Unit 4:
Using demonstration as a strategy for teaching the components of food
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Introduction

When you are learning something new, it is often helpful to watch someone doing the same task, whether it is cooking a meal, changing a car tyre or operating a machine. Unlike an explanation from a teacher or a textbook, which requires learners to visualise a particular concept or process themselves, a demonstration enables concepts and processes to be observed directly, which in turn makes learning easier.

As a teaching technique, a demonstration is a valuable alternative to getting students to 'learn by doing'. While learning by doing is ideal in subjects like science, adopting this approach is not always possible. With large numbers of students, for example, the time, space and resources required to enable all of them to engage in hands-on activities may not be available. Similarly, learning by doing may not be appropriate where there are possible safety risks.

Teacher demonstrations can introduce students to specialised equipment and materials and show them how they are used. At the same time, they can draw students’ attention to the psychomotor skills needed to undertake delicate tasks such as an experiment or a dissection.

More importantly perhaps, teacher demonstrations can provide students with opportunities to develop key scientific skills. Students can be encouraged to make predictions and announce or record their observations as they watch.

Demonstrations are often accompanied by explanations. As with all explanations, asking your students questions, at the start and as you progress, can help you to assess their prior knowledge and evolving understanding, enabling you to reinforce and clarify points as necessary. Similarly, whether they are made individually or collectively, their scientific conclusions can help you identify appropriate ways of reinforcing or extending their learning.
Learning outcomes

After studying this unit, you should be able to:

• plan and deliver a structured classroom demonstration that develops students’ skills of scientific enquiry
• identify ways to engage students during a demonstration by using visual aids and questioning techniques.
1 Planning a successful classroom demonstration

Activity 1: Planning a classroom demonstration

Careful planning will contribute to the success of a classroom demonstration. What kind of things do you need to consider when doing such planning?

Make a note of your ideas and compare them with those in the discussion below. You may find it useful to refer to TDU 3, *Teaching life processes using explanation as a teaching strategy*, which focuses on delivering explanations that engage all your students.

Discussion

Here are some suggestions:

- Identify the intended learning outcomes of the demonstration, so that you can communicate them to your students.
- Consider the various steps involved in the demonstration, listing the equipment and other materials that you will need to collect together before the lesson.
- Check whether you require teaching aids such as charts, pictures, posters and models to complement the demonstration. The board may be used to highlight key words and important points.
- Check that the classroom seating arrangements provide your students with a clear view of the demonstration.
- Rehearse the demonstration so that you are sure of the order in which to do things and can address any possible problems.
- List the questions that you can ask your students before, during and after the demonstration to engage them and focus the attention.
- Identify as many opportunities as possible to develop scientific enquiry. Allow your students to predict what will happen, observe any perceptible changes, record their observations and draw their own conclusions.

End of Discussion

A good classroom demonstration should capture your students’ interest from the start, with an appropriate introduction to the topic, reference to the intended learning outcomes and some exploratory questions to establish their current knowledge and understanding.

As you undertake the demonstration, you should explain what you are doing. It is important to carry out the demonstration neatly and systematically. The intention is to provide a good example to your students if they later carry out the activity themselves.
The next section of this unit begins with a case study in which a teacher describes how demonstrations can be used to investigate the presence of starch in food. It then suggests ways for you to practise giving a demonstration outside the classroom. This is followed by an activity that guides you through the process of giving a demonstration to your students.

Classroom demonstrations are suitable for many elementary science topics. Several topics are suggested where you could use this technique. You are encouraged to think of other topics that would be suitable.

2 Using demonstrations to teach science

Now read Case Study 1, which describes how a teacher planned and implemented a classroom demonstration to investigate the presence of starch in food.

Case Study 1: Anju uses classroom demonstration

Anju, a teacher at an elementary school, was teaching her class the major components of food. She wanted her students to learn that some food items contain starch, which can be detected through a simple test. Anju realised that if every student was to carry out the test, large quantities of iodine, test tubes and other equipment would be required and a number of food items would be potentially wasted. In addition, monitoring every student as they carried out the test would be difficult and could lead to problems with classroom management. So Anju thought that she would use classroom demonstration as a teaching strategy to show the presence of starch in certain foods. Here she describes how she went about this.

I developed a plan for the demonstration, beginning with the formulation of the learning outcomes. I identified that students should be able to:

- predict which foods contain carbohydrates
- observe and describe the changes that take place
- list some common food items that contain carbohydrates.

Next, I planned how I would do the demonstration, noting down:

- a list of equipment and materials required
- a plan of the seating arrangements
- the stages and method to be followed
- the introduction to the lesson
- ways of involving my students during the demonstration, including a list of questions to encourage them to make predictions and notice any significant changes as the demonstration progressed.
Before starting, I asked the students seated in the last few rows to stand behind those seated in the first two rows so that everyone would have a good view of the demonstration.

I then introduced the topic by first exploring what my students already knew about food, before asking them: ‘Why do we eat food containing carbohydrates? How are carbohydrates stored in plants?’ I noted their responses on the board and summarised them as follows: ‘So you know that carbohydrates, which are nutrients, give us energy and are found as starch and sugar in certain food items’ [Figure 1]. I then continued by explaining: ‘It is easy to detect the presence of starch in foods. Now you will see how this can be done.’

![Figure 1](image.png)

**Figure 1** Poster in a classroom showing examples of foods that contain carbohydrates.

**Description**

Photograph of a wall poster which shows examples of foods, such as a bottle of cooking oil, bread, butter, rice, potatoes.

First, I filled the test tube rack with clean test tubes and placed food items of various types in disposable plastic cups on the table. I then asked my students to predict which foods they thought would contain carbohydrates.

Next I prepared a dilute solution of iodine by adding a few drops of iodine tincture to a test tube half-filled with water. I explained that adding iodine to starch makes it turn blue-black. I put a small amount of food of each type in a test tube and asked the students to describe the colour (a) before and (b) after adding a few drops of iodine solution to it [Figure 2]. I noted the original colour and the change in colour on the board.
Figure 2 An item of food with iodine solution added. It has turned a blue-black colour, indicating that it contains starch.

Description
Photograph of an item of food (unspecified) that is shown among other items, and has a blackish stain on part of the surface.

On the board I made four columns, the first for the food type, the second for the original colour of the food, the third for the change in colour and the fourth left to fill in with conclusions on the presence of starch. Next I asked a volunteer to write the appropriate answer in each column [see Table 1].

Table 1 Finding out which foods contain starch.

<table>
<thead>
<tr>
<th>Food item</th>
<th>Original colour</th>
<th>Colour change?</th>
<th>Is the presence of starch indicated?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato</td>
<td>White</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Edible oil</td>
<td>Yellowish-brown</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Milk</td>
<td>White</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Wheat flour</td>
<td>White</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cooked rice</td>
<td>White</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

I then discussed the conclusions my students had drawn from the experiment and helped them establish what the demonstration had shown them. I prompted them to think back to their original predictions and asked if they were surprised by any of the results. I invited them to suggest other foods that could contain starch.

While carrying out the demonstration, I told my students what precautions I was taking. I explained that iodine should be handled with care so that it doesn’t spill and stressed the importance of washing my hands after the test. It is dangerous to taste iodine and the food to which it has been added. I
collected the equipment and the remaining iodine after the demonstration and said that I would carefully dispose of all the food that had been tested.

Pause for thought

Think back to Anju’s account, specifically with reference to her learning outcomes for her students, her plan for the demonstration, and the way she conducted it.

- Which of her practices did you especially like?
- Is there anything you would have done in a different order?
- Did she encourage students to make predictions and observations and draw conclusions?
- Are there any aspects you could improve on or extend?
- What kinds of things could she do with her students in the next lesson, as a follow-up to the demonstration?

3 Preparing yourself for a classroom demonstration: building confidence

Having read about Anju’s experience in Case Study 1, look now at Activity 2, where you will consider how you can rehearse for a classroom demonstration and build your confidence beforehand. This prepares you for Activity 3 in the next section, which includes a plan for demonstrating the presence of protein in food.

Activity 2: Rehearsing a classroom demonstration

As you can see from Anju’s experience, planning and delivering a classroom demonstration while managing a large group of students is quite a complex teaching strategy. However, the fact that demonstrations can impact so positively on your students’ learning makes the effort very worthwhile.

One of the most challenging tasks is combining useful questioning techniques and appropriate explanations with the physical act of demonstrating a concept or process.

A fun way of building your confidence with combining these skills is to rehearse them informally in relation to a relatively familiar task at home.

You can start with demonstrating something quite simple, like sweeping a room or peeling a fruit, and then move on to more complex activities such as making roti, cooking a particular dish or fixing a bicycle puncture.

Can you think of any other examples of tasks that you can use to practise demonstrating in this way?
Choose a suitable activity to demonstrate and identify a suitable time to rehearse it. This may be when you’re on your own, or – even better – in the presence of a small audience such as members of your family.

- Collect together the tools and materials that you will need.
- Talking out loud, explain what you plan to do and what the intended learning outcomes are.
- Start by asking some initial questions to ascertain what your audience, imaginary or real, already knows about the process.
- Then give the demonstration, providing explanations as required, asking questions to check comprehension and mentioning any safety precautions, as necessary.
- End the demonstration by briefly recapping the main points, or inviting your audience to provide these.
- Finally, reflect on how your demonstration went and what you could have improved. Better still, ask for feedback from your audience.

Ways of asking questions during demonstrations

As you rehearsed your demonstration, what questions did you ask? Did any of your questions promote scientific thinking?

Before carrying out Activity 3, read the following questions. What scientific skills do they encourage?

- What do you think will happen when …?
- Explain why you think …?
- Why is … happening?
- What do you see when …?
- Why did … happen?
- What evidence is there for …?
- What does the evidence tell us about …?
- What do you think would happen if …?

Questioning before, during and after a demonstration is a useful way to help you assess your students’ prior knowledge and progress. Planned questioning gives students an opportunity to demonstrate their ability to observe, predict and collect information.

The role of carefully planned questioning in elementary science will be explored further in TDU 5, Using questions to extend students’ understanding of forces.
4 Your first classroom demonstration

Activity 3 is intended to guide you in demonstrating to your students the presence of protein in food items in your science classroom. At the end you will have the opportunity to reflect on the experience.

Activity 3: Demonstrating the presence of protein in food

Read through all the instructions that follow. Then re-read them, bearing in mind how they could apply to your particular classroom context, making notes as necessary. You may find it helpful to look back at how Anju planned and undertook her demonstration in Case Study 1.

If possible, make time to rehearse the demonstration beforehand, either alone or with a small audience.

At the end of this unit there are further examples of simple teacher demonstrations involving food. You may use an alternative suggestion if you feel the following activity is not appropriate for the age range or ability of your class.

Initially you should outline a plan of the activity, making sure that you include the following:

- the intended learning outcomes of the demonstration
- the equipment and materials needed
- the steps you will take for carrying it out
- teaching aids such as charts, pictures and models to highlight any key learning points
- the precautions you will take
- an introduction to the lesson
- the questions you will ask before, during and after the demonstration
- opportunities for students to make predictions, describe or record any significant changes and draw their conclusions from the experiment
- ways of involving the students at each stage of the demonstration (see TDU 3, Teaching life processes using explanation as a teaching strategy).
- the seating arrangements so that all students can see the demonstration clearly.

On the day of the lesson, check that you have all the equipment and materials required for the demonstration and arrange them neatly on the table. You could prepare the chemicals beforehand to save time, or show the students how this is done at the start of the lesson.

Introduce the topic, relating it to what has been covered previously and establishing the students’ prior knowledge of the subject by asking them
Then start the demonstration, highlighting any key points, checking comprehension and encouraging your students to ask you questions as you carry out the following steps. Remember to allow your students to make predictions, to say or record what they see and to draw their own conclusions at the end of the demonstration.

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Prepare copper sulphate solution by dissolving 2 g of copper sulphate in 100 ml of water.</td>
</tr>
<tr>
<td>2.</td>
<td>Prepare a solution of caustic soda by dissolving 10 g of caustic soda in 100 ml of water.</td>
</tr>
<tr>
<td>3.</td>
<td>Take a small quantity of a food item containing protein, such as an egg white, and put it in a test tube.</td>
</tr>
<tr>
<td>4.</td>
<td>Add ten drops of water to it and shake the test tube, explaining that this has to be done carefully so that the content does not spill out.</td>
</tr>
<tr>
<td>5.</td>
<td>Add two drops of copper sulphate solution and ten drops of caustic soda solution to the test tube using separate droppers.</td>
</tr>
<tr>
<td>6.</td>
<td>Shake the test tube well, repeating the advice to be careful.</td>
</tr>
<tr>
<td>7.</td>
<td>Let the test tube stand for a few minutes.</td>
</tr>
<tr>
<td>8.</td>
<td>Ask the students to explain what they see happening and note the change in colour of the contents of the test tube. Ask them what they think the violet colour indicates. Explain that this indicates the presence of protein.</td>
</tr>
<tr>
<td>9.</td>
<td>Repeat this test on a selection of food items, some of which do not contain protein. Ask the students to predict what they think will happen each time.</td>
</tr>
<tr>
<td>10.</td>
<td>Ask the students if they notice any similarities between the foods that did, and did not, contain protein. Allow them to share their conclusions and list their ideas on the board.</td>
</tr>
<tr>
<td>11.</td>
<td>Review with the students the precautions to be taken for this experiment.</td>
</tr>
<tr>
<td>12.</td>
<td>Use the board to highlight the main points of the demonstration (Figure 3).</td>
</tr>
</tbody>
</table>
Figure 3 The presence of protein is indicated by a change in colour.

**Description**
The clear liquid in the test tube has turned to a pale violet colour.

**Pause for thought**

Having completed this activity, reflect and make notes on the following questions:

- What went well with your demonstration?
- What could have been improved?
- How far were the suggested plan and recommended steps helpful?
- How might you amend or develop them?
- Did you follow up your demonstration with a related activity in a subsequent lesson? If so, what did you do? If not, can you think of what might be a useful and interesting follow-up activity for your students? How could you extend the demonstration into a further investigation?
Good teacher demonstrations should provide opportunities for students to use skills of scientific enquiry. During a demonstration, it may not be possible or appropriate to make notes on all your students’ responses. However, reflecting on your students’ comments after a lesson can be a useful way to gauge their progress.

Use Table 2, which outlines some of the key skills of scientific enquiry, to record the progress of an individual student or group of students after one of your classroom demonstrations.

The grid can be extended or simplified according to the age range and ability of the students in your class. The statements relate to the skills used during scientific investigations. You may want to add your own ideas and statements and use the table again.

Table 2 Key skills of scientific enquiry.

<table>
<thead>
<tr>
<th>Planning</th>
<th>Obtaining and presenting information</th>
<th>Considering evidence and evaluating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can students make predictions based on their scientific knowledge and understanding?</td>
<td>Can students gather information from a range of sources?</td>
<td>Can students draw conclusions and communicate them in appropriate scientific language?</td>
</tr>
<tr>
<td>Can they suggest methods of testing, including ‘fair tests’?*</td>
<td>Can they describe, or show in the way they perform the task, how to vary one factor while keeping the others the same?</td>
<td>Can they provide simple explanations for differences in observations and measurements?</td>
</tr>
<tr>
<td>Do they recognise that scientific ideas are based on evidence and creative thinking?</td>
<td>Can they repeat measurements and observations?</td>
<td>Can they identify trends and patterns?</td>
</tr>
<tr>
<td>Can they select</td>
<td>Do they communicate</td>
<td>Can they begin to</td>
</tr>
</tbody>
</table>
Do they identify some factors and variables they cannot control?  

Do they carry out a ‘fair test’* identifying key factors that need to be considered?

Can students suggest how to collect evidence?

* A test is ‘fair’ if only one factor is changed at a time, while the other factors are kept the same.

5 Demonstrations using everyday foods

This section provides three ‘ready made’ demonstrations that could be used in elementary science lessons.

Feeding yeast

You will need

- a packet of dry yeast
- a small, clean, clear, plastic bottle, 0.45 litre (16 fl. oz.) or smaller
- 1 teaspoon of sugar
- warm water
- a small balloon.

What to do

1. Fill the bottle up with about one inch of warm water.
2. Add the entire yeast packet to the water in the bottle and gently swirl the mixture for a few seconds. The microorganisms are ‘resting’ in yeast when it is cold or dry. When the yeast is dissolved, it becomes activated.
3. Add the sugar and swirl the mixture around again. Yeast needs food to be activated.
4. Stretch out the balloon by blowing it up a few times. Place the opening of the balloon over the neck of the bottle to collect the gas that will be created.
5. Let the bottle sit in a warm place for about 20 minutes.
What’s happening?
The balloon will slowly inflate. As the yeast ‘digests’ the sugar, it releases carbon dioxide which inflates the balloon.

Further possible investigations
1. How would temperature affect how much gas is created by the yeast?
2. Does the size of the bottle affect how much gas is created?
3. What ‘yeast food’ creates the most gas (sugar, syrup, honey, etc.)?

Volcanic eruption
You may want to set up this demonstration outside in the school grounds. Guidance on outdoor activities is given in TDU 15, Using outdoor spaces: studying plants in their environment.

You will need
- Baking soda (*not* baking powder)
- Vinegar
- Red or yellow food colouring (optional)
- A small tray or container to hold everything
- A cup
- Towels.

What to do
1. Put the cup into the tray. Place some of the baking soda into the cup.
2. Optional: add a few drops of food colouring.
3. Pour in some of the vinegar.
4. Watch as the reaction takes place.

What’s happening?
Baking soda has a base of sodium bicarbonate, while the vinegar contains acetic acid. When the two are mixed together they react and form carbonic acid, which is unstable and splits into carbon dioxide, water and a sodium acetate solution. The eruption is produced as the carbonic acid decomposes and produces a build up of carbon dioxide gas.

To make this demonstration look more impressive, you could make a model volcano out of clay, soil or a paper cone. Find a small container that fits inside your volcano and pour the ingredients into it.

Further possible investigations
1. Make model volcanoes, as suggested above. Does the shape of the volcano affect the direction in which the eruption travels?
2. What can be added to the ‘lava’ to slow it down and make it more like real lava?
3. Change the quantities of vinegar and baking soda. Which quantities create the biggest eruptions?

### Oil and water

#### You will need

- A clear glass
- A quarter of a cup of vegetable oil
- 1 teaspoon salt
- Water
- Food colouring (optional).

#### What to do

1. Fill the glass about three-quarters full of water.
2. Optional: add four drops of food colouring.
3. Pour the vegetable oil slowly into the glass. The oil will float on top of the water at this stage.
4. Sprinkle the teaspoon of salt on top of the oil.
5. If the effect slows down, you can add another teaspoon of salt.

#### What’s happening?

The oil floats on top of the water as it is lighter (less dense) than the water. The salt is heavier (more dense) than the oil so it sinks down to the bottom of the glass. When this happens, the salt takes some of the oil with it. As the salt dissolves into the water, the oil floats to the surface again.

#### Further possible investigations

1. Try using different types of oil. Do all oils behave in the same way?
2. Change the salt for different substances, such as sugar or flour. What effect does this have?
3. How long can you keep the movement going?

### 6 Summary

Ideally, learning in elementary science should be based on evidence. Teacher demonstrations help students to learn through observation. They are suitable when a school cannot afford either the resources or time that might be required if all the students were to carry out an investigation themselves. They can provide more opportunities to engage students than teacher or textbook explanations alone.
Scientific enquiry can still be developed while a teacher is giving a demonstration. It is important to provide students with opportunities to predict what will happen, observe relevant changes and draw their own conclusions.

Not all processes and phenomena lend themselves to classroom demonstration, however. Some experiments may be too complicated or lengthy to be practical in the classroom environment or are simply not possible to demonstrate.

Careful planning is as important with a demonstration as it is with any other teaching strategy. It is also helpful to rehearse the demonstration before carrying it out in the classroom. If fragile equipment or dangerous chemicals are involved, you will need to alert your students to the precautions to be taken.

Questions will help you to capture and maintain your students’ interest and support their understanding. The board can be used to highlight the main points of a process, record any observations and note your students’ responses.

Demonstrations can make a substantial difference to students’ learning and are therefore a valuable addition to your elementary science teaching repertoire.

**Pause for thought**

- How much planning time do you need to prepare a demonstration lesson? How does this compare to your other lessons, such as those where the content is based primarily on the textbook?
- Have you found rehearsing your demonstrations useful? How practical is this for you?
- Have you allowed your students to predict, observe and conclude during your demonstrations? What impact has this had on their learning?
- To what extent do you see an increase in your students’ interest when you do a classroom demonstration? How does this manifest itself?
7 Resources

Resource 1: The components of food

An Indian meal usually consists of cereals in the form of roti or rice, lentils, dhal and vegetables. It may also include milk and milk products, such as curd and paneer, and may include non-vegetarian food like eggs, fish and meat. It is important to ensure a variety of food items are eaten each day because eating only one type of food is not enough to provide all the nutrients we need for a healthy diet. Different food items have different nutrients, so a meal is said to be nutritious when it contains a wide range of the nutrients needed by your body.

The major nutrients are carbohydrates, proteins, fats, vitamins and minerals. Apart from these nutrients, our body also requires dietary fibre and water. These nutrients are available from different sources, which is why a variety of foods need to be included in a meal. Some nutrients, like carbohydrates, fats and proteins, are needed in large amounts and some, like minerals and vitamins, are needed in smaller amounts to maintain good health.

Table R1.1 highlights the functions of such nutrients and gives some examples of the foods in which they may be found.

Table R1.1 The functions of major nutrients with some example sources.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Functions</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>Give us energy</td>
<td>Rice, roti, bread, oat, bhutta (corn) and potato</td>
</tr>
<tr>
<td>Protein</td>
<td>Body building food needed for growth and maintenance of our body</td>
<td>Eggs, meat, beans and pulses</td>
</tr>
<tr>
<td>Fat</td>
<td>Gives us energy</td>
<td>Oil, ghee, butter, whole milk</td>
</tr>
<tr>
<td>Minerals</td>
<td>Calcium and phosphorous are needed for healthy bones and teeth; iron is needed for haemoglobin in blood. There are many other minerals, such as potassium, sodium, copper and manganese, that are needed by our body</td>
<td>Calcium is found in milk and other dairy products, and in green leafy vegetables; phosphorous is found in fish and poultry; iron is found in eggs, meat and green leafy vegetables; potassium is found in tomatoes, bananas and potato skin; sodium is found in common salt; copper is found in sesame seeds, liver and nuts; and manganese is found in nuts, rice bran and wheat germ</td>
</tr>
<tr>
<td>Vitamins</td>
<td>Vitamin A has functions like</td>
<td>Vitamin A is found in carrots</td>
</tr>
</tbody>
</table>
keeping our eyes healthy; vitamin B complex is a group of vitamins that prevents diseases like Beriberi or Pellagra; vitamin C gives many health benefits like immunity and prevents scurvy; vitamin D is needed for healthy bones; and vitamin E is needed for preventing cell damage, for immunity and metabolic functions and yellow melons; vitamin B is found in liver, eggs and rice bran; vitamin C is found in lemon and other citrus fruits, and guava; vitamin D is found in fish and cod liver oil (and sunlight is necessary for synthesis of vitamin D); and vitamin E is found in sunflower seeds and almonds

Fibre

Dietary fibres add bulk to the food and help in excretion of undigested food

Beans, whole grain and oatmeal

Water

Drinking water is essential as it helps our body to absorb nutrients from food, and also helps in excretion and other functions

Apart from the water we drink and water taken through tea, juices, soup, etc., we also get water from food such as fresh fruit and vegetables

Foodstuffs generally contain more than one type of nutrient: for example, potato chips have both starch and oil, and rice has more carbohydrates than other nutrients like vitamin B. A deficiency of vitamins and minerals may cause diseases like goitre, scurvy, weak bones and anaemia, as well as disorders in metabolism, the nervous system, muscles, the immune system, etc. However, excess levels of these nutrients may also be dangerous to health, hence the indiscriminate use of vitamin and mineral pills should be avoided. It is best to get vitamins and minerals from natural sources – that is to say, food.

A balanced diet provides us with the right amount of nutrients. It is necessary to eat food that provides energy, is rich in proteins and contains vitamins and minerals in the right amounts as they help us grow, give us energy to move and think, and can be used to repair damage. Expensive foods are not necessarily the best source of nutrients because many inexpensive foods, such as sprouted seeds, green leafy vegetables, bananas, khichri made of cereal and pulses, gur (jaggery), sattu and soya beans are just as nutritional.

To avoid the loss of nutrients, fruit and vegetables should not be overcooked. They should not be washed after peeling. Children should also learn that eating food with too much fat, refined flour, junk food and soft drinks with a high amount of sugar lead to obesity and the early onset of certain diseases like diabetes that are as harmful as diseases resulting from the deficiency of one or more nutrients.
The presence of the nutrients, carbohydrates (starch), fat and protein in food can be easily tested, but tests indicating the presence of other nutrients are more complex. This unit contains tests for starch and protein. A test for fat is also easy to carry out: a small amount of food needs to be placed on a piece of brown wrapping paper and crushed gently to avoid tearing the paper. The food is then removed from the paper and the paper is straightened and allowed to dry for some time. Flatten the paper and hold it in front of a light source. If a greasy or oily patch can be seen, this indicates the presence of fat in the food (Figure R1.1). However, it does not show the amount of fat that it contains.

Figure R1.1 A greasy spot on a piece of paper, indicating the presence of fat. (Source: Sutapa Bose)

Description
A greasy spot remains on a piece of brown wrapping paper after it has been allowed to dry. The spot glistens somewhat, reflecting light.

Further resources

- ‘Components of food’ (National Council of Educational Research and Training, undated)
- ‘Components of food’ (TutorVista.com, n..d.)
- ‘Understanding the components of food’ (Richard Kelley, 2011)

Resource 2: Related topics where you could use demonstration as a teaching strategy

Classroom demonstration may be applied to several science topics as a teaching strategy. Two such topics are listed below. You may be able to suggest others that can be taught effectively through demonstration.

Separating substances

Some methods of separating substances lend themselves to being taught through demonstration. Sedimentation and decantation, for example, can be demonstrated by keeping a glass of muddy water still for some time. The water at the top is then carefully poured out, leaving behind the sediment at the bottom of the glass. This simple process is also suitable for students to do themselves.
Separating a mixture of sand and salt requires a combination of methods, such as decantation, evaporation and condensation, and is therefore more complex and time consuming. Water is added to a mixture of sand and salt and stirred so that the salt dissolves in the water. After keeping the mixture still for some time, the salt water may be decanted. Evaporation may be used to obtain salt as a residue. The steam formed due to evaporation may be collected by putting ice on a steel plate and holding the plate thus cooled in the steam coming out. When the steam comes into contact with the cool plate, it condenses to form water droplets that no longer contain salt.

**Reversible and irreversible changes**

Demonstrations linked to the above can also be used to teach the concept of reversible and irreversible changes. Examples of reversible changes include changes in states of water due to variation in temperature, which lend themselves well to classroom demonstration: ice melting into water and heated water changing into a gaseous state (steam), and condensing on a cool metal plate to form liquid water. Alternatively salt and water could be combined and the change of state then reversed through a process of evaporation and condensation.

Examples of irreversible changes include burning an incense stick or a piece of paper burning to form a new substance. Similarly, adding lemon juice to milk while it is boiling makes it paneer.
References


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Figure R1.1: photo by Sutapa Bose.

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