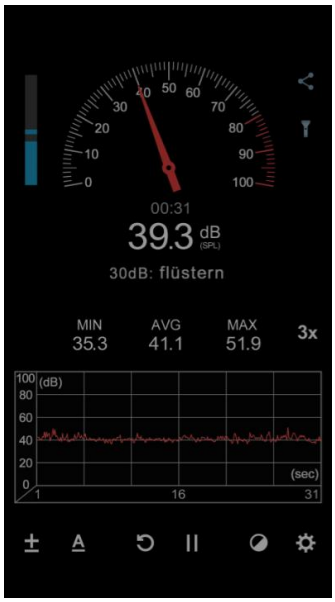
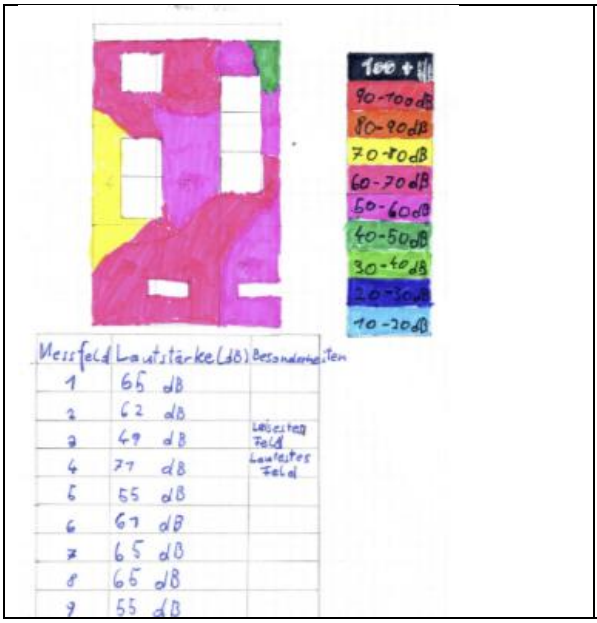
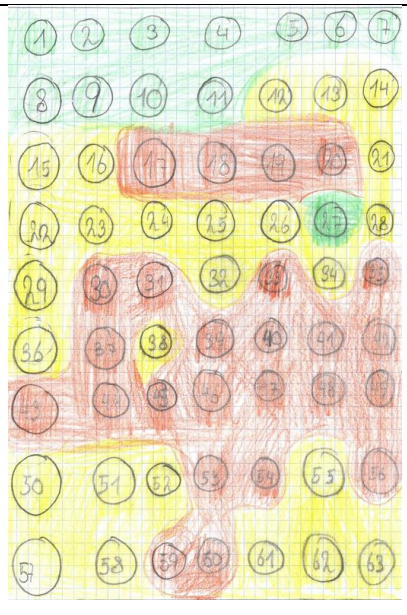
# Pictures and Worksheets

## Screenshot App "Sound Meter":




## Examples of noise maps:



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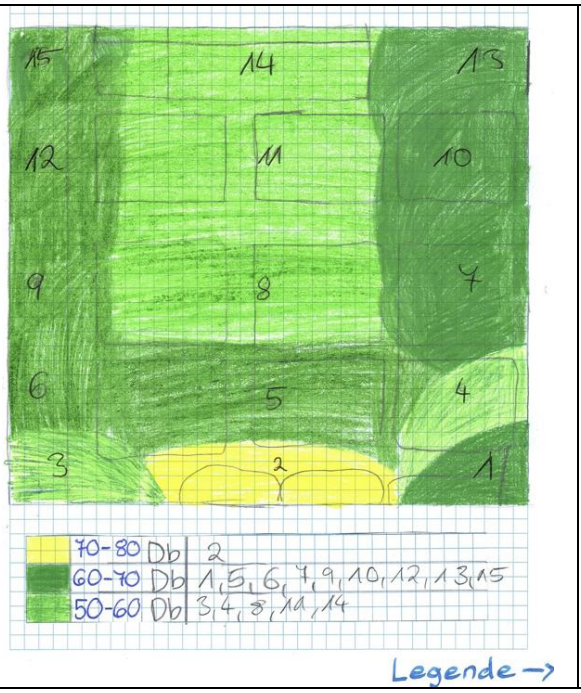





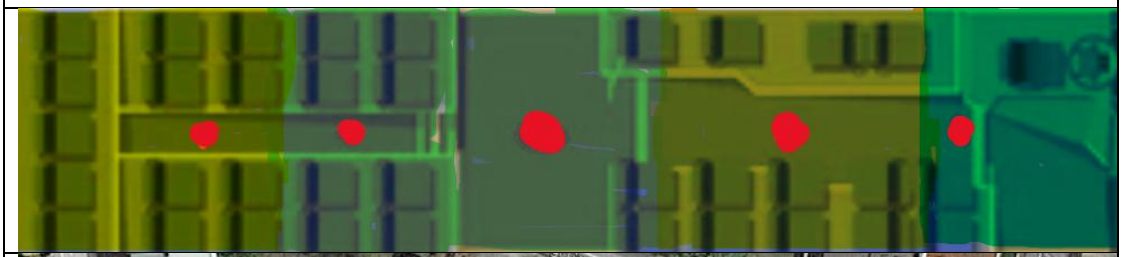




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# Appendix

## Level of Inquiry

Refer to the table below for information about the level of inquiry according to Orosz et al. (2023). Select the relevant level of inquiry for your unit in your template above. Please note that, as discussed during LTT2, you can adjust the responsibilities assigned to students and teachers at Levels 1 and 2 if you wish.

| Level of Inquiry | Problem/ Question | Procedures | Interpretation of Results | Purpose & Requirements |
|---|---|---|---|---|
| Level 0 – Confirmatory Inquiry | Teacher | Teacher | Teacher | Students reproduce the results |
| Level 1 – Structured Inquiry | Teacher | Teacher | Students | Practising simple inquiry skills (e.g., observation, measurement, data interpretation, discussion of results, documentation) or introducing students to IBL |
| Level 2 – Guided Inquiry | Teacher | Students | Students | Opportunity for cooperative learning, room for creativity, development of skills and abilities (above + formulation of hypotheses, designing the experiment) |
| Level 3 – Open Inquiry | Students | Students | Students | Greatest level of freedom; demands advanced inquiry skills, reasoning ability and creativity, and high level of responsibility |

## Science and Engineering Practices

As a framework for designing the learning units, this project used the science and engineering practices according to the Next Generation Science Standards (NGSS). Detailed descriptions of each practice can be found in the Appendix F of the NGSS:
*https://www.nextgenscience.org/sites/default/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf*

## Literature

NGSS Lead States. (2013). *Next Generation Science Standards: For states, by states. Appendix F: Science and engineering practices in the NGSS.* National Academies Press. https://www.nextgenscience.org/

Orosz, G., Németh, V., Kovács, L., Somogyi, Z., & Korom, E. (2023). Guided inquiry-based learning in secondary-school chemistry classes: A case study. *Chemistry Education Research and Practice*, *24*(1), 50–70. https://doi.org/10.1039/D2RP00110A

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