

## Questioning: why do we fall ill?



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### **Video resources**

*Some of the activities in this unit are accompanied by the following icon: . This indicates that you will find it helpful to view the TESS-India video resources for the specified pedagogic theme.*

*The TESS-India video resources illustrate key pedagogic techniques in a range of classroom contexts in India. We hope they will inspire you to experiment with similar practices. They are intended to complement and enhance your experience of working through the text-based units, but are not integral to them should you be unable to access them.*

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All India - English

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## What this unit is about

This unit is about asking good questions, responding to students' answers and encouraging students to ask questions.

Teachers spend 35–50 per cent of their time on class questioning. Effective questioning enhances student learning. Good questioning can direct their attention to key concepts and help to improve your students' understanding. It will also help you to find out what your students know and understand about a topic, enabling you to adjust your approach if necessary. However, effective questioning is difficult for teachers. There are different types of questions to consider, and questions can be asked in all sorts of different ways. Careful planning is required to ensure that you ask the kinds of questions that support student thinking and learning. How you react to students' responses will also determine how effective your questioning is, in terms of supporting learning. As you will discover, thinking of good questions to ask will help your own understanding of a topic and the same applies to your students. So creating an atmosphere in which students feel confident to ask questions themselves will help you to become a more effective teacher.

The ideas in this topic will be illustrated through the Class IX topic 'Why do we fall ill?', but they also apply to all the other topics that you will have to teach in science.

## What you can learn in this unit

- The importance of asking different types of questions and how to construct different types of questions.
- Some different ways of asking questions in your classroom.
- How to encourage your students to ask questions.

## Why this approach is important

Asking questions is an important way of finding out what your students know and understand. But there are other reasons why teachers ask questions:

- to check prior knowledge and understanding
- to extend students' thinking from concrete and factual to analytical
- to help students recall knowledge, drawing on existing knowledge in order to build new understandings
- to lead students through a planned sequence that progressively establishes key understandings
- to stimulate interest, challenge and encourage thought and understanding
- to promote reasoning, problem solving, evaluation and the formulation of hypotheses
- to raise a self-awareness of how they learn.

Asking questions can also be used as a classroom management tool. They can be used to distract students who are being inattentive or to involve students who are side-tracked. They can also be used to boost student confidence and self-esteem.

Evidence shows that two of the most effective teaching methods involve providing feedback and whole-class interactive teaching. Asking questions provides the opportunity for you to provide feedback and for students to feedback to each other. And importantly, questions can be used to make whole-class teaching interactive.

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For whole-class teaching to be interactive (Petty, 2009), teachers need to:

- ask challenging and interesting questions
- expect full participation, if necessary, nominating students to answer in order to keep them involved
- model respect for all students' answers even if the answers are weak
- ask students to explain their thinking
- invite students to respond to each other's answers to the questions.

The key to effective questioning is to think what you are trying to achieve with your questions, to plan your questions and to listen carefully to your students' answers. Resource 1 covers quite a bit of detail about using questioning effectively.

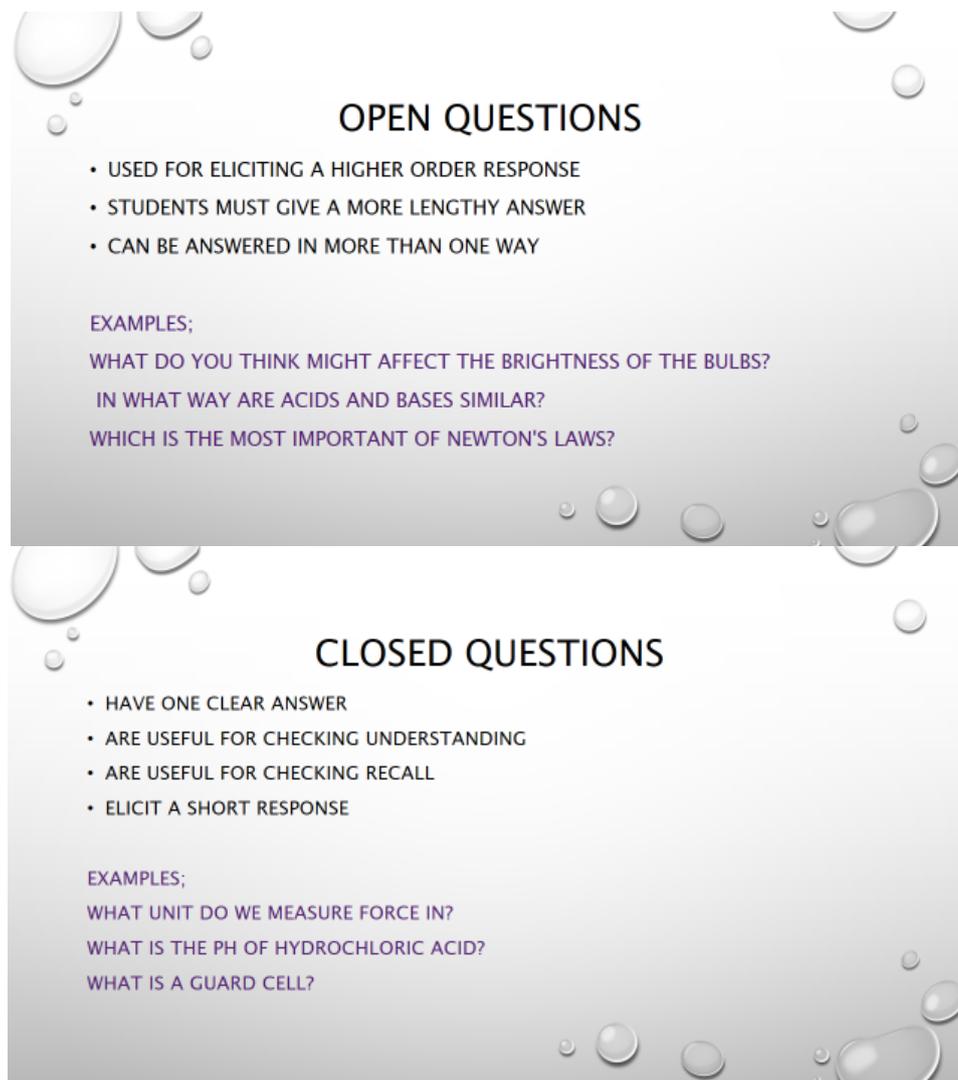


Video: Using questioning to promote thinking

<http://tinyurl.com/video-usingquestioning>

## 1 Thinking about different types of questions

There are many ways to classify question types. The easiest of these classification systems sees questions as being either open or closed. Figure 1 shows the difference between open and closed questions.



**Figure 1** The differences between open and closed questions.

There is a tendency for teachers to ask too many closed questions, which do not require students to think.

'Open' questions cause students to go beyond memory recall and help them to develop more complex thinking skills such as summarising, comparing, contrasting, explaining, analysing and evaluating.

Often a closed question can helpfully be followed up by a more challenging open question. For example, 'What is the pH of hydrochloric acid?' could be followed up by 'How do we know?' or 'What does that tell us about hydrochloric acid?'

### Activity 1: Devising good questions

This activity is for you to do as part of your planning. It would be helpful to do the activity with a colleague.

Expert teachers ask good questions. In order to become an expert, you need to practise. Before you start to teach the topic 'Why do we fall ill?', plan a set of questions that you might ask your students to find out what they already know. You will need some simple closed questions that will establish if they understand key words such as 'virus' or 'infection'. You will also need more open questions that require longer answers and will help you establish how much they already know about how diseases spread and can be treated.

When you have planned some questions, use Resource 2 to plan how to ask your questions.

## 2 Questioning techniques

Asking questions to the whole class is an important technique for all teachers. Here is one way of asking a question to the whole class which allows every student to contribute – an active learning technique.

### Activity 2: Practising a new questioning technique to teach the difference between bacteria and viruses

Write this question on the board: 'What are the differences between bacteria and viruses?' (Please note that if you have already taught this topic, you could use a different question.)

Divide your students into groups of four to six students. Give the groups five minutes to write down some of their ideas to answer this question. You might want to let them use the textbook to try and find the information. While they are working, move around the room and nominate someone in each group to provide the answer on behalf of the group.

Depending on the group, you could also ask some prompt questions which might help them to make progress, such as: What diseases are caused by bacteria? Where do viruses live in the body?

After five minutes, ask your students if they need any more time. If the conversations are still going on, give them another two minutes.

In order to answer this question, students need to understand that viruses and bacteria belong to different families and work in different ways. They cause different diseases.

Now ask each group for their ideas. Rather than just ask for the answer, you should ask a series of questions which will check understanding.

Ask one question to each group. If the nominated person can't answer, give them the chance to get help from their classmates. Here are some suggested questions:

- What effect do bacteria and viruses have on the body?
- What diseases are caused by bacteria?
- What common diseases are caused by viruses?
- How do bacteria multiply?
- How do antibiotics work?

If a group gives an answer which is not quite right, or not detailed enough, pass the questions to another group. Do you agree with that? Can you add to that?

Write the responses on the blackboard, or ask a student to act as class scribe. Don't worry about how you organise the information. Just write down the points that the groups make.

After each group has had an opportunity to respond, check that all the information on the board is accepted scientific thinking.

Then ask your students to work in pairs to make a list in their exercise books of the difference between bacteria and viruses. They can use the information on the board, but will need to sort it out for themselves.



## Pause for thought

- How did your students respond to this approach?
- What have you learnt about your students' understanding from doing this activity?

## Case Study 1: Whole-class interactive teaching

*Mrs Gandhi uses whole-class interactive teaching to encourage the girls to become more involved.*

I try to ask my class as many questions as possible, so I can find out what they know and adjust my teaching. I usually ask for volunteers because I don't want to make them feel uncomfortable or embarrass them if they don't know the answer. In my Class IX this year, I have more girls than boys but I noticed that most of the people who regularly put their hands up to answer are boys. So, one day, while they were doing an experiment, I asked some of the girls, 'Why they don't you put your hands up?' A few said that they were not always sure they knew the right answer and did not want to look silly in front of the other students. Another said that she often did know the answer, but couldn't think of it quickly enough.

The next day we were studying the prevention of disease. I planned to ask a few questions to check their understanding of the work we did last lesson on the causes and treatment of disease. I planned to start with a few, quick closed questions and then to ask some more probing open questions, to find out what they already understood about disease prevention.

I asked three short questions:

- 'What causes disease?'
- 'How can infectious diseases spread?'
- 'What do antibiotics do?'

I asked my students to think about the questions on their own and then compare their answers with the person sitting next to them. I gave them a few minutes to do this and I walked round and listened to the conversations.

Then I nominated people to answer the questions. All the people I chose were girls. I purposefully chose girls who I knew had the right answer because I had heard them talking to their partners. When they got it right, I praised them carefully and asked a follow-up question. I hoped this would build their confidence in speaking in front of the class.

Then I asked a more general question, 'How do you think we can prevent diseases?' I deliberately asked, 'How do you think ...?' to make it clear that I was interested in their ideas and was not expecting them to know the answer from the textbook. When they had discussed it in pairs, I asked a boy to give us one way of preventing disease and then three different girls. I realised that they knew quite a bit about vaccinations. Some understood the importance of hygiene in preventing infection but very few made the connection between good diet and staying healthy.

I have been using this technique for a few weeks now, and yesterday I reverted to my old strategy of asking for volunteers. I was pleased that more girls were volunteering, but it was not as many as I had hoped. I will need to find more ways of building their confidence!

Mrs Gandhi is using one technique to involve all her students in questions. There are other techniques which you might like to try. One technique is to allow all of the students one or two minutes to write down their answer to the question. Then ask particular students or ask for volunteers to offer the answer. Another

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technique is to wait for a few seconds after asking the question. Both of these techniques give students time to think and to evaluate. Then your students' answers are likely to be longer and more thoughtful. It also means that all students have the chance to think about the answer rather than the few that always put their hand up.



Video: Involving all

<http://tinyurl.com/video-involvingall>

### 3 Encouraging students to ask questions

There are two main reasons why students need to learn to ask questions. Firstly, if they don't understand the work and need help, it is important that they have the confidence to ask you or to ask a classmate. Feeling that it is OK to ask and being able to formulate a question are equally important.

Secondly, in order to become active members of a democratic society they need to be able to interpret data, question its validity and challenge assertions that people make.

#### Case Study 2: Asking questions

*Mr Singh asks his students to make up some questions.*

When I reach the end of a topic, I usually ask my students if they understand everything and if anyone has any questions. I always get the response 'Yes, we understand', and very few students have ever asked me a question. However, when it comes to the test, they never do as well as I had hoped and it is obvious that there are a significant number who don't understand some of the concepts. I decided that I need to do something about this.

When I finished the topic 'Why do we fall ill?', I decided to adopt a different approach. For homework, instead of doing the questions at the end of the chapter, I asked them to make up a test for their classmates. Everyone had to devise five questions. I also asked them to separately make a note of any questions that they wanted to ask about the topic.

The next day I arranged them in groups of four. I arranged the groups so that students of similar attainment levels were together. Each group had to work through each person's questions (making 20 in total). I concentrated on supporting the groups of weaker students but I found that they had devised some good questions at an appropriate level. If a group finished early, I asked them to think of extra questions around any areas they needed help with.

In the last ten minutes of the lesson, I set them the task of answering the questions at the end of the chapter. As they did this, I went around and answered any questions that the students were still unsure about.



Pause for thought

What steps can you take to make sure that your students feel able to ask questions?

It is important that students feel confident to ask questions. You need to create the time and opportunity for them to ask questions, and must respond carefully. Tell them that it is a good question and you are

pleased that they have asked. Explain the answer as clearly as you can, maybe finishing with a follow-up question that will demonstrate if they really have understood. If you can create a supportive and friendly atmosphere, students will find it easier to ask questions.

### Activity 3: Encouraging your students to ask questions

This activity will give your students the opportunity to think of questions to ask about some data. It is this sort of thinking and questioning that will help them to become good citizens in a democratic society. They can follow this up with some project work.

- Copy the data from Resource 3 on to the blackboard (If you have other data available you could use this instead).
- Ask students to look at the data and write down two questions that they could ask about the data.
- Ask them to compare their questions with the person next to them and together to try and think of two more.
- Ask for volunteers and record some of the students' questions on the blackboard.

Hopefully, you will have some obvious ones such as, 'Which state has the highest immunisation rate?' and some more interesting ones, such as, 'Is there a relationship between being breast fed as a baby and being underweight as a child?' or 'Why is there such a big difference in the percentage of children immunised in West Bengal and Uttar Pradesh?'

Now ask your students to choose one of their questions to investigate in more detail. They could do this for homework. Encourage them to choose a question that it is realistic for them to answer. For example, if they have access to the internet, they could choose a different question than if they were relying on the library, the TV, the radio or family members.

## 4 Summary

Questioning is hugely important. Most teachers do a great deal of whole class teaching. Careful and thoughtful questioning can make whole class sessions interactive and productive. The key is to involve as many students as possible, to ask questions that make your students think and to listen carefully to their answers.

The techniques that you have learnt in this unit will apply to all topics.

## Resources

### Resource 1: Using questioning to promote thinking

Teachers question their students all the time; questions mean that teachers can help their students to learn, and learn more. On average, a teacher spends one-third of their time questioning students in one study (Hastings, 2003). Of the questions posed, 60 per cent recalled facts and 20 per cent were procedural (Hattie, 2012), with most answers being either right or wrong. But does simply asking questions that are either right or wrong promote learning?

There are many different types of questions that students can be asked. The responses and outcomes that the teacher wants dictates the type of question that the teacher should utilise. Teachers generally ask students questions in order to:

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- guide students toward understanding when a new topic or material is introduced
- push students to do a greater share of their thinking
- remediate an error
- stretch students
- check for understanding.

Questioning is generally used to find out what students know, so it is important in assessing their progress. Questions can also be used to inspire, extend students' thinking skills and develop enquiring minds. They can be divided into two broad categories:

- **Lower-order questions**, which involve the recall of facts and knowledge previously taught, often involving closed questions (a yes or no answer).
- **Higher-order questions**, which require more thinking. They may ask the students to put together information previously learnt to form an answer or to support an argument in a logical manner. Higher-order questions are often more open-ended.

Open-ended questions encourage students to think beyond textbook-based, literal answers, thus eliciting a range of responses. They also help the teacher to assess the students' understanding of content.

## Encouraging students to respond

Many teachers allow less than one second before requiring a response to a question and therefore often answer the question themselves or rephrase the question (Hastings, 2003). The students only have time to react – they do not have time to think! If you wait for a few seconds before expecting answers, the students will have time to think. This has a positive effect on students' achievement. By waiting after posing a question, there is an increase in:

- the length of students' responses
- the number of students offering responses
- the frequency of students' questions
- the number of responses from less capable students
- positive interactions between students.

## Your response matters

The more positively you receive all answers that are given, the more students will continue to think and try. There are many ways to ensure that wrong answers and misconceptions are corrected, and if one student has the wrong idea, you can be sure that many more have as well. You could try the following:

- Pick out the parts of the answers that are correct and ask the student in a supportive way to think a bit more about their answer. This encourages more active participation and helps your students to learn from their mistakes. The following comment shows how you might respond to an incorrect answer in a supportive way: 'You were right about evaporation forming clouds, but I think we need to explore a bit more about what you said about rain. Can anyone else offer some ideas?'
- Write on the blackboard all the answers that the students give, and then ask the students to think about them all. What answers do they think are right? What might have led to another answer being given? This gives you an opportunity to understand the way that your students are thinking and also gives your students an unthreatening way to correct any misconceptions that they may have.

Value all responses by listening carefully and asking the student to explain further. If you ask for further explanation for all answers, right or wrong, students will often correct any mistakes for themselves, you will develop a thinking classroom and you will really know what learning your students have done and how to

proceed. If wrong answers result in humiliation or punishment, then your students will stop trying for fear of further embarrassment or ridicule.

## Improving the quality of responses

It is important that you try to adopt a sequence of questioning that doesn't end with the right answer. Right answers should be rewarded with follow-up questions that extend the knowledge and provide students with an opportunity to engage with the teacher. You can do this by asking for:

- a *how* or a *why*
- another way to answer
- a better word
- evidence to substantiate an answer
- integration of a related skill
- application of the same skill or logic in a new setting.

Helping students to think more deeply about (and therefore improve the quality of) their answer is a crucial part of your role. The following skills will help students achieve more:

- **Prompting** requires appropriate hints to be given – ones that help students develop and improve their answers. You might first choose to say what is right in the answer and then offer information, further questions and other clues. ('So what would happen if you added a weight to the end of your paper aeroplane?')
- **Probing** is about trying to find out more, helping students to clarify what they are trying to say to improve a disorganised answer or one that is partly right. ('So what more can you tell me about how this fits together?')
- **Refocusing** is about building on correct answers to link students' knowledge to the knowledge that they have previously learnt. This broadens their understanding. ('What you have said is correct, but how does it link with what we were looking at last week in our local environment topic?')
- **Sequencing** questions means asking questions in an order designed to extend thinking. Questions should lead students to summarise, compare, explain or analyse. Prepare questions that stretch students, but do not challenge them so far that they lose the meaning of the questions. ('Explain how you overcame your earlier problem. What difference did that make? What do you think you need to tackle next?')
- **Listening** enables you to not just look for the answer you are expecting, but to alert you to unusual or innovative answers that you may not have expected. It also shows that you value the students' thinking and therefore they are more likely to give thoughtful responses. Such answers could highlight misconceptions that need correcting, or they may show a new approach that you had not considered. ('I hadn't thought of that. Tell me more about why you think that way.')

As a teacher, you need to ask questions that inspire and challenge if you are to generate interesting and inventive answers from your students. You need to give them time to think and you will be amazed how much your students know and how well you can help them progress their learning.

Remember, questioning is not about what the teacher knows, but about what the students know. It is important to remember that you should never answer your own questions! After all, if the students know you will give them the answers after a few seconds of silence, what is their incentive to answer?

## Resource 2: Questioning strategies

Here are some strategies that you could use in your classroom for asking questions and responding to the students' answers.

### Volunteers answer

Students are invited to put their hands up in order to indicate that they would like to volunteer the answer. The thinking time is usually very short and if students call out the answer instead of putting their hand up then the thinking time for other students is even less. This method has low participation – the same students tend to volunteer. Students learn that if they don't put their hand up they will not be asked. One reason teachers tend to like this method is it does not put students under pressure. Only those who want to answer have to.

If this method is used with closed questions, the opportunities for dialogue and feedback are limited because the people who volunteer are likely to be the ones who know the correct answer.

### A nominee answers

Students are nominated by the teacher to answer a question. This has the advantage of increasing the thinking time. The teacher asks the question and pauses, giving the students a chance to think. The teacher then nominates someone to answer the question. This also increases participation as the teacher will often choose people who are reluctant to volunteer. However, this can make students feel uncomfortable and teachers can be tempted to limit the challenge of the questions in order to help students who feel uncomfortable with this technique.

### Bouncing

When a student answers a question, instead of saying whether it is right or wrong, the teacher asks someone else to respond. For example, 'What do you think, Sanjay? Is there anything you can add to that, Ditta?'

This increases the level of participation and gives students the chance to think a bit more about possible answers. It also increases the amount of dialogue in the classroom and gives the teacher the chance to ask a more demanding question, or one that requires a longer answer. The person the question is 'bounced to' can be a volunteer or a nominee.

### Pairs/groups

Students work in small groups or pairs to answer questions. Students work in small groups or pairs to answer a thought-provoking question or to complete a short task. The teacher can then ask each group in turn to contribute part of the answer, allowing a volunteer within the group to answer. For example, 'What sorts of things cause disease? Can you give me one cause for disease?' Then the teacher would move on to another group for a different cause.

Alternatively, the teacher might nominate an individual in advance of the discussion. The nominated student answers on behalf of the group, but they have chance to talk to the rest of the group so that they are confident about their reply.

This method promotes high participation. It enables the teacher to ask challenging questions and gives plenty of thinking time. As the questions are likely to be more challenging, it opens up the opportunity for better dialogue and feedback.

## Promoting more discussion

Students work in groups to discuss a thought provoking question, and evaluate each other's responses. For example, the teacher might ask a question for which different interpretations are likely, or for which there are number of possible answers (How can we prevent disease?). The teacher will monitor the discussion (Does everyone have some answers? Do you need more time?) and then they will nominate an individual to give their group's answer. The teacher will record the answer, without evaluating it and then ask another group for their answer. Once the teacher has a number of answers to the question, they ask a group to comment on the answers (Do you agree with all of these answers? If not, why not?), or they ask a follow up question (Which of these methods might be the most effective or the easiest to implement?).

This method involves high participation and gives your students plenty of time to think about their responses. It also promotes dialogue, and if the questions are challenging enough, promotes higher ordered thinking in a relatively 'safe' environment. Students who find the work difficult are not exposed, but are encouraged to think about the ideas.

## Pair checking

The teacher asks a question and students are given time to think about the answer for themselves. In pairs they then compare answers and give feedback on each other's answers. They say something that is good about the answer and something that could be improved. The teacher then gives the correct answer or nominates a pair to give the answer. Everyone has to participate in thinking about the questions, there is plenty of opportunity for thinking and discussion. Again, this is a good method to use for demanding or challenging questions.

(Source: based on Petty, 2009)

## Resource 3: Diseases and death in India

This information is available on the internet.

State	Percentage of children exclusively breast fed for five months	Percentage of children under five who have been immunised	Percentage of children under three who are underweight
UP	51	23	47
Bihar	28	33	58
MP	22	40	60
West Bengal	59	64	44
Odisha	50	52	44
Assam	63	31	40
Karnataka	58	55	41

If you have access to the internet, look for data relevant to other topics that could be used to stimulate student questions.

## Additional resources

- Exam questions for Class IX: <http://cbse-notes.blogspot.co.uk/2012/10/cbse-class-9-science-ch-13-why-do-we.html> (accessed 20 May 2014)
- A PowerPoint presentation covering the key points: <http://www.slideshare.net/MADHUPARNABHOWMIK/why-do-we-fall-ill-29421845> (accessed 20 May 2014)
- A video on 'Why do we fall ill?': [https://www.youtube.com/watch?v=\\_B6IDPNtZs4](https://www.youtube.com/watch?v=_B6IDPNtZs4) (accessed 20 May 2014)
- A video discussing the difference between fungi, bacteria and viruses: <https://www.youtube.com/watch?v=dWAdY57SQHs> (accessed 20 May 2014)
- An activity to raise awareness of the effect of smoking: <http://www.raftbayarea.org/ideas/Catching%20Your%20Breath.pdf> (accessed 20 May 2014)

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