



SCIENCE FOR LIFE

Working with socio-scientific issues in school



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Why work with socio-scientific issues?

In today's world we cannot open a newspaper without confronting questions which to a lesser or greater extent have scientific content. Subjects under discussion can be, for example, climate change, genetic therapy, health issues or environmental concerns. We also encounter science in advertisements, for cosmetics or food for example. There are many reasons to work with science in school, using the issues the pupils encounter in their daily life through the television or newspapers, for example. Pupils find it interesting to work with this type of question and they practise using their knowledge in relevant contexts.

However, we also know that problems can arise from this work method. The pupils will discuss keenly their own values and problems in society, while forgetting all too easily the scientific content. How can one combine stimulating the pupils' interest with learning about science? Interest is encouraged, but how much scientific knowledge is actually gained? Are they learning more about science? Are they encouraged to participate more actively in social debates? Is their confidence in their skills in using science increased? We believe that if pupils are to be able to use their scientific knowledge outside school, they must learn to do so by working with authentic questions, preparing them for active citizenship. They also develop their skills at critical appraisal. If pupils learn so they understand, so that they can put questions and make their own decisions on social issues with scientific content, they acquire greater confidence in themselves and their skill at understanding and using science.

Research project

You participate in a research project which aims at obtaining more knowledge about the way pupils learn, and develop interest in and awareness of their own skills in science, while working with socio-scientific issues. We want to investigate what happens if one starts with authentic social problems instead of purely scientific content. The working methods and content are not new. Our interest lies, however, in discovering more about what happens to the pupils' interest in science, their knowledge and awareness of their own skills in these subjects, and what causal connections there are between these factors.

We are also interested in how teachers find working with this type of task. We would like to know how you view the pupils' knowledge development, their interest, involvement and what difficulties and developmental possibilities you see – as well as how you think you have developed yourself in terms of knowledge, both concerning the subject and the teaching method. We have formulated the following research questions for the project as a whole:

- How does the knowledge of different pupils develop when they work with socio-scientific issues?
- How is their interest and confidence in their scientific skills influenced by this work? What is the significance of the choice and form of the task?
- How does working with these questions develop the pupils' argumentation skills?
- How does the teachers' knowledge and view of teaching develop?

Working with the cases

We have worked up the basic structure of 6 cases and you can choose to work with one or several in one or several classes. The condition is that for each case in each class you meet the following criteria:

- At least 5 hours is allocated to the case
- Present the case in the way we suggest. Let the pupils ask questions, in the class or in groups, in order to answer any queries but also to stimulate ideas about how the cases can be solved. It is important that they take some initiative at an early stage.
- Organize the work so that the pupils are able to find answers to some of their questions through actively seeking knowledge, discussion and argument. At that point it is important that they are able to air and discuss their opinions. This often happens best in a group. But this does not mean that you cannot have teacher-supervised classes or classroom discussions. Practicals are an important component in the teaching of science. Consider carefully the reporting mechanisms you choose and how you will assess the learning outcomes.
- The pupils fill in a questionnaire and a test before and after the theme teaching
- You fill in a questionnaire after the work with each theme.

We have written a description of each case with a text addressed to the pupils and another to you, where we explain the idea behind the case and make suggestions about questions and resources. We have chosen not to complement the pupils' text with questions to answer as we want to allow you a great deal of choice in how you structure the work. Instead, we give suggestions for questions you can ask as teacher or which you encourage the pupils to ask. Of course you can work with the questions and the resources you find appropriate. It is important that you and your pupils work with questions that you find relevant. You decide too when to introduce new questions to the pupils, if at all. The idea is therefore not that the pupils necessarily have to work with the questions we have posed. Regard our questions instead as inspiration. It is you as the teacher who decides how you work. It is important to respond with further questions when the pupils state something or express a belief. How do you know? Who has written/said that? Are there other ways of looking at this? And what do they base their opinion on? etc. Your role as teacher is important. Many of the tasks can be carried out or answered simply with general reflection without consideration of the scientific content. But it is important that the pupils learn to build their argumentation on both scientific knowledge and personal opinion.

There are concrete goals set out for each case, as well as a list of targets from the Syllabus 2000, which are of varying relevance. We emphasize that the goals concern the natural science subjects with particular reference to *nature and man, activities in the natural sciences* and *the use of knowledge*. At the end of this brochure there is an attachment with current targets taken from the Syllabus 2000. There are also some pages of ideas on how one can work with media. In the same way as with the questions, you decide when the pupils see the goals for the different cases. Perhaps you would like them to think freely first and then see how this coincides with the goals, or perhaps you would like the pupils to know the goals at an earlier stage. You decide.

Socio-scientific issues

English speakers use the term “socio-scientific issues” to describe the type of content that the cases we outline contain.

Socio scientific issues:

- have their basis in science, frequently at the frontier of scientific knowledge
- involve forming opinions, making choices at personal or societal level
- are frequently media-reported
- deal with incomplete information because of conflicting/incomplete scientific evidence , and inevitably incomplete reporting
- address local, national and global dimensions with attendant political and societal frameworks
- involve cost-benefit analysis in which risks interacts with values
- may involve consideration of sustainable development
- involve values and ethical reasoning
- may require some understanding of probability and risk
(Ratcliffe & Grace, 2003)

One type of question that the pupils meet in their daily lives is where certain scientific content is well known to them, but that this scientific knowledge is not the basis of information that is presented.. This can be, for example, dieting methods, descriptions of training regimens, astrology and the like. Pupils need to be able to apply their knowledge of science in order to be able to make judgements about what is reasonable, to be able to critically assess information and to realize what is, actually, quite wrong. In order to illustrate this type of question, we have chosen to allow the pupils to work from the television programme *You are what you eat*.

Another type of question is where the scientific content again is well known and can make understanding the situation easier, but where the formation of an opinion itself is dependent on other knowledge and personal values. We illustrate this type of problem with three cases: *To hear or not to hear*, *Laser treatment and near-sightedness* and *Me, my family and global warming*. The three are characterized by the type of argument used and the level at which the case is argued. The case about hearing concerns ethics on an individual level, the case about sight concerns ethics at a community level and in the case about fuel, certain consequences for a family create a conflict of interest.

A third type of question is one where scientific knowledge cannot provide a certain foundation of knowledge. In the work on these questions, the pupils learn to interpret and discuss a variety of sources. One example of this sort of question is *Are mobile telephones hazardous?* When it comes to *Climate-friendly food in school?*, the science is known, but it is difficult to evaluate the consequences of various alternatives, as there are complex causal connections to be considered. The tasks build upon calculations that are difficult to absorb and understand.

Many of the questions are connected to the environment and to health but concern almost always biology, physics and chemistry. All the cases are characterised by their foundation on authentic social questions whose solutions require knowledge of the natural sciences, rather than on concepts drawn from the natural sciences that are explained using examples.

A little about what research says about motivation and learning

Motivation is strengthened by that which is closest to the pupil's own world, by having influence over their work, by an appropriate level of difficulty and if they are allowed to discuss matters. Amongst the general public, interest for the natural sciences is greatest when it concerns the application of science and technology within the fields of medicine, the environment and industry, as well as inventions and discoveries.

The natural sciences and learning

Concepts and theories must be relevant in relation to the task; the pupils must understand these and further, the connection between the task and these concepts or theories. One can understand a question with relatively limited knowledge if these are placed in a context and are well structured. No-one knows how learning occurs and there are many theories about learning. This project has its basis in theories that hold that new knowledge should be built upon previous knowledge. Previous knowledge has significance for how one absorbs new knowledge. Learning is a communicative process.

Case 1

1. You are what you eat?

(Image from TV-programme)

Swedish Television 3 (TV3) broadcasts the programme *You are what you eat*. Programme host Anna Skipper helps people with various weight and health problems. She gives them advice on what they should do to loose weight and improve their health. But how wise are her suggestions?

Task

Your task is to watch en episode of the TV programme *You are what you eat* and critically assess Anna Skipper's advice and how she motivates her suggestions. Write a short summary of the problem that the person participating in the programme has and how Anna Skipper helps him or her. What is the problem? What does one do to solve it? What is the result? Describe as well the things you find difficult to understand or things you wonder about. If you like, you can instead record your summary on an mp3 player.

Compare your summary with others, either in a group or together with the whole class. What else do you need to know to be able to understand what Anna Skipper is saying? And what do you need to find out to be able to make a judgement about her advice? Work further with some of these questions and compare what you come up with to the results of other groups. It is particularly interesting to talk about things you don't agree on. Try to explain why you don't agree.

You can read more about the programme and the people who are on the show on TV3's homepage (www.tv3.se).

To the teacher:

Many children and adolescents are overweight. Other youngsters suffer from eating disorders. There is concern that today's young people do not have sufficient knowledge about what one should eat to feel healthy. Besides this, the array of so-called junk food is enormous. At the same time, the world we live in is characterized by the demands made on young people about the way they look. This increases interest in information about how to live a healthy life and look good. The media makes the most of this interest and there are a great number of articles about life-style in the daily and weekly press. TV3 shows a programme concerning this area of interest. The channel shows the programme *You are what you eat*, with Anna Skipper as the host. It is an entertainment programme that has become popular amongst younger teenagers.

The programme's basic theme is that a person with weight problems – usually overweight – is helped in changing this through advice on nutrition and exercise. The programme uses many terms and concepts and the viewer is given information about the effect on the body of various substances. Sometimes the advice is consistent with what we teach in science lessons. Sometimes, as a science teacher, it seems that there is no foundation for the advice at all. The contents of the programme are therefore appropriate for critical analysis. It is also appropriate to assess the way in which the information is given. The relationship between the host and the participants is not always equal. The participants are in a subordinate position in seeking help to solve their weight problems. There is a power relationship which is created and strengthened in various ways.

This task requires the students to watch the programme as homework. If they are not able to watch it when it is broadcast, they can record it. They can decide if they want to watch it individually or in small groups. After the programme they write, or record, a short summary according to the instructions in the pupils' section above. It doesn't matter if all the pupils see the same programme as there is a detailed homepage where the various programme participants are introduced. The homepage also gives all the recipes for the food cooked on the programmes as well as links to information about nutrition, exercise, food additives and so on.

At school, the pupils discuss their summaries in groups. Then they formulate the questions that arise from the task. Some of these should concern nutrition and exercise. Most appropriately they then choose, in groups or individually, which parts they wish to work further with. The work can continue using the programme's homepage.

The work can result in the pupils writing to the programme to ask questions. They can make an alternative programme, organize a debate, arrange an exhibition or make up a suitable diet-plan for themselves. It is a good idea to discuss the form of report with the pupils.

Concrete socio-scientific issues

The question has clear socio-scientific content and is an example where the natural sciences can help one to be critical and not to "swallow" everything. The content deals with different types of food substances and how the body copes with these. It deals with what the body needs, leading to material and energy and metabolism. What is important here is to see the connection between the whole person and what is happening and the cellular and molecular levels. We can learn about good eating habits and about various methods of dieting, but if we are to know how they affect the body, we have to explain the mechanisms on the molecular level. We can also acquire knowledge about how weight increase and weight loss on the individual level is an interplay between nutrition, exercise and hunger. This leads us to consider cellular activity and what happens when we gain and lose weight.

Examples of questions:

- How do we see ourselves? Are you satisfied with your body?
- When is one satisfied? When do you think that others are satisfied with your body?
- What does the body need in order to function?
- What does the food we eat contain?
- Why does one gain or lose weight?
- What happens during exercise?
- What is the burning up of fat? Does it help to train before you eat?
- Why is there so much different advice when it comes to nutrition and health? Who do you trust? Why do you trust that specific advice? What knowledge are various types of advice founded on?
- What does it mean for the individual – that is to say, me – to be overweight or underweight? What is normal? How does our view of what is normal vary between different cultures, historically and geographically?
- What impact does obesity or eating disorders have on society – that is to say, with regard to health care costs etc.?
- Do you have a critical attitude towards the programme and other information? How does one know? How do you know? What do you want to argue for? On what grounds?
- What methods does the programme host use to strengthen her position in relation to the participants?

Goals for this case:

After working on this case, the pupils should be able to:

- use their knowledge about the metabolism of cells and the constituent parts of food to be able to assess nutritional advice critically;
- find information about various substances that are found in food, from – for example - the National Food Administration and from the homepage of the TV programme’s website, and be able to compare information;
- explain how weight gain and weight loss occurs; that is to say, the relationship between intake and use, and how one keeps hunger under control;
- discuss how exercise affects weight;
- form an opinion with regard to their own lives in relation to nutrition and exercise based on relevant knowledge and personal values;
- discuss various opinions about what a “normal” or “beautiful” body is;
- discuss to what extent arguments are based on values and on knowledge of the natural sciences.

Case 2

Laser treatment and near-sightedness

Sussie tells her story about her near-sightedness and laser treatment on a personal homepage:

PRK-laseroperation

Antingen så är jag urusel på att söka fram information på nätet, eller så finns det helt enkelt inte den informationen som jag är ute efter?

Jag har nyligen opererat bort min närsynthet, på ena ögat, med laser. Och naturligtvis så ville jag gärna läsa om det på nätet innan. Men jag hittade inga sidor där privatpersoner skulle ha skrivit ner sina erfarenheter. Så.. det som man inte hittar på nätet får man väl sätta ut själv?

Jag kommer inte att berätta om själva operationen, det får du läsa om på klinikernas egna sidor. Där berättar de utförligt hur operationen går till. Jag tänkte mest berätta om hur det kändes, samt hur jag uppfattade det efter operationen.



Varför jag valde operationen?

Jag har använt linser sedan jag var ca 14 år. Jag minns faktiskt inte exakt när jag fick mina första linser, förutom att jag gick i högstadiet. Innan dess hade jag sett dåligt i många år. Jag fick ett par glasögon i lågstadiet som jag vägrade använda. Men ca 10 år med kontaktlinser sätter sina spår. Eftersom jag hatar glasögon så använde jag linserna hela tiden. Ca 15 timmar om dagen och 7 dagar i veckan. Alla kontaktlinsebärare vet att det är alldeles för mkt. Men jag ville inte sätta ett par fula glasögon på näsan. En vacker dag sade min optiker åt mig att mina ögon inte kommer att orka så värst länge med linserna mer. Och det hade jag nog märkt själv. Mina ögonvitor var inte längre vita, de var blodsprängda, och mina ögon var irriterade och sjuka. Jag kände att jag bara hade 1 alternativ. Glasögon eller operation!?

Det var inte ett särskilt svårt beslut, eftersom jag verkligen HATAR glasögon av hela mitt hjärta! Och jag skall berätta varför:

Jag var tvungen att använda glasögonen i 2 veckors tid, innan undersökningen och operationen, och jag kom på hur många anledningar som helst för att hata glasögonen.

Top reasons to hate glasses längre ner på sidan.

http://www.geocities.com/sussie_mad/laser.htm

PRK-laser operation

Either I'm so pathetic at finding information on the Net or there just isn't the information I'm after?

I recently had an operation for my near-sightedness, on one eye, with a laser. And of course I wanted to read about it on the Net before I did. But I didn't find any pages where patients had written about their experiences. So ... what you don't find on the Net you publish yourself, right?

I'm not going to talk about the operation itself. You can read about that on the home pages of the clinics that do it. You can get a lot of details there about how they do the operation. I thought I'd talk most about how it felt, and what I thought about the whole thing after the operation.

Why did I choose the operation?

I've been using contact lenses since I was about 14 years old. I really don't remember exactly when I got my first contacts, except that I was in high school. Before that, my sight had been bad for a long time. I got a pair of glasses in primary school that I refused to wear. But about 10 years with contact lenses has consequences. Because I hated glasses I used my contacts all the time.

About 15 hours per day, seven days a week. Anyone who uses contacts knows that that is just too much. But I couldn't bear to put a pair of ugly glasses on my face.

So, one day my optician told me my eyes just couldn't take lenses any more. And I'd realized the same thing myself. The whites of my eyes weren't white anymore – they were bloodshot, and my eyes were irritated and unhealthy. I only had one alternative: glasses, or the operation!?

It wasn't a difficult decision, because I HATE glasses just so much. And I will tell you why.

I had to wear glasses for two weeks before the examination and operation, and I came up with SO many reasons for hating glasses.

[Top reasons to hate glasses at the bottom of the page.](#)

Many people do just the same as Sussie. They agree to a laser operation to correct their near-sightedness. Others don't because they think it costs too much, because they think it is too much of a risk and the operation might be uncomfortable, or because they fear the result might not be good enough. What do you think when you read Sussie's story? What are the deciding factors when you have a choice like Sussie's to make?

Tasks

Now it's your turn to decide if going through a laser operation to correct near-sightedness is worth it. You should also decide who is to pay for the operation, if it is to take place. When you report on your decision you should be very clear in your explanation of why you think the way you do. Do it in a way that will make others trust you. What more do you need to learn in order to build up a good argument? How will you find this information? Where will you find the information to read and who can you ask?

You will report your decision and compare it with others'. You can do this in a group, or with the whole class. It is particularly interesting to talk about things we are not necessarily in agreement on.

To the teacher

It is said that more and more people are near-sighted. Is this correct? And if so, is this a problem? Should we devote national health-care funding to correcting near-sightedness with operations when there are other illnesses that are more life-threatening? If not, who should pay?

The task requires the pupil to make a decision and to argue for his or her point of view. There is a clear connection to the natural sciences as well as a social perspective that can be discussed at various levels. One can begin from an individual perspective: what would I do if it was me? One can also view the question from a more national perspective: what significance does this have socio-economically? It is important to help the pupils to support their opinions with knowledge from the natural sciences and from social studies, as well as personal considerations. The work could be reported on in the form of an article, debate or role-play.

Concrete socio-scientific issues

This task deals with the structure and function of the eye: i.e. how one sees, the properties of light and its refraction. The task includes as well the need for knowledge about lasers and how a laser operation is carried out. Energy concepts are central above all in this context.

Examples of questions

- What is a sight defect? What defects do your classmates have? What causes these defects?
- What is a handicap?
- How is a laser operation for near-sightedness carried out? What are the risks with this operation?
- How does the eye function before and after the operation?
- What is the difference between wearing glasses, contact lenses and having your eyes operated on?
- What does a laser operation cost? Who pays?
- How do we see? (Subject didactics in practice /Nordlab)
- How does the eye function?
- Should you correct defects if there are any present?
- Are there alternatives, and how do they work? (glasses and contact lenses)
- Are there risks? How do you weigh up risk versus benefit?
- Who should pay? How should we prioritize this kind of health care?

Goals for this case:

After working on this case, the pupils should be able to:

- use their knowledge about the structure and function of the eye and of the properties of light in order to describe how one sees and what is happening in the eye in the case of near-sightedness
- use their knowledge about laser treatment and what happens during this treatment in order to judge the risk involved in relation to the benefits
- list some alternatives to laser treatment - for example contact lenses - and be able to explain how they function. The pupils should also be able to judge the advantages and disadvantages, thus reaching a personal conclusion
- reach a conclusion about the use of medical technology in relationship to what it costs society or the individual. Consideration should be given to the individual and national perspectives.
- evaluate and use information- which can be coloured by a variety of interests – in order to reach an opinion about laser treatment and other medical technology
- discuss to what extent arguments are based on values and on knowledge of the natural sciences.

Case 3

To hear or not to hear

This task begins with reading an extract from the novel *Talk Talk*, by T C Boyle. The book is about Dana who is deaf, and how her family and her boyfriend view her handicap and her refusal to try to treat it with a so-called cochlear-implant. Now read two different extracts from the book. The first episode is a discussion between Dana's mother, Vera, and Dana's boyfriend, Bridger. The second extract describes a later conversation between Dana and Bridger.

EPISODE 1

From the kitchen, down the hall and two rooms away, there was the thump and clatter of things being shifted around, a sudden crash, a curse. "What?" he said, distracted. And drunk. Drunk for sure.

"She can be stubborn. But you already know that."

He shrugged. This was neither the time nor place for a critique.

Vera—could he call her Vera?—seemed deflated suddenly. Her own wineglass was empty and she rose to refill it and gestured toward him, but he laid his palm over the rim of the glass and shook his head. Her face composed itself. She sat heavily. For a long moment she said nothing and he was beginning to think the interview was over when she waved her glass and said, "Cochlear implants. For example. Take cochlear implants."

He'd never heard the term before he took his Sign language course. It was the first night, *and* one of the students wanted to know why the deaf didn't just go out and get implants and dispense with Sign altogether. The teacher—she was married to a physicist who was prelingually deaf and used a combination of speech, lip-reading and Sign to communicate—pointed out that not everyone was a candidate for implants, for one thing, depending on the extent and pathology behind their hearing loss, and that among those who were, the results were often mixed. She went on to explain the procedure—the patient would have a receiver and electrodes surgically embedded in the mastoid bone and cochlea in order to pick up sounds from a tiny microphone located behind the ear. In the best-case scenario, these sounds would be transmitted to the auditory nerve and the patient would have some measure of hearing restored, perhaps enough to allow him to function almost normally in the hearing world, especially if he'd lost his hearing later in life. For the rest, it might be enough to improve lipreading and enable them to talk on the telephone, hear alarms and car horns, that sort of thing. It wasn't a magic bullet.

"You know about cochlear implants?"

He nodded.

"Well, Dana... and this really frustrated me and her father too, and maybe frustrated is too mild a word because I was ready to scream"—she paused to give him a brittle smile—"but of course Dana wouldn't have heard me no matter if I screamed all day and all night for the rest of my life. But the point is she refused to be evaluated. Wouldn't even go to the otologist, not even to find out if she was physically capable of improvement—wouldn't hear of it." Another smile. "Listen to me. Just the way we talk, the expressions we use—"

"I hear you," he said, and for a moment she looked startled. Then her features rearranged themselves again and she slapped the arm of the chair and they were both laughing, the siren playing distantly beneath them, keening as if to split the night in two.

EPISODE 2

She watched for the words, but already the impulse was dying away. After a moment, after he'd turned back to the map, she said, "Never mind. It's not important."

On the way up from the city she'd quizzed him about her mother and how they'd seemed to get along so famously. "What did you talk about?" she asked him.

He was squinting against the glare of the road, his eyes jumping to the mirrors and back—traffic was heavy and it made him tentative. "You," he said. "What else?"

"Yes?" She laid a hand in his lap and he glanced at her before coming back to the road. It was muggy, overcast, threatening rain. "Tell me. What did she say?"

She couldn't read him in profile, but she saw his lips move.

“I didn’t hear you;” she said. “What?”

He swung his face to her, gave a little smile. “She said you were stubborn.”

Me? Don’t believe everything you hear, my friend, especially considering the source. Especially from your girlfriend’s mother—”

“Girlfriend? I thought you were my fiancée?”

“Your fiancée’s mother:” She glanced out the window on vegetation so dense they could have been in the Amazon—less than ten miles from the city and there was nothing visible but a fathomless vault of green. “So I’m stubborn, huh?” she said, turning back to him. “What brought that up?”

A shrug. “I don’t know. That first night, when you did the dishes and went to bed right after we ate—?”

His head was tilted forward, eyebrows cocked. Was he asking a question or making a statement? “I’m not following you,” she said.

He glanced tensely at the rearview, then brought his face round so she could see the words: “When-you-were-in-bed.”

“Yes?”

“Cochlear implants. She said you wouldn’t even go in to get examined”

It took her a moment, the sweet smell of chlorophyll flowing at her through the vents, the sky closing in, darkening like a spread umbrella. She said, “She would think that. She was always pushing, pushing. But you don’t understand—she didn’t understand. It was my decision and nobody else’s.”

“What about now? Would you do it now?”

She let out a laugh, the kind of laugh that was meant to be bitter, mocking, but it might have sounded like a scream for all she knew. “No way” she said, and she relished the brevity and finality of the phrase, so much intransigence packed into two little syllables.

“Why not? Other people—

She signed it: *You sound like my mother.*

He gave her a look and took both hands from the wheel. *Other people do it*, he signed. *Why don’t you?* *Then*—the car began to drift and he made a quick grab for the wheel—“then we could talk,” he said aloud, his eyes darting to the rearview mirror.

“We are talking.”

“You know what I mean.

“No,” she said. “No, I don’t. You mean I have to talk on your terms, in your language, is that what it is?”

“It’s just that it could be better, that’s all I’m saying.”

“Listen,” she said, “even if I wanted to let somebody open up my head, and I don’t—would you want somebody to open up yours? Even if I did, even if I could hear something, anything, the best things in the world—music, my own lover’s voice, your voice—I wouldn’t do it. This is me. If I could hear, even for an hour, a minute, I’d be somebody different. You understand what I’m saying?”

He nodded, but his eyes had that vague look, as if she were speaking in some foreign language, and then he snatched them away and focused on the car ahead of him. Maybe he hadn’t heard her properly, maybe that was it. Whenever she got passionate, whenever she got wound up, she tended to garble her words. She repeated herself, the whole speech, because her mother was wrong—she wasn’t stubborn, just determined. And decisive. Even as a child she’d known which world she wanted to live in—the world she’d created for herself, the one she’d built block by block around her till it was impenetrable—and there was no one, not her mother or father or the nimblest and most persuasive audiologist in the world, who could tell her different.

When one discusses handicaps, one usually assumes that everybody wants to be “normal”. But as the dialogues between Bridger and the mother, and between Bridger and Dana show, there are different ways of looking at “handicaps” and the need to correct them. Why do Bridger and Vera (the mother) want Dana to have cochlear implants? Why doesn’t Dana want this? How do cochlear implants work, compared with “ordinary” hearing? What ways do deaf people have of communicating with each other and with hearing people? Report on various opinions about being deaf and about “curing” deafness.

Task

What do you think about when you read this text?

Now you are to make a report on the different reasons why some deaf people choose to have cochlear implants, while other choose not to, even if their hearing could be improved. What more do you need to know in order to understand how you can explain different views on cochlear implants? Where would you find this information? Who can you ask?

You are to report on the various explanations you have found why some deaf people choose to have cochlear implants while others choose not to. Then you are to compare these explanations you have found with other people’s thoughts. You can do this either in a group, or with the whole class. It is particularly interesting to talk about things you do not agree on. Try to explain why you are not in agreement.

To the teacher:

Many pupils may find this text long and difficult to read. To help the pupils get through the text, it might be appropriate to read it aloud together in class.

The aim of the task is to make use of knowledge of the natural sciences and of social studies to be able to discuss a complex authentic problem, illustrated here by the use of cochlear implants.

As medical technology goes forward, the possibilities of treating and “curing” various handicaps increase. Our perception of who is “normal” changes with technological development. Cochlear implants are yet another form of treatment to make hearing-impaired people “normal”. But for the individual, the handicap itself can be a strong part of that person’s identity. What is regarded as something self-evident by society can for the handicapped person feel like a deprivation of cultural belonging. A cochlear implant also has the result of setting the individual in a no-mans land between hearing and hearing-impaired, where he or she becomes “almost hearing” perhaps in only one ear.

In this context, the pupils should consider questions about what is possible to treat and about where economic resources should be expended. Should we for example, develop techniques for treating unusual handicaps, or use our resources in treating more common - perhaps less serious – illnesses and handicaps? Should one treat a condition, just because one can?

Concrete socio-scientific issues:

This task deals with hearing. This includes the structure of the ear and its function, and how sound is made, spreads and is registered. The techniques behind cochlear implants are dealt with as well.

Examples of questions

- How do we hear?
- What is sound?
- What are some of the causes of impaired hearing?
- What does a person’s hearing impairment mean for their identity?
- Who can be helped by cochlear implants?
- How does this type of hearing impairment occur?
- What causes hearing impairments?
- What causes it to occur from birth?
- How does hearing created with the help of cochlear implants work?
- What difference does it make having hearing in one or both ears?
- How do people with impaired hearing experience the world?
- How are hearing and speech connected?
- How can you communicate together without being able to hear?
- What is deaf culture?
- Why do not all deaf people want to have an implant?

Goals for this case:

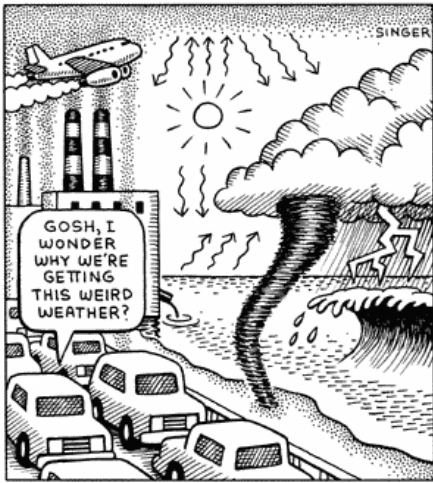
After working on this case, the pupils should be able to:

- use their knowledge about sound and the structure of the ear and its function to be able to describe how “normal” hearing works, compared with hearing created by electrical impulses from a cochlear implant
- using hypotheses about what it is like to live as a deaf person (in one or both ears), to design and carry out trials; as well as to draw conclusions from the results about the advantages and disadvantages of cochlear implants
- weigh up the advantages and disadvantages of cochlear implants, both on ethical and medical levels
- evaluate and use information and gain understanding of how it may be coloured by various interests
- be able to differentiate between arguments based on values and arguments based on scientific knowledge.

Case 4

Me, my family and global warming

THE GREENHOUSE EFFECT



You haven't missed all the news about climate change? One important reason for this is the emission of carbon dioxide from cars, busses, aeroplanes and other forms of transport. Both young and old alike are worried about how our climate will develop in the future. Politicians and the mass media are heavily engaged in the problem. For example, you can read in the newspapers about tips on how to reduce our effect on the climate.

Task

You are to make some suggestions for how you and your family or how your town or city can reduce its emission of carbon dioxide. To be able to do that, you need first to find out what the situation is like today.

How does your family travel around?

What modes of transport and vehicles do you use in your daily lives and in your spare time?

How are these vehicles fuelled?

What other alternatives are there for travelling to the places you need to go to? Are there other solutions? Do they bring with them a reduction in carbon dioxide emissions?

Report on how much you can reduce your emissions by choosing other alternatives and explain as clearly as possible what you need to do. Discuss what is possible to do in your family and what you think is important. What do you need to learn more about to be able to carry out this task? Where can you read about this? Who can you ask?

You are to report your results and compare them with others'. You can do this in a group or with the whole class. It is particularly interesting to talk about things you don't agree about. Try to explain why you don't agree.

To the teacher:

We think that this task can form part of a larger theme-based project on climate and energy. One way of dealing with the concern that many feel is to be involved in these questions and to understand what ways there are of affecting what happens. The questions about transport contain a number of conflicts of interest on the individual level, as well as on local, regional and international levels. We make choices based on personal circumstances, knowledge and what is in fact possible to do. On the personal level, it can concern economy, the environment, convenience, freedom and what choices are actually possible. These possible choices are decided by where we live, where we work, what public transport is like, etc. The task can appropriately be given a local and personal relevance. In April 2007, the effect of snow-scooters on climate change was discussed both locally on northern Swedish TV and on a national level. Nobody can be unaware of the media coverage of climate change in 2006-2007.

In order to make judgements about various solutions, one has to consider energy use, energy production and environmental effects in the whole chain of fuel production from cultivation/extraction to burning in motors. Depending on social systems such as politics, economy, legislation etc, we can as citizens be led to use different fuel alternatives.

It is easy to become moralizing or prescriptive when working with this type of task. It is therefore a good idea to start by investigating the actual current situation. In what way and how much does the family use transport?

Not all families have vehicles of this type. This is why there is the alternative of using local traffic situations. Some groups can work with the family situation, while others can look at the local public situation.

Concrete socio-scientific issues:

The natural science content deals with materials, energy and its storage and transfer. The effect on the environment of the burning of fossil fuels and bio fuels is the starting point of the task. These questions touch on consumption and the chemical reactions involved in photosynthesis, cell respiration and breakdown. In this context there is also a focus on the environmental effects of various fuels in a long-term perspective. The green-house effect and acidity are brought up as they are the most important environmental effects in this case. The subject content can be expanded widely, but this task should be limited to questions about decreasing the use of fossil fuels.

Examples of questions

What motor-driven vehicles are there in your family? (cars, scooters, lawn mowers, mopeds etc.)

- How much are they used? What for?
- What transport needs does the family have?
- What fuels are used?
- What advantages and disadvantages do these fuels have?
- What is an eco-car?
- What alternatives are there? Can you ride the bus or cycle, or do you need to use the car?
- Is it possible to reduce the need of transport?
- What is the difference between bio-fuels and fossil fuels?
- What happens to the fuel when the vehicle is driven?
- What becomes of the petrol, for example?
- What fuels result in the most carbon dioxide, and why?
- What fuels are used on buses?
- Why has that fuel been chosen?
- What advantages and disadvantages does it have?
- What does your town do to encourage people to use public transport?

Goals for this case

- after working on this case, pupils should be able to:
- compare a variety of alternative fuels using knowledge about the burning of fuel and the products of burning, and about their effects on the environment from a “start to finish” perspective
- discuss various ways of reducing carbon dioxide emissions and - considering ecological, social and economic consequences – weigh up the advantages and disadvantages of a variety of modes of transport in order to propose a concrete plan of action for his or her family and/or town
- argue for his or her own personal opinion using knowledge of natural science
- evaluate and use information - which can be coloured by various interests – in order to make a proposal for how carbon dioxide emissions can be reduced both in the long term and short term
- discuss to what extent arguments are based on values and on scientific knowledge.

Case 5

Are mobile telephones hazardous?

(Note: The yellow boxes contain headlines from two newspaper articles taken from the same daily newspaper, slightly over one month apart. One says that using mobile telephones increases the risk of brain tumours. The other one says that using mobile telephones do not cause cancer.)

Aftonbladet 070131:

Din mobil kan öka risken för hjärntumör

Dramatisk ökning av elakartade tumörer

Mobiltelefoner ökar risken för elakartad hjärntumör med 39 procent.

Det visar en ny FN-studie.

– Undersökningen är den största i sitt slag och en kalldusch för mobilbranschen, säger professor Lennart Hardell.

Aftonbladet 061205:

Mobiler ger inte cancer

Lugnande besked i stor dansk studie

STOCKHOLM.

Det finns inget som tyder på att strålning från mobiltelefoner kan ge cancer.

Inte ens hos personer som använt mobil under mycket lång tid.

Den slutsatsen dras i en mycket stor dansk studie där 420 000 personer deltagit.

In recent years, newspapers, radio and TV have broadcast different reports about the risks of using mobile telephones. Researchers disagree on how dangerous the radiation from mobile telephones and telephone masts really is. They also disagree on ways in which people might be affected. This disagreement often concerns if the radiation can increase the risk of brain tumours, but other illnesses have also been discussed.

As a newspaper reader, you get very mixed messages; newspapers can give conflicting information, sometimes even the same issue. Mobile telephones are an important means of communication for most of us today. How are we to know what is dangerous, and if so, how can we protect ourselves?

Task

Your task is now to find out what risks you expose yourself to when you use mobile telephones. Should you change the way you use your mobile? What do you think when you read this type of article? What more do you need to know to be able to decide what you want to do? Where do you find information about this? Where can you read more about it? Who can you ask?

Read through the messages contained in the newspaper articles. Which articles should we trust? Who is it making these different claims in the newspaper? Has this person or this organization any particular motivation for making this claim?

When you report on this task, you should describe what possible risks there are in using mobile telephones and how you have reached this conclusion. You should also describe your thoughts about your own use of mobile phones and if – and in that case, why – you need to change the way you use them. You should report your conclusions and compare them with others'. You can do this in a group, or in the whole class. It is particularly interesting to talk about things we do not agree on. Try to explain why you are not in agreement.

To the teacher:

This aim of this task is to encourage the pupils - using well-founded arguments – to reach a conclusion about the use of mobile telephones. To be able to do this they need knowledge about how the radiation from mobile phones works and how this can have an effect on cells.

The task also has a socio-scientific goal. The pupils are to develop their competence in critique of the media, to be able to critically assess the material presented in daily newspapers in a relevant context. The pupils should also be able to weigh up advantages and disadvantages and make a risk assessment of the use of mobile telephones. If they conclude that radiation from mobile telephones is hazardous, to what extent are they prepared to change their behaviour?

Concrete socio-scientific issues

This task concerns radiation and its effect on cells and tissues. It also sheds light on how mobile telephones work and how signals are transferred. It concerns both telephones and telephone masts. In this context it can also be interesting to discuss the character of natural science; that is to say, how one presents a hypothesis and interprets data, as well as how natural science is used in industry and so on.

Examples of questions:

- What kind of radiation is discussed in connection with the use of mobile telephones?
- How does radiation work; spread, penetration, effect on tissues and cells?
- How can you block radiation?
- How can you show this in an experiment?
- What are you in agreement about?
- What do you have different ideas about?
- What is a brain tumour? How does it originate? How can you cure it?
- What mobile telephones emit the most radiation?
- What do its manufacturers say?
- What connection is there between masts and telephones and radiation?
- What significance does the age of the user have?

Goals for this case

After working on this case, the pupils should be able to:

- explain what radiation is and how radiation affects cells
- describe how mobile telephones work
- explain how to protect oneself from radiation – what protects the brain from radiation
- describe and evaluate the risk that can be attributed to the use of mobile telephones and weigh these against the advantages that the use of mobile telephones confers

- evaluate information given by the mass media and to critically assess various sources
- get an insight into the scientific processes that can lead to differing results

- use their own values and relevant knowledge in arguing for or against the use of mobile telephones
- discuss to what extent an argument is based on values and on scientific knowledge.

Case 6

Climate-friendly food in school?



Our eating habits affect the environment more than one would think. More and more reports discuss the connection between food and the climate. This is seen clearly from the following quote:

“The food industry is responsible for more than one quarter of the green house emissions in Swedish society. The transport of ingredients and food makes up for a significant amount. The very worst is the very last short transport”, says researcher Ulf Sonesson of the Institute for Food and Biotechnology, “from the supermarket shelf to your refrigerator.” (*Dagens Nyheter (The Daily News, 2007-04-10)*). During the summer of 2007 it was reported that the National Food Administration was working on a climate marker for food. This means that consumers are given information about their own influence on the green-house effect. On the homepage of the KRAV association there is advice about what one can do as a private person, until this marker system is in place. (The advice given by KRAV is in its own interests. There are other opinions about what is the most climate-friendly way to produce food).

Choose food according to season. Lettuce, tomato and cucumber are fine in August when there is a lot of locally produced vegetables. In January, however, it is better to serve a salad of grated cabbage and apple.

Eat less meat. Meat generally has a high effect on the climate, while for example KRAV-marked beef also has a number of advantages for the environment.

Choose KRAV-marked food. Agriculture certified with the KRAV mark has larger amounts of carbon in the soil in the form of plant material and living organisms, KRAV-certified animal husbandry is largely founded on the local provision of fodder, minimising the import and transport of animal fodder. (Source: www.krav.se/klimat)

Task

Your task is to make suggestions for how the food served at school can be more climate-friendly. Write a letter from your class to the school management (or your municipality) and describe your suggestions, and present your arguments. The work in putting your suggestions together can be undertaken in groups, with each group choosing a food commonly served in your school cafeteria, like milk, pasta, potatoes, carrots or meat. What more do you need to learn in order to argue in a convincing way? Where do you find the information? What can you read, and who can you ask?

Find out what differentiates this food from more climate-friendly varieties – above all when it comes to production and transport – but don’t forget to consider economics. In what ways are the foods you recommend more climate-friendly than those already in your cafeteria? Investigate as well what consideration your school already gives to environmentally-marked and climate-friendly food. Then compare your results and formulate a letter together. Think about what the differences and similarities there are in what you have come up with. Do you all think the same thing?

To the teacher:

This task has a number of aims. One is that the pupils increase their knowledge of the production of food and the effect on climate and the connection between the use of energy and climate change. Another aim is that they attain a greater understanding of the role played by the economy in the purchase of food. The third aim is that they develop competence in purchasing that affects their own daily lives, helped by – amongst other things – well-grounded arguments. It is interesting to follow up the answers from the school management and consider what they mean. This lies outside the scope of this task, however, and can be viewed as a more long-term project.

Concrete socio-scientific issues

The task concerns energy from a number of different perspectives. It concerns, amongst other things, the energy used in food production and transport, the energy consumption of various products and the energy use of various modes of transport – but also what type of energy is used. This also touches on the laws of thermo-dynamics on the indestructibility of material and energy transformation. It concerns material and the products of burning, where carbon dioxide plays a decisive role.

Examples of questions

What does it mean when a food product is KRAV-marked?

Why is climate-marking necessary on food?

What distinguishes the food served today from more climate-friendly varieties, above all when it comes to production and transport?

Is climate-friendly food more expensive?

What consideration does the school show today concerning environment-marked and climate-friendly food?

In what ways do production, handling and transport of various food products contribute to the effect on the climate?

Who decides on the purchase of food for the school cafeteria?

What modes of transport are best from a climate perspective?

What do you need to consider when you choose a mode of transport for a particular food?

What difference is there between a vegetarians' effect on the climate and someone who eats 1 kilogram of beef per week?

Goals of the case

After working on this case, the pupils should be able to:

Use energy and material concepts in explaining the effect on the climate of various foods

Explain the connection between energy consumption, carbon dioxide and climate change

Critically assess various sources

Act to change their daily lives at school

Use their own values and relevant knowledge in the argumentation for or against the purchase of climate-friendly food for the school cafeteria

Differentiate between arguments based on values and arguments based on scientific knowledge.

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