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Science, technology, and values guideline

Methods for implementing the value aspects in science and technology lessons with Experimento | 10+

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This guideline is based in part on the “Science, technology, and values guideline” for Experimento | 8+, developed in collaboration with the Department of Psychology at Ludwig-Maximilians-Universität München to implement the aspect of values in Experimento | 8+ (authors: Dr. Heinz Mandl, Dr. Birgitta Kopp, Dr. Sandra Niedermeier, Dr. Marina Meixner; License: CC BY-SA 4.0 international).

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As a nonprofit foundation, we promote sustainable social development, which is crucially dependent on access to basic services, high-quality education, and an understanding of culture. To this effect, our project work supports people in taking the initiative to responsibly address current challenges. Together with partners, we develop and implement solutions and programs to support this effort, with technological and social innovation playing a central role. Our actions are impact-oriented and conducted in a transparent manner.

Foreword

Values, whether conscious or not, are always the basis for our actions. This guideline is intended to highlight opportunities to link the formation of specific values with selected experiments from Experimento | 10+.
School curricula should teach skills that empower students to weigh their options, make sound decisions, and act with purpose in a complex world on the basis of socially accepted values. The values formed in school include a sense of responsibility, good judgment, the ability to work well on a team, and independence. Teachers impart these and other values by example through their attitudes and actions in the classroom. They set standards, create criteria, and strengthen the personal and cultural identity of the students:

In addition to the family environment as a place for value formation, schools in particular also have a role to play here as a component of their educational responsibility. The focus is on the development of the ability to make ethical decisions and the strengthening of an independent and socially competent personality. Science and technology lessons play an important role for the examination of values. Corresponding learning processes require evaluation, decisions, and reflection. That's why the goal in teaching these subjects is also to promote attitudes, skills, and approaches that empower people to live responsibly and self-confidently in modern society.

With its international educational program called Experimento, the Siemens Stiftung aims to strengthen the formation of values during science and technology education. Experimento is built on the principle of inquiry-based learning, a method that fosters empathy and self-confidence and sensitizes students to social interaction through cooperative experimentation. These are valuable characteristics in terms of successful personality development and are an excellent foundation for the formation of values.

Value formation in Experimento | 10+, as in Experimento | 8+, is achieved both through "values related to the learning process" such as *openness*, *acceptance of responsibility*, and *team spirit* as well as through "object-related values" such as *solidarity*, *environmental awareness*, *health awareness*, and *sustainability* that relate to the content of the Energy, Environment, and Health modules. In selecting the values, the authors of this guideline turned to the "Science, technology, and values guideline" for Experimento | 8+, developed in collaboration with the Department of Psychology at Ludwig-Maximilians-Universität München to implement the aspect of values in Experimento | 8+. Other groundbreaking input for value formation in discovery-based learning came from multipliers and authors of Experimento | 10+ during a meeting of experts organized for this purpose.

We are pleased that you're working with Experimento | 10+. This guideline is designed to provide you with helpful suggestions for how to integrate value formation into science and technology lessons.

We wish you much success as you put the suggestions in this guideline into practice in your classroom.

Dr. Barbara Filtzinger
Head of Working Area Education, Siemens Stiftung

Science, technology, and values guideline

Contents

1 What is the purpose of this guideline?

This guideline is designed to encourage interested teachers to discover opportunities to link their science and technology curriculum to selected values.

The basis for this is the experiments described in Experimento | 10+, which provides a sound basis for confronting students during science and technology lessons with value-related issues beyond the curricular content. The following chapters of the guideline show how values can be integrated into Experimento lessons and which goals can be targeted. In addition, it presents methodical-didactical approaches to promote the discussion of values during science and technology lessons.

In this guideline, we first consider the question of why the formation of values is important within the context of science and technology lessons and establish a reference between values and the experiments in Experimento | 10+. The values selected for Experimento are then listed below. An overview of the possibilities for embedding the values in science and technology lessons within the context of Experimento I 10+ is provided at the end. Various methods are presented to facilitate sensitization for values.

2 Why are values so important in science and technology lessons?

Long-standing (and necessary) discussions – even confrontations – about the opportunities and limitations associated with how scientific and technological insights are used show that it is still necessary for individuals and society as a whole to come to an understanding on value-related issues Values are conscious or subconscious standards and principles that guide individuals and societies. People's values vary culturally, individually, or among specific groups – sometimes significantly – and different values sometimes make value-based behavior more difficult or impossible.

Different values can come into play, for example, in complex everyday situations, and have to be weighed against one another. The divergence between the knowledge of recognized social values and individual actions, which may be driven by interests rather than values, might create a gap between the knowledge of values and the value-based behavior that is actually intended. Inconsistent behavior may also arise due to diverging interests of various individuals and segments of society.

Differing values can lead to unresolvable conflicts if the parties cannot find common ground and are unwilling to talk and compromise. The way for schools to avoid having this very situation occur is to prepare for such conflicts by having students think through various positions and change their perspective, and by conducting a proactive, respectful discussion of values in the classroom.

Common values can unite people by creating a framework for orientation and actions that all agree on. Due to the importance of values in one's personal and social life, it is necessary to encourage a heightened awareness of values to build a foundation for agreeing on common values. In this context, the topic of values should be addressed in connection with scientific and technical issues as part of Experimento I 10+.

Science and technology are often seen as the engine of prosperity, progress, and social change. Young people in our high-tech and increasingly digital society are confronted with science and technology issues early on. However, working solely with corresponding phenomena and issues in science and technology lessons alone is not sufficient for an assessment of the importance of such topics. That's why the educational standards laid down by the Standing Conference of the Ministers of Education and Cultural Affairs in Germany (KMK) also cite evaluation skills as one of the process-oriented skills to be taught. For the teaching of science and technology to be linked with value formation, knowledge of science and technology must incorporate values, not be acquired in isolation. Critical reasoning helps achieve insight and is a skill that students in grades 5 to 8 can increasingly acquire and use to reflect on the significance of values. This makes it obvious that the skills laid out by the KMK for science and technology education also include evaluation criteria so that students can …

- … critically assess issues and make decisions,
- … see and take different perspectives,
- … reflect on and evaluate science and technology issues.

The skill of judgment makes it possible to reasonably assess science and technology issues and thereby become an active stakeholder in society.

In this Experimento | 10+ guideline, we offer practical tips on the methodological-didactic approach to teaching the values selected for Experimento.

3 What values are addressed in Experimento | 10+?

A number of values appear to be suitable for science and technology lessons. With input from experts, the Siemens Stiftung selected the following values for Experimento I 8+: *openness, initiative, acceptance of responsibility, team spirit, tolerance, dependability, solidarity, environmental awareness, health awareness,* and *sustainability*.

The values should be discussed based on the specific experiment or teaching content. The values can be related to the learning process (1) and the learning object (2). While it is primarily the values that are significant as fundamental values during the experimentation phase that are addressed in the learning process, object-related values are directly related to the experiment's topic.

(1) **Values related to the learning process** are addressed during experimentation.
Values play a fundamental role in interaction with each other and also in independent behavior.
"Values related to the learning process" include *openness, initiative, acceptance of responsibility, team spirit, tolerance,* and *dependability*.
One example of implementation of the value *team spirit* is that mutual support and consideration are provided during the cooperative experimentation phase.

(2) **Object-related values** refer to the content dimension of the Energy, Environment, and Health modules discussed in Experimento | 10+.
"Object-related values" include *openness, initiative, acceptance of responsibility, solidarity, environmental awareness, health awareness,* and *sustainability*. An example of implementation of the value of *acceptance of responsibility* means that actions are taken to handle the environment responsibly – for example, by preventing unnecessary CO_2 emissions in one's own areas of responsibility.

The values of *openness, initiative,* and *acceptance of responsibility* relate to the learning process as well as to the object. For example, the value of *openness* means being receptive to new and unfamiliar things. Thus, *openness* is addressed as a value related to the learning process in the context of group work if the point is to be open on the team and for different viewpoints and approaches to an issue. Related to the object, *openness* means being receptive and unbiased to scientific phenomena.

The following sections provide tips and suggestions for planning teaching and learning units to help conduct the experiments while integrating the values. Examples are used to explain the importance of values as well as the teaching of values in science and technology lessons.

(1) Values related to the learning process

Values related to the learning process are addressed during experimentation. Values play a fundamental role, both in interaction with one another and in independent behavior.

The following breakdown illuminates individual values and their importance while also highlighting examples of possible implementation in science and technology lessons.

The value and its importance	Example of implementation in science and technology lessons
Openness … means being receptive to new things.	▪ Wanting to discover new things ▪ Asking questions ▪ Scrutinizing topics, results, and one's own position ▪ Making, admitting, and reflecting on mistakes
Initiative ... means becoming active on one's own.	▪ Developing one's own solutions and paths ▪ Formulating and pursuing objectives ▪ Making decisions independently and acting independently ▪ Striving for knowledge and new insights
Acceptance of responsibility … means bearing the consequences for one's own decisions and behavior.	▪ Conducting an experiment responsibly ▪ Handling materials responsibly ▪ Taking on responsibility for the preparation, execution, and results of an experiment
Team spirit … means cooperating effectively and successfully.	▪ Making one's best contribution to a solution ▪ Providing mutual support while conducting the experiment ▪ Offering to help others and approaching them ▪ Listening to others without interrupting them
Tolerance … means recognizing different opinions.	▪ Listening to all opinions (including those different from one's own) ▪ Accepting other opinions ▪ Constructively discussing and evaluating solutions ▪ Accepting different learning speeds and levels
Dependability … means keeping binding agreements.	▪ Being able to rely on one another ▪ Precisely following specified instructions, performing tasks punctually ▪ Obeying established rules and agreements ▪ Cleaning up materials and disposing of them in an environmentally compatible manner

(2) Object-related values

Object-related values refer to the content dimension of the Energy, Environment, and Health modules discussed in Experimento | 10+.

Since object-related values always include a content dimension, they are presented in the context of the respective subtopic. Their meaning and examples are also provided.

Energy module

In this module, students become familiar with the properties of solar cells, for example, and should also understand the concepts of voltage, current, and power. The materials for Experimento | 10+ encourage students to explore the processes of converting different types of energy and to learn further about the importance of forms of energy and their storage in the natural and technical worlds.

The value and its importance	Sample implementation in the Energy module
Openness … means being receptive to new things.	▪ Being receptive to discovering scientific phenomena in the area of energy.
Initiative ... means becoming active on one's own.	▪ Developing one's own ideas and solutions for generating electrical energy.
Acceptance of responsibility … means bearing the consequences for one's own decisions and behavior.	▪ Thinking about how different types of power generation impact the environment.
Solidarity … means understanding cohesion and mutual support in society.	▪ The value of *solidarity* is covered as a main point in the Environment module.
Environmental awareness … means protecting the environment and behaving in an environmentally sensitive manner.	▪ Behaving in an environmentally sensitive manner through the effective, low-impact use of electrical energy.
Sustainability … means also being considerate of the people and animals of other countries.	▪ The value of *sustainability* is covered as a main point in the Environment module.

Environment module

In the Environment module, students are made aware of how they can make a contribution to preserving the environment. The focus here is on the water cycle, greenhouse effect, drinking water production, waste separation, solar energy, and renewable energy sources and their storage. For instance, students should understand the importance of the greenhouse effect and develop options for taking action to protect the environment.

The value and its importance	Sample implementation in the Environment module
Openness … means being receptive to new things.	▪ Going through life with open eyes, taking in and describing natural phenomena impartially. ▪ Becoming sensitized to the local environment.
Initiative ... means becoming active on one's own.	▪ Getting actively involved in environmental protection.
Acceptance of responsibility … means bearing the consequences for one's own decisions and behavior.	▪ Taking actions to protect the environment and standing by them. ▪ Using natural resources responsibly. ▪ Consciously selecting environmentally friendly modes of transportation.
Solidarity … means understanding cohesion and mutual support in society.	▪ Recognizing that one's own actions impact the lives of generations to follow. ▪ Becoming aware of the fact that everyone can make a contribution to a well-functioning environment. ▪ Showing consideration for other segments of society and approaching their values peacefully.
Environmental awareness … means protecting the environment and behaving in an environmentally sensitive manner.	▪ Acquiring knowledge of the environment. ▪ Developing environmental attitudes: becoming aware of the necessity of preserving the natural environment. ▪ Behaving in an environmentally sensitive manner: knowing and weighing the ecological consequences of economic decisions.
Sustainability ... means also being considerate of the people and animals in other countries.	▪ Recognizing that the topic of the environment goes beyond national borders. ▪ Becoming aware of the increasing scarcity of energy resources as a global problem. ▪ Recognizing that our own consumer behavior and actions have an impact in other countries. ▪ Discussing global strategies to conserve resources.

Health module

In the Health module, students should become sensitized to their own bodies and develop an awareness of healthy nutrition and its importance for their lives and personal hygiene. The focus here is on cellular respiration, carbohydrates as an energy source, metabolism, pH value, and skin and hygiene. For instance, the students should understand the effect of carbohydrates and sugars on metabolism and how they can do something for their own health by eating a healthy diet.

The value and its importance	Sample implementation in the Health module
Openness … means being receptive to new things.	▪ Being receptive to understanding the body through selected functions. ▪ Using the example of the energy provision and immune function of the skin, perceiving the structure and function of one's own body and seeing it as a compartment.
Initiative ... means becoming active on one's own.	▪ Playing an active role in maintaining the health of one's own body.
Acceptance of responsibility … means bearing the consequences for one's own decisions and behavior.	▪ Becoming aware that it is important to take good care of one's own body.
Solidarity … means understanding cohesion and mutual support in society.	▪ The value of *solidarity* is covered as a main point in the Environment module.
Health awareness ... means knowing one's body and taking care of one's own health.	▪ Acquiring health knowledge: understanding the positive and negative factors affecting one's health. ▪ Developing attitudes for dealing with one's own health: being aware of the necessity of maintaining good health. ▪ Behaving in a healthy manner: weighing the health risks of unbalanced diets, taking hygiene measures, etc.
Environmental awareness … means protecting the environment and behaving in an environmentally sensitive manner.	▪ The value of *environmental awareness* is covered as a main point in the Environment module.
Sustainability ... means also being considerate of the people and animals in other countries.	▪ The value of *sustainability* is covered as a main point in the Environment module.

4 How are values integrated into Experimento | 10+?

Experimento | 10+ includes experimentation instructions for students between 10 and 18 years of age and their secondary school teachers. With the help of these teaching and learning materials, the experiments can be conducted in order to then encourage the formation of values using the methods mentioned below as examples. In this way, students should grasp correlations between the scientific or technical phenomenon and the associated value. Rather than this timeline, however, it might also make sense to have a discussion of values before the experiment or after the completion of specific parts. When it doesn't seem easily possible to assign certain values to an individual experiment in advance, the focus should be on the larger themes (the thematic experimentation units in Experimento | 10+).

The conceptual approach of the experiments in Experimento | 10+ is important so that the values can be integrated into the experiments. This approach is based on three didactic methods: research-based learning, cooperative learning, and problem-oriented learning. The didactic concept of Experimento | 10+ focuses on the activity, self-monitoring, and cooperation of the students in all topics. They support the integration of the value aspect into Experimento | 10+ and encourage the students' thinking processes for values.

Specific methodological components put the didactic focus on the values. Thus, in line with the dominant educational themes of the experiments in the Energy, Environment, and Health modules, teaching suggestions for promoting the values in science and technology lessons are described below.

The complete process of an ethical evaluation comprises various steps:

- Formulating and applying value-based evaluation criteria
- Formulating possible courses of action
- Evaluating the consequences of actions

It is not always possible or necessary to go through the entire evaluation process in the classroom. A methodological implementation in the classroom might encompass the following partial aspects, for example:

- Solicit or dictate **possible courses of action**.
- Ask about **selection criteria** (and any underlying values).
- Based on this, ask about a reasoned **decision** for one course of action.
- Based on a decision, ask for a weighting of criteria or for alternative decisions **(reflection)**.

Another fun way to explore values is the *Experimento Game*, a serious game developed for Experimento | 10+. The game is attached to the drinking water production and waste separation experiments in Experimento | 10+ and uses two dilemma stories to address the issue of value formation. It takes about 15 minutes and, in addition to the dilemma stories, also includes two dexterity games.

The following sample methods can be selected for practical lesson planning:

- Techniques to get the students thinking
- Use of cases with dilemmas
- “Flash” round, in which each person offers short, concise input on a topic
- “Socratic method” for testing the logical coherence of one’s own views and perspectives
- Other options include role-playing games such as “TV discussion,” “town forum,” “roundtable,” etc.
- “Freeze frame” is a good way to express attitudes and opinions: One group mimes project results, and the others try to interpret what they are expressing.

Teachers can use these sample methods flexibly in Experimento | 10+ to encourage discussions of values. These suggestions do not make any distinction by school type or class level or the level of difficulty of each method. Teachers will choose an appropriate method depending on the selected experiment and the students’ prior knowledge. Depending on which method is chosen, it might make sense to then collaborate in defining the learning process.

The following instructions apply to the methods outlined above:

1. Methodically **prepare** the starting point for the discussion of values.
   For example, you can read the text of a dilemma or the statements for discussion to the class or write a question for discussion on the board. Alternatively, you can hand out written work instructions so that the students initially experience the text/prompt quietly at their desks or in partner work.

2. **Clarify** any (technical) questions about the content.

3. Have the students **process/discuss** the starting problem using the selected method.

   Tip: Before the discussion with the entire class, you can have the students think about the problem in partner work or group work.

   If necessary, encourage the students by using **prompts** (as "help prompts"), such as:
   - "Describe the dilemma"
   - "Weigh the pro and contra arguments"
   - "Present your opinion"
   - "Defend a position"

4. **Clarify** various **positions** and value-based **opinions**.
   Incorporate the addressed values. Allow the students to find **reasons** for these positions and opinions.

5. **Record** the students' positions and opinions.
   For instance, write the different opinions and views on the board.

6. Hold a **closing class discussion**.
   Above all, clarify the question: *What is the "takeaway" for the students?*
   Wherever this makes sense, you and the students should also develop possible actions for everyday life.

7. **Reinforce** the **results**.
   Have the students record the various results in writing; for example, as an entry in their exercise books.

The basic aspects of two methods (techniques to get students thinking and dilemmas), as well as practical examples of values related to the learning process and object-related values in the three Energy, Environment, and Health modules, are presented below.

4.1 Techniques to encourage students to reflect in Experimento | 10+

Techniques to get the students thinking can be verbal (for example, observations, requests) or nonverbal (for example, pictures, gestures). Their purpose is to encourage the students to reflect. Through a prompt on a certain topic or problem, the students are motivated to express opinions, thus creating opportunities for discussion. For this purpose, both the topic and the material must be understandable. Value-related prompts are suitable for quick integration into science and technology lessons. Subconscious views, opinions, or attitudes on value-related topics may be brought to light during the process.

A prompt through observations, requests, or questions is essential for the method. Other prompts can be used as well, such as cartoons, video clips, songs, newspaper articles, quotations, or gestures.

Prompts as starting point for the discussion based on reflections

The prompts serve as a starting point for the actual discussion in order to support constructive handling of technical, personal, social, and societal aspects.

Depending on the extent to which a reflections-based discussion takes place – for example, through the use of images for discussion – a direct discussion question (such as “Does a centralized power supply make sense?”) can support the students in developing a dialog that illuminates the value-related problem.

In the following sections, you will find examples of prompts for values related to the learning process and examples of prompts for object-related values.

4.1.1 Examples of values related to the learning process

Starting point: The students have conducted the experiments.

Purpose of reflection: The students should give each other feedback on the work done in the group by saying what worked well and what needs to be optimized. The value of *team spirit* (reviewing/optimizing work together as a team) is addressed in the process. However, the value of *dependability* (complying with rules) may come up.

Examples of prompts:

Questions for discussion: What went well in the way your group worked together?
Did you follow the instructions?

Statement for discussion: Observation by the teacher:
"I observed that the collaboration in some groups needs improvement in the areas of …"

The following possible statements by the students are listed here as examples to provide teachers an idea for more in-depth reflection about the working atmosphere in the groups. The teacher should ensure that the working groups develop the skill to give one another honest feedback, especially when it comes to reviewing presentations, in order to optimize collaboration with the goal of better work results for the entire group.

Possible examples of students' statements:

What goes well in group work?	What doesn't go well in group work?
▪ The collaboration is productive / I never could've solved the problem on my own. ▪ … helped me / now I understand … ▪ More ideas are generated in the group.	▪ I'm faster / less distracted when working alone. ▪ I can't work with … / … doesn't follow the rules. ▪ One person does all the work.

4.1.2 Examples of object-related values

Various prompts for examining object-related values based on the Energy, Environment, and Health modules are listed here.

Energy – A5 Properties of solar cells – Voltage, current, and power

Starting point: In the experiment, the students examined the topic of solar cells.

Purpose of reflection: The students will consider the possibilities that solar cells offer for generating electricity. They will explore the limits of this technology and gather ideas for the sensible use of energy generated in this manner. The values of *environmental awareness* and *sustainability* as well as the value of *acceptance of responsibility* (conscious use of energy) will be addressed. However, the value of *initiative* (taking active measures to save electricity) may also be addressed.

Examples of prompts:

Image for discussion:

Question for discussion: Ask yourself what conditions must be present for photovoltaic systems to be used effectively. What are the local criteria for building photovoltaic systems?

Statement for discussion: Observation by the teacher:
“A contractor told me that the fire department doesn’t put out fires in buildings with photovoltaic systems.”

Environment – B4 We produce drinking water – Methods of purifying water

Starting point: In the experiment, the students have examined the methods of water purification.

Purpose of reflection: The students will consider the sensible use of water resources. The values of *environmental awareness* and *sustainability* (conscious use of water) as well as *solidarity* (water as a diminishing resource in developing countries) will be addressed. However, the value of *initiative* (taking active measures to save water) may also be addressed.

Examples of prompts:

Image for discussion:

Statement for discussion: *Germans use approximately 120 liters of water per person, per day. Food preparation and hygiene require only about 50 liters, however, and this amount is not available in developing countries where water is often in short supply.*

Questions for discussion:
Why is it generally a good idea for us to reduce our water consumption as well?
What can you do at home to save or make good use of water?
What options do we have to save water – at school, for example?
Which projects could help make more water available in developing countries?

Health – C6 Skin and hygiene – What happens when you wash your hands?

Starting point: In the C6.1 What happens when you wash your hands? subexperiment, the students have examined importance of soap in hand washing. They know that the skin can transmit germs and that the tenside molecules in the soap surround the microorganisms so that they can then be rinsed away with water.

Purpose of reflection: Students will gather reasons for washing one's hands after using the bathroom and for using soap.
The values of *health awareness* and *acceptance of responsibility* (taking care of one's own health) will be addressed in the process.

Examples of prompts:

Image for discussion:

Question for discussion: Why is it important that you thoroughly wash your hands with soap after each use of the bathroom?

4.2 Use of cases with dilemmas in Experimento | 10+

The use of cases with dilemmas helps create an awareness of a value-related conflict. Students reflect on the fact that a decision has certain consequences. Through controversial discussion of dilemmas related to values, the students reflect on values and become acquainted with various positions and perspectives.

Discussion of a dilemma based on a particular story is essential for this method. This story can be read aloud by the teacher, worked on in groups, and finally discussed. In addition, role-playing dilemmas can be carried out and contemplated. The various roles are assigned and acted out. Freeze frame is also a very good way to depict dilemmas.

In the following sections, you will find examples of cases with dilemmas for values related to the learning process and examples of cases with dilemmas for object-related values.

4.2.1 Example of values related to the learning process

Dilemma related to working in a group:

The group “Lords of Science” has so far worked together smoothly and achieved good results. The problem began last week with the arrival of “new kid” Paul, who keeps rubbing people the wrong way with strange remarks, who always knows better, and who doesn’t like it when people talk to him directly. On the other hand, he always comes through quickly with solutions that would not have occurred to anyone else.
Most of the students are annoyed by his behavior, and they express this one day when he is absent. The group is even wondering what it can do to get rid of him.
Anna thinks to herself: It’s really not as bad as all that. Paul does have lots of creative ideas, after all, so just let him be the way he is! But if I say something now, the others will think I’m not with them.

Think about it: Should Anna say something or remain quiet?

Addressed value:

Tolerance (respecting one another)

4.2.2 Examples of object-related values

Energy – A5 Properties of solar cells – Voltage, current, and power

Dilemma related to the environment:

Electricity from photovoltaic systems is considered “clean.” The manufacturing of photovoltaic cells requires toxic heavy metals, however, and when the modules reach the end of their useful life after 20 to 30 years at most, they will pose a significant threat to the environment.

Find out: Is this statement correct?
Consider: Does it make sense to stop promoting solar energy under these conditions?
Discuss: How can the use of solar energy benefit society?

Addressed value:

Environmental awareness and *sustainability*

Environment – B6.3 Wind power

Town forum:

The state government decided to approve open space directly adjacent to a nature preserve for the construction of wind turbines.

Views: Gather arguments for and against this zoning decision as representatives of the politicians, the zoning authority, the mayor, the local residents, the tourism association, and the farmers.
Discussion: After a round in which arguments are exchanged (listen only!), a solution should be found and an agreement reached.

Addressed value:

Environmental awareness and *sustainability*

Environment – B4 We produce drinking water – Methods of purifying water

Drinking water / groundwater dilemma:

Forest areas in the Hessian community of Ried are literally dying of thirst. Businesses and the local water supplier have been tapping into the groundwater for decades, and now the groundwater level has fallen so far in some places that more and more forest area is drying up. The tree roots can no longer reach the lower groundwater levels. The fall of groundwater levels is a problem wherever a lot of water is needed for big cities or water-hungry industries.

Discuss in a group consisting of representatives of an environmental organization, the city government, and the local industry: What can we do to solve the problem of diminishing resources in such a way that none of the stakeholder groups is severely disadvantaged?
Might it even be necessary and reasonable to charge higher fees to make the area less attractive to water-hungry industrial businesses so that they'll go elsewhere? Is the risk that jobs will be lost acceptable and responsible?

Addressed value:

Solidarity

Health – C6 Skin and hygiene – What happens when you wash your hands?

“Hand washing” dilemma:

You and your family are going to visit your grandma in her retirement home. You’re really looking forward to seeing her, and you know she’s looking forward to seeing you, too. The last time the family visited, you weren’t able to join them, since you were in bed with the flu. Your grandma also just had the flu and is now getting better. You bought something to bring to her and hope it’ll make her happy. On the way over, you tell your mother about the gift and say that although you’re looking forward to seeing your grandma, you don’t want to hug her or shake her hand, because you’re afraid you’ll get infected. Your mother doesn’t know what to do, because she knows that her mother will find that very impolite and hurtful.

Think about it: How do you behave with your grandma?

Addressed values:

Health awareness, *acceptance of responsibility* (being responsible for one’s own health)

4.3 Example of methodological implementation in Experimento | 10+

In this section, you will find an example from the teacher instructions for the Health module, topic of skin and hygiene, subexperiment C6.1 What happens when you wash your hands?:

In the discussion about values for this experiment, the teacher can provide a prompt or tell a story that poses a dilemma. What’s important is that the reference to values can be established in the experiment. Here, too, the values to be discussed can be either those related to the learning process (for example, “Was the group work team-oriented?”) or object-related values (for example, “Why is it important to wash your hands after using the bathroom?”).
The student instructions for C6.1 What happens when you wash your hands? implicitly address object-related values. The following suggestions should help examine the values in this experiment.

Object-related dilemma: An object-related dilemma can be integrated in the discussion of the values *health awareness* and *acceptance of responsibility* at the end of the student instructions. The students should express their opinions.

“Keyboard” dilemma:

Several years ago, a popular British magazine tested computer keyboards, toilet seats, and other areas for the presence of germs. Among 30 keyboards, 4 were found to have more bacteria than a toilet seat that was also tested. Levels of bacteria this high are a health threat and can lead to such symptoms as an upset stomach or diarrhea. That means it would be a good idea to wash your hands each time you finish using a keyboard or tablet/smartphone. But unlike with trips to the bathroom, this is not generally done, so the health risk is present.
(Quelle: http://www.gesundheitstrends.de/kompakt/gesundheitstipps/computertastatur.php)

Think about it: How do you behave?

Questions, if necessary: Encourage the students, if necessary, using questions for discussion, such as:
- “What reasons do you have for behaving as you do?”
- “What alternative actions are there?”

Possible examples of students’ statements:

Take action	**Take no action / ignore**
▪ I now wash my hands more often than before. ▪ Wear gloves, germs can be transferred via the skin, an infection from heavily used keyboards is likely. ▪ Disinfect the keyboard.	▪ Those are just harmless germs/bacteria. ▪ We’re surrounded by germs anyway. ▪ I don’t like sterile environments. ▪ I trust my immune system.

Objective: The students should learn to pay attention to their own bodies.
This dilemma deals with the values of *health awareness* and *acceptance of responsibility* for one’s own body.

Alternatives: Prompts can also be used to lead to the formulated case with a dilemma or for the following reflection. The values of *health awareness* and *acceptance of responsibility* remain unchanged.

Image for discussion shown by the teacher:
Sample image

Question for discussion
(necessary only if a discussion did not ensue from other prompts):

Why is it important to wash your hands after using the bathroom?

Note: The students should reflect on values and express their opinions. It may turn out that other values are addressed, such as *initiative.*