

Primary Investigations and you

As a teacher, you are the most important resource in the classroom, responsible for creating a dynamic learning environment. While the lessons in *Primary Investigations* contain a great deal of information, including teaching strategies and commentaries, regard it as advice only. Be flexible—adapt, modify and enrich the program according to the needs of your students and your school. Many lessons contain lesson extensions, some of which you can substitute for a particular lesson.

When using *Primary Investigations*, consider yourself an instructional leader and guide, and allow students to bring their own experiences to their learning. Your role is to question, probe, clarify, monitor, assist and otherwise encourage students to progress. While you will sometimes need to define vocabulary and provide direct answers to questions, particularly when students require this information before they can move on, use these instructional strategies sparingly. As students ask for help, share the background information provided in the lessons; or use it to ask questions that will help students with their investigations.

Teacher in-service workshops and continuing support from qualified trainers are an integral part of the program. Take advantage of such support.

Major features of *Primary Investigations*

Integration	<i>Primary Investigations</i> integrates the biological sciences, physical sciences, technology and the environment to help you co-ordinate your teaching strategies. This integration also helps students develop an understanding that spans traditional disciplinary boundaries.
Concepts and skills	The program is organised around a major concept and skill for each year. These link the hands-on activities and promote meaningful learning and conceptual understanding.
Instructional model	The instructional model used in <i>Primary Investigations</i> is based on constructivist learning theory. This theory suggests that students learn best when they are allowed to work out explanations for themselves over time through a variety of learning experiences.
Co-operative learning	This integral part of the program builds students' self-esteem, leadership and communication skills. Co-operative learning also helps you with classroom management.
Equity	<i>Primary Investigations</i> is designed to cater for the interests and learning styles of both girls and boys.
Relevance	Activities and discussions relate closely to students' experiences at home, school and in the community. Students learn that science and technology are an important part of their daily lives.
Hands-on activities	Emphasis is on high-interest, hands-on activities as the foundation for learning. Students use equipment and tools to observe, test and measure results.
Simple equipment	Activities use simple equipment and recycled materials, such as popsticks, pipe-cleaners, straws, marbles, balloons, plastic containers and egg cartons.
Assessment	Each unit of <i>Primary Investigations</i> contains an assessment checklist and an evaluation lesson. Students also complete various projects and reports that you can assess.
Student learning outcomes	<i>Primary Investigations</i> will help students to meet the learning outcomes that are being developed in all states and territories.
Whole-school implementation	Use of the program throughout the whole school promotes co-operation amongst teachers and fosters collaboration between teachers and administrators. It uses well-tested strategies for staff development.

About this book

Suggested time

Each lesson gives a suggested time, based on the average time in which teachers taught the lesson during trials. The actual time a lesson takes will depend on factors such as class size, availability of helpers and student response. Depending on the needs of your students, you can break the lessons into additional sessions or make the session breaks in different places from those specified.

Lesson summary

Corresponding student book page numbers are listed.

Instructional model

See page xxi.

Lesson outcomes

See page xiv.

Equipment and preparation

Each lesson lists the equipment required for class demonstrations and team investigations. See pages xv–xvii.

LESSON
3

One-up, all-up

60 mins

Students explore the concept of energy transfer by playing games in which the energy of motion of a metal washer is transferred to another washer. They then discuss the results.

At a glance Student book pages 8–10

- Explain and play the games of one-up and all-up.
- Explain 'energy source' and 'energy receiver'.
- Summarise energy transfer and use the terms 'source' and 'receiver' when describing examples.

Explosive

32 Unit 1 Introducing energy

Lesson outcomes

- 1 **Students understand that energy can be transferred from one object to another.**
They show their understanding by explaining that energy of motion was transferred from one washer to another.
- 2 **Students understand that when energy is transferred it goes from an energy source to a receiver.**
They show their understanding by explaining which is the source and which are the receivers in the games of one-up and all-up.

Equipment and preparation

Team investigation


For each team 15 metal washers (about the size and weight of a 10 cent piece)
1 marker pen
1 strip of paper (about 100 x 30 centimetres)
1 ruler
writing paper
job badges for director, manager and speaker

Preparation Collect washers.

Mark out each team's paper strip like this:

6	5	4	3	2	1
					starting line
					firing line

Lesson 2 Jumping with eggs 25






Teaching strategies

- Introduce the word 'energy' by asking: **How many ways can you use the word energy in a sentence?**

Explain that in the following lessons students will find out about the different meanings of energy.

Suggestions could include:

 - At the end of a race I ran out of energy.
 - Food gives us energy.
 - We get energy from electricity and gas.
 - The world is facing an energy crisis.
- Outline the team investigation: *Can we find evidence of energy stored in a flit flap?*

Form teams and allocate jobs.
Ask managers to collect team equipment.
- Ask students to carry out steps 1 to 5 in the student book.
 - Step 1 Make holes in two card squares with scissors (or a hole punch). Make the holes about 1 centimetre from the edge.
 
 - Step 2 Tape the two pieces of card together to form a hinge. The hinge is opposite the holes.
 
 - Step 3 Thread one end of the elastic band through one of the holes in the card. Break a matchstick in half and put one piece through the loop as shown.
 

Teaching strategies

You can adapt the step-by-step teaching strategies and discussion questions to meet the needs of your students.

Questions and questioning

The lessons include questions that can be used to initiate discussion. See page xxii.

Commentaries

These anticipate children's responses to questions and provide related information.

Co-operative learning

This icon indicates when children should join their teams. See pages xviii–xx.

Student book texts

Relevant material from the student book is incorporated for handy reference.

Background information

Science concepts are explained clearly.


Extensions

Many lessons have extension activities. Use them as enrichment material or as a substitute for the lesson.

118 Unit 2 Energy and food chains


4 What sorts of things could you try in order to increase the amount of stored energy?

Lengthen the thread. Increase the weight of the plasticine. It might be necessary to increase the efficiency of the mechanism to raise a heavier weight. Students might suggest adjusting the angle of the blades and changing the size of the wheel.



Background information

Wind energy is driven by the heat of the sun. It can be captured by the sails of boats (to propel the boat) or by stationary windmills to grind grain, pump water or generate electricity. Modern engineers are investigating use of wind energy for large-scale energy generation. This is promising but is at present too expensive compared with alternatives and has the problem that winds do not blow steadily in most parts of the world, so that a means of energy storage must also be provided.



Extensions

Students use library resources to find out about windmills (to grind wheat, pump water or generate electricity). Include modern wind farms for electricity generation.

Students use library resources to find out about water wheels (for the same purposes).

Student book texts

Relevant material from the student book is incorporated for handy reference.

Background information

Science concepts are explained clearly.

Extensions

Many lessons have extension activities. Use them as enrichment material or as a substitute for the lesson.

Lesson outcomes



In *Primary Investigations* the philosophy of assessment goes hand in hand with the philosophy of learning. Students develop their knowledge and skills over time and progress at different rates. They need benchmarks against which to measure what they understand and can do at a given time.

Student assessment

To help you assess student progress, *Primary Investigations* provides the following:

- an assessment checklist for each unit, based on the learning outcomes of the lessons in the unit.
- an evaluation lesson at the conclusion of each unit that enables students to apply their knowledge and skills to a new activity. These lessons are a logical point at which to assess what students have learnt.
- student work, including projects and written reports. While much of the work will be the result of team effort, there may be occasions when you will prefer that students do their own work.

Student recording methods

Encourage students to use recording methods that will develop their communication skills and increase their understanding. The lessons use a variety of recording methods. You could use the one outlined in the lesson or one more appropriate to your students' needs (eg, audiotape recordings, collages, collections, diagrams, diaries, displays, drama presentations, field notes, graphs, log books, models, oral presentations, photographs, poems, posters, reports, sculptures, sketches, stories, structures, tables, timeline friezes, worksheets).


Equipment and preparation



Primary Investigations is based on hands-on learning. The equipment required comprises:

- simple science equipment (eg, magnets, magnifying glasses, mirrors, thermometers, balloons);
- recycled materials (eg, ice-cream, yoghurt and margarine containers, egg cartons, milk cartons);
- natural materials (eg, pebbles, soil, leaves); and
- classroom materials (eg, paper, pens, rulers).

Equipment features



Equipment and preparation

Session 2

For class demonstration
a completed penguin puppet

For each child
pattern of a penguin puppet (BLM 1.7), glued to thin black card
scissors

For each team
1 opaque container (eg, yogurt)
1 tray (eg, 4-litre ice-cream container lid)
coloured pencils
writing paper

Preparation
Make a penguin puppet for the class demonstration by copying BLM 1.7 and following the instructions on page xx.
If possible, arrange for other adults or older children to help make the penguin puppets.
Make sufficient copies of BLM 1.7 for each child to have a pattern of a penguin puppet. Glue each pattern to thin black card.

Writing paper

This means that BLMs or other recording methods are not specified for the lesson. Students should use your preferred recording method (eg, notebooks, sheets of paper, log books).

Coloured pencils

These are listed whenever children are required to draw. They can be replaced by whatever your class usually uses, such as crayons or felt pens.

Substitutions

If items on the equipment list can be replaced by others, they are described as generally as possible. For example, '1 container, holding 12 buttons' could be a box, a paper lunch bag, a plastic bag, a yogurt container or an envelope.

Sometimes an example is given in parentheses, to show the approximate size that works best: '1 opaque container with lid (eg, margarine)'. You can use any opaque container and lid of similar size, such as a cottage cheese or ice-cream container.

Sometimes items are more specific because of the required use: '1 polystyrene foam cup'.

You should always check the use of the containers in the lesson before making substitutions.

Preparation

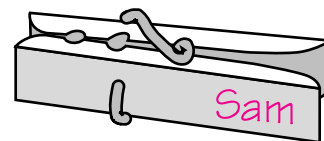
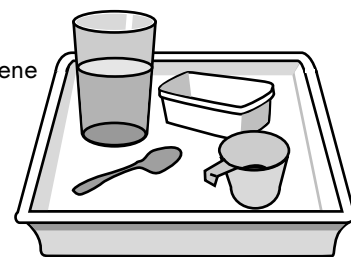
Scan the preparation list for each lesson at the beginning of the year and again at the beginning of each unit. This will help you in your forward planning:

- to ask for helpers when needed;
- to collect large numbers of some types of equipment;
- to copy BLMs;
- to make demonstration models;
- to prepare other materials in advance;
- to arrange to use an outdoor or open area; and
- to collect useful resources from the library.

Classroom organisation

The following hints may help you to organise equipment and materials in the classroom.

- Set up work areas for each team. Use tables, benches around the sides of the room, desks pushed together or small areas on the floor. Ask students to clean up their work areas at the end of each investigation.
- Set aside space for an equipment table where students can collect and return their equipment. Ask students to help prepare and organise the equipment table.
- Organise equipment for each team in a polystyrene foam tray or a large plastic container (eg, ice-cream container). The tray or container will make it easier for students to carry the equipment to and from their work area.
- Make name pegs by writing each student's name on a wooden clothes peg (spring-type). Students can use the pegs to identify their projects whenever they need to be stored.



Managing equipment

You will find a complete list of all the equipment required for the year on pages 224–227. While you will have to buy some equipment and consumable items, you will be able to obtain many of the recycled items from students. Check the list early in the year for those items that you want students to bring from home.

Safety

We have tried to select activities that are safe for students. The following guidelines will help you to provide a safe environment.

- Be aware of the school's policy on safety in the classroom and on excursions.
- Check students' health records so that you are aware of possible problems (eg, allergies).
- Be aware of potential danger by trying out activities before students do them.
- Caution students about potential dangers before they begin an activity.
- Clean up spills immediately—slippery floors can cause accidents.
- Instruct students never to taste or place anything in their mouth unless you give permission.
- Always allow students sufficient time to clean up.

Co-operative learning



Working in teams enables students to share their experiences and to consider different points of view and solutions to a problem. Co-operative teams develop the social skills of sharing leadership, communicating, building trust and managing conflict. These skills are relevant to students' lives, not only at school and work, but also within family and personal relationships.

The benefits of co-operative learning include:

- more effective learning. Students learn more effectively when they work co-operatively than when they work individually or competitively. They also have a better attitude towards their school work.
- improved self-confidence. All students tend to be more successful when working in groups and this builds their self-confidence.
- better classroom management. When students work in co-operative groups they take responsibility for managing much of the equipment.

Students need to be taught how to work co-operatively. They need to work together regularly to develop effective group learning skills.

Structuring co-operative learning

Use the following ideas in planning co-operative learning with your class.

- Assign students to teams rather than allowing them to choose partners.
- Vary the composition of each team. Give students opportunities to work with others who might be of a different ability level, sex or cultural background.
- Keep teams together for two or more lessons so that students will have enough time to learn to work together successfully.
- If the number of students in your class cannot be divided into teams of three, form two teams of two students rather than one team of four. It is difficult for students to work together effectively in larger groups.
- Keep a record of the students who have worked together as a team so that by the end of the year each student has worked with as many others as possible.

Team jobs Students are assigned jobs within their team (see box). Each team member has a specific job but all share leadership responsibilities. Each member of the team is accountable for the performance of the team and should be able to explain how the team obtained its results. Students must therefore be concerned with the performance of all members of the team. It is important to rotate team jobs each time a team works together, to give all students an opportunity to perform different roles.

Team jobs

Manager



The manager is responsible for collecting and returning the team's equipment. The manager also tells the teacher if any equipment is damaged or broken. All team members are responsible for clearing up after an activity and getting the equipment ready to return to the equipment table.

Speaker



The speaker is responsible for asking the teacher or another team's speaker for help. If the team cannot resolve a question or decide how to follow a procedure, the speaker is the only person who may leave the team and seek help. The speaker shares any information obtained with team members. The teacher may speak to all team members, not just the speaker. The speaker is not the only person who reports to the class; each team member should be able to report on the team's results.

Director



(Books 3–7) The director is responsible for making sure that the team understands the team investigation and helps team members to focus on each step to be completed. The director is also responsible for offering encouragement and support. When the team has finished, the director helps team members to check that they have accomplished the investigation successfully. The director provides guidance, but is not the team leader.

For Books 1 and 2 the teams consist of two students—manager and speaker. For Books 3 to 7 the teams consist of three students—director, manager and speaker. Each member of the team wears a job badge. The badges make it easier for you to identify which job each student should be doing—and easier for the students to remember what they and their team mates should be doing. Use BLM 6.9 to make job badges or create your own.

Team skills *Primary Investigations* focuses on social skills that will help children work in teams and communicate more effectively.



Children will practise the following five team skills throughout the year:

- moving into their teams quickly and quietly;
- speaking softly;
- staying with their team;
- taking turns; and
- doing their jobs.

To help reinforce these skills, display the team skills chart (BLM 6.1) and the team jobs chart (BLM 6.2) in a prominent place in your classroom.

Even though the team skills seem simple, focus on only one skill at a time. This will help you monitor each team's use of the skill. Encourage students to use the skill by observing them as they work and providing them with feedback—this sends the message that working together effectively is important. Leave enough time at the end of co-operative activities to help teams assess their use of the skill.

Supporting equity

In science lessons in the past there has been a tendency for boys to manipulate materials and girls to record results. *Primary Investigations* tries to avoid traditional social stereotypes by encouraging all students, irrespective of their sex, to learn to the maximum of their potential. Co-operative learning encourages each student to participate in all aspects of team activities, including handling the equipment and taking intellectual risks.

Observe students when they are working in their co-operative teams and ensure that both girls and boys are participating in the hands-on activities.

The instructional model

The instructional model used in *Primary Investigations* is based on constructivist learning theory. This theory suggests that students learn best when they are allowed to work out explanations for themselves over time through a variety of learning experiences. Students bring knowledge with them to these experiences; they then link new information with their prior knowledge. To help them make the connections between what they already know and new information, each unit has been organised into five stages—Engage, Explore, Explain, Elaborate and Evaluate.

Engage



Each unit begins with a lesson that mentally engages students with an event or question. It captures their interest, provides an opportunity for them to express what they know about the concept or skill being developed, and helps them to make connections between what they know and the new ideas.

Explore



Students carry out hands-on activities in which they can explore the concept or skill. They grapple with the problem or phenomenon and describe it in their own words. This stage allows students to acquire a common set of experiences which they can use to help each other make sense of the new concept or skill.

Explain



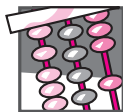
Only after students have explored the concept or skill does the program provide the explanations and terms necessary to describe what they have experienced. The significant aspect of this stage is that explanation *follows* experience.

Elaborate



This stage provides opportunities for students to apply what they have learnt to new situations and so develop a deeper understanding of the concept or greater use of the skill. It is important for students to discuss and compare their ideas with each other at this stage.

Evaluate



The final lesson in each unit has a dual purpose: students continue to develop their understanding, and they evaluate what they know and can do. This is also the logical stage at which to assess students' understanding of the concepts and their skill proficiency.

Questions and questioning

The questions you ask are very important in helping students to think about various ideas. Ask questions that are related in style to the stage of the instructional model:

- Engage: open questions that encourage students to discuss their ideas and experiences.
- Explore: questions that use students' language and ideas to express common experiences.
- Explain: focused questions that reinforce the explanation of the concept.
- Elaborate: questions that help students understand the concept in a new situation.
- Evaluate: questions that assess students' understanding.

Ask a balance of broad and narrow questions

A broad question has more than one answer, for example, 'What did you observe?' A narrow question has only one answer, for example, 'What is the name of this animal?'

Allow sufficient wait time

Wait time is the time you are willing to wait for students to answer a question. Research suggests that students learn better if you allow a wait time of more than three seconds.

Listen

By listening carefully to students' responses, you can ask questions that build on what they understand.

Using *Primary Investigations* in your school

While *Primary Investigations* has been carefully structured to provide the maximum opportunity for students to learn the major concepts and skills, you may need to reorganise the program to suit the needs of particular students and your particular circumstances.

Keep the following points in mind if you intend to reorganise the program.

- The first unit of each book introduces the co-operative learning skills and the major concept and skill for the year; it is best taught first.
- The subsequent units follow in a sequential manner but could be taught in a different order with little effect on the program.
- The lessons in each unit follow the five stages of the instructional model. Before changing the sequence of lessons, consider how important the stages in the model are in helping your students understand the concepts and develop skills.

Using library resources

Although many of the activities in *Primary Investigations* are self-contained, you can enrich them or integrate them with other parts of the curriculum by using library resources. Consult your teacher-librarian, resource teacher or local public librarian well in advance for help in obtaining:

- picture books, stories or poems that can provide absorbing lead-ins to investigations;
- non-fiction books, videos, posters or kits that supplement information presented in lessons;
- materials that students can use for investigations requiring library research; and
- resources that meet the special needs of individual students (eg, books containing simple language for students with reading problems, more challenging material for students who are gifted or talented).

When given advance notice, teacher-librarians can help select new resource materials to support the program, provide bulk classroom loans, teach information skills using science topics, and set up displays on science themes. They can also assist individual students with research tasks or enrichment materials.

Using the program with composite classes

There are several ways in which you can use *Primary Investigations* with composite classes, without students having to repeat part of the program.

- Use Book 1 with beginning students each year, and then alternate between Books 2, 4 and 6 in even years and Books 3, 5 and 7 in odd years.
- Your whole school could schedule science at a fixed time each week, with all students going into their own year group.
- Teach core lessons one year and extensions the next, so that even if some students have to repeat a book, they will be undertaking different activities.