

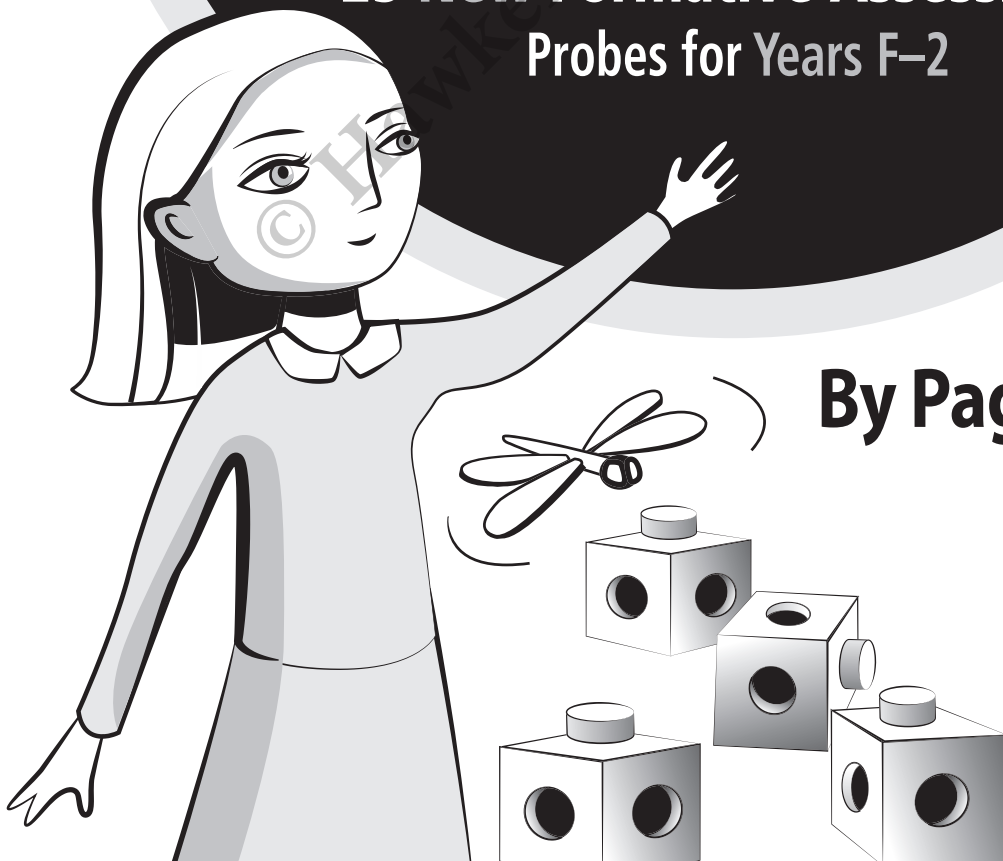
VOL.1

Uncovering Student Ideas in Primary Science

**25 New Formative Assessment
Probes for Years F-2**

By Page Keeley

 **Hawker Brownlow**
EDUCATION





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Preface

This is the eighth book in the *Uncovering Student Ideas in Science* series, and the first one that exclusively targets young children's ideas. Like its predecessors, this book provides a collection of formative assessment probes designed to uncover the ideas students bring to their science learning. Each probe is carefully researched to elicit commonly held ideas young children have about phenomena or scientific concepts. A best answer is provided along with distractors designed to reveal research-identified misconceptions held by young children.

A major difference between this book and others in the *Uncovering Student Ideas in Science* series lies in the format of the student pages. The probes in this book use minimal text so that they can be used with children who are just developing their reading and writing skills. Each probe provides a visual representation of the elicited idea using familiar phenomena, objects and organisms or set in situations that can be duplicated in the classroom. For example, "Is It Living?" elicits students' ideas about living and non-living things using pictures of familiar objects and organisms. "Big and Small Magnets" uses a concept cartoon format to elicit children's ideas about magnetism, which can then be tested in the classroom using magnets of different sizes. The visuals are designed to capture children's interest and stimulate their thinking. Each probe ends by asking, "What are you thinking?" to draw out students' reasons for their answer choices and encourage "science talk."

Other *Uncovering Student Ideas* Books That Include F–2 Probes

While this book is specifically designed for F–2 students, other books in the series include

F–12 probes that can be used or modified for the primary year levels. The following is a description of each of the other books in the *Uncovering Student Ideas in Science* series and selected probes that can be used as is or modified for the primary year levels:

***Uncovering Student Ideas in Science, Volume 1* (Keeley, Eberle and Farrin 2017)**

The first book in the series contains 25 formative assessment probes in life, physical, and Earth and space science. The introductory chapter provides an overview of what formative assessment is and how it is used. Probes from this book that can be used in Years F–2 include:

- "Making Sound"
- "Biscuit Bits"
- "Is It Matter?" (This probe has been modified for this book.)
- "Is It an Animal?" (This probe has been modified for this book.)
- "Is It Living?" (This probe has been modified for this book.)
- "Wet Jeans"

***Uncovering Student Ideas in Science, Volume 2* (Keeley, Eberle and Tugel 2017)**

The second book in the series contains 25 more formative assessment probes in life, physical, and Earth and space science. The introductory chapter of this book describes the link between formative assessment and instruction. Probes from this book that can be used in Years F–2 include:

- “Is It a Plant?” (This probe has been modified for this book.)
- “Needs of Seeds”
- “Is It a Rock?” (version 1)
- “Is It a Rock?” (version 2)
- “Objects in the Sky”

Uncovering Student Ideas in Science, Volume 3 (Keeley, Eberle and Dorsey 2017)

The third book in the series contains 22 formative assessment probes in life, physical, and Earth and space science, as well as three probes about the nature of science. The introductory chapter describes ways to use the probes and student work for professional learning. Probes from this book that can be used in Years F–2 include:

- “Is It a Solid?”
- “Does It Have a Life Cycle?”
- “Me and My Shadow”

Uncovering Student Ideas in Science, Volume 4 (Keeley and Tugel 2017)

The fourth book in the series contains 23 formative assessment probes in life, physical, and Earth and space science, as well as two probes that target the key idea of systems. The introductory chapter describes the link between formative and summative assessment. Probes from this book that can be used with Years F–2 include:

- “Magnets in Water”
- “Moonlight”

Uncovering Student Ideas in Physical Science, Volume 1 (Keeley and Harrington 2015)

The fifth book in the series, and the first in a planned four-book series of physical science probes, contains 45 force and motion formative assessment probes. The introductory chapter

describes why students struggle with force and motion ideas and the implications for instruction. Probes from this book that can be used in Years F–2 include:

- “How Far Did It Go?”
- “Rolling Marbles”
- “Talking About Forces”
- “Does It Have to Touch?”
- “Balance Beam”

Uncovering Student Ideas in Life Science, Volume 1 (Keeley 2015)

The sixth book in the series, and the first in a planned three-book series of life science probes, contains 25 life science formative assessment probes. The introductory chapter describes how formative assessment probes are used in a life science context. Probes from this book that can be used in Years F–2 include:

- “Cucumber Seeds”
- “No Animals Allowed”
- “Pumpkin Seeds”
- “Rocky Soil”
- “No More Plants”
- “Chrysalis”

Uncovering Student Ideas in Astronomy (Keeley and Sneider 2015)

The seventh book in the series contains 45 formative assessment probes for astronomy. The introductory chapter describes how formative assessment probes are used to understand students’ mental models in astronomy. Probes from this book that can be used in Years F–2 include:

- “Where Do People Live?”
- “Sunrise to Sunset”
- “Seeing the Moon”
- “Sizing up the Moon”
- “Crescent Moon”

**Concept Matrix: Life Science
Probes #1–#8**

	PROBES	1. Is It Living?	2. Is It an Animal?	3. Is It a Plant?	4. Is It Made of Parts?	5. Seeds in a Bag	6. Do They Need Air?	7. Senses	8. Big and Small Seeds
RELATED CONCEPTS ↓									
animals			✓				✓		
breathing							✓		
characteristics of life	✓								
classification			✓	✓					
closed system						✓			
germination						✓		✓	
information processing								✓	
living and non-living things	✓								
needs of living things	✓					✓	✓		
parts and wholes					✓				
plants				✓					
plant tropisms								✓	
seeds						✓			✓
senses								✓	
structure					✓				
systems					✓				



Is It Living?

Teacher Notes

Purpose

The purpose of this assessment probe is to elicit children's ideas about living and non-living things. The probe is designed to find out what characteristics children use to decide if something is living.

Related Concepts

characteristics of life, living and non-living things, needs of living things

Explanation

There are five living things on this list: cat, frog, seed, grass and tree. The fire, river, rock and cloud are non-living things. Living things can be defined by their forms and functions; all living things are made up of one or more cells. In addition, living things can carry out basic life processes such as obtaining or manufacturing food, extracting energy from food, growing, exchanging gases, reproducing, reacting to stimuli, moving and eliminating waste. Not all living things show all of these characteristics all of the time. Some of these characteristics are easily observable, but others are not.

Curricular and Instructional Considerations for Years F–2

At the F–2 level, the curricular emphasis should be on familiar plants and animals. Understanding what constitutes “living” involves identifying organisms' needs and observable characteristics. For example, young children can see that plants and animals are made up of different parts that allow them to meet their needs. Both plants and animals

need food, water and air to live, and plants need sunlight as well. Plants and animals carry out basic observable functions such as using food and water, taking in air, growing, moving, responding, reproducing and eliminating wastes. At the F–2 level, students are more likely to think of a developed organism as living rather than the initial stage of development, such as a seed, being a living thing. Therefore, students should have the opportunity to observe that a seed carries out functions of living things such as taking in water and growing. As students begin to recognise the diversity of life on our planet, it is important that they are able to distinguish between things that are living and things that are not living.

Administering the Probe

Review the things on the list with students to make sure they are familiar with each object listed. Name each object as you associate it with the picture. This practice is especially important for EAL/D learners. Make sure the pictures are clear to the students – for example, some students may think the river is a road. If you have other pictures that illustrate each of the objects listed, you might show those to the students in addition to the ones on the student page. Instruct students to circle or colour in the things they think are living. Additionally, you may ask them to put an X over the ones they think are not living. Have students explain the rule they used to decide whether the things on the list are considered living or non-living. Listen carefully for the criteria they use to decide if something is living. See

pages xxvi–xxx in the introduction for techniques used to guide “science talk” related to the probe.

Related Ideas in the F–10 Curriculum: Science Content Descriptions (ACARA 2014)

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Foundation Year Biological Sciences

- Living things have basic needs, including food and water (ACSSU002)

Foundation Year Planning and Conducting

- Participate in guided investigations and make observations using the senses (AC SIS011)

Year 1 Biological Sciences

- Living things have a variety of external features (ACSSU017)
- Living things live in different places where their needs are met (ACSSU211)

Year 2 Biological Sciences

- Living things grow, change and have offspring similar to themselves (ACSSU030)

Year 3 Biological Sciences

- Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044)

Year 4 Biological Sciences

- Living things have life cycles (ACSSU072)
- Living things depend on each other and the environment to survive (ACSSU073)

Year 5 Biological Sciences

- Living things have structural features and adaptations that help them to survive in their environment (ACSSU043)

Related Research

- Children have various ideas about what constitutes “living”. Some may believe things that are active are alive – for example, fire, clouds or the Sun. As children mature, they include eating, breathing and reproducing as essential characteristics of living things. People of all ages use movement, and in particular movement as a response to a stimulus, as a defining characteristic of life. When doing so, people tend to omit plants from the “living” category. Some studies show that young children will infrequently cite growth as a criterion for life – the exception being when plants are identified as living (Driver, Squires, Rushworth and Wood-Robinson 1994).
- A study by Stavy and Wax (1989) revealed that children seem to have different views for animal life and plant life. In general, animals were recognised more often than plants as being alive.
- Some studies indicate that the ability to reproduce is occasionally given by young children as a criterion for life. But some non-living things were said to be living because they “reproduced” (Driver, Squires, Rushworth and Wood-Robinson 1994).
- Objects that children anthropomorphised are categorised as living things. For example, objects such as the Sun, cars, wind and fire “felt” and “knew” things and were therefore alive. Studies indicate that there is a marked shift as students age from the view that things (including living things) carry out certain tasks “because they want to” to reasoning that “they need to in order to live” (Driver, Squires, Rushworth and Wood-Robinson 1994).
- Carey (1985) suggested that progression in the concept of “living” is linked to growth



in children's ideas about biological processes. Young children have little knowledge of biology. In addition, it is not until around the age of 9 or 10 that children begin to understand death as the cessation of life processes.

- Piaget carried out some of the earliest studies on children's ideas about living. His results showed a predictable pattern in students' development of the concept of "living". From birth to age 5, students have almost no concept of living things; from ages 6 to 7, students believe things that are active or make noise are alive; from ages 8 to 9, students classify things that move as alive; from ages 9 to 11, students identify things that appear to move by themselves (including rivers and the Sun) as living; and past age 11, to adulthood, animals or animals and plants are considered living (Driver, Squires, Rushworth and Wood-Robinson 1994).

Suggestions for Instruction and Assessment

- A particularly challenging example is the chrysalis stage of a butterfly. Many children see the butterfly as "dead" at this stage, even though they know it is part of the butterfly's life cycle. Combine this probe with "Chrysalis" from *Uncovering Student Ideas in Life Science* (Keeley 2015).
- There is also a F-8 version of this probe – "Is It Living?" in volume 1 of the *Uncovering Student Ideas in Science* series (Keeley, Eberle and Farrin 2017) – that can be adapted for use with F-2 students.
- Add additional objects to the list to encourage further discussion and argumentation: Sun, mushroom, ant, feather, leaf, shell, car, wind, waves and caterpillar. Include objects used in recent classroom investigations.
- Engage students in thought-provoking exercises that allow them to "discover" why things are considered alive. Have children observe a number of objects that are classified as living – from whole organisms to parts of organisms, such as a carrot top placed in a dish of water. Have students identify characteristics that make these things "alive". Include items that may not be readily recognised as alive, such as plant seeds, flower bulbs, potatoes, mushrooms and insect pupae.
- Be sure to distinguish needs from processes. For example, a seed may not need water for many years while it is dormant, but once environmental conditions are right and it can take in water, it will grow into a plant capable of sustaining life. Lessons should address the life processes (use of food for energy, reproduction, reaction to stimuli, breathing, movement and waste elimination) in developmentally appropriate ways as students progress through the years.
- Be aware of the tendency of younger children to anthropomorphise (attribute human form or personality to things that are not human). Explore the use of common phrases that imply non-living things act in the same way as living things – for example, a fire "breathes" or waves "grow". Pay close attention to literature and images that make non-living things seem living, such as putting a face on the Sun or clouds. Be a discerning user of children's literature.
- Have young students compare and contrast a stuffed animal toy or artificial plant with the real thing. Ask questions such as these: What can the living animal or plant do that the stuffed toy or artificial plant cannot? Why is one considered living and the other is not? Is the stuffed animal toy or artificial plant dead, or was it never alive? How do you know?
- The card-sort strategy can be used with this probe (Keeley 2008). Provide students with

a set of cards that have pictures and names of living and non-living objects on them. Have students work in small groups to sort the cards into three groups: things we think are living or were once living, things we think were never alive and things about which we are unsure. A set of picture cards to choose from can be downloaded from the *Uncovering Student Ideas in Science* website (www.uncoveringstudentideas.org/science_tools).

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