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Over the last four years, we continued to engage in conversations about the nature of curriculum models and how they can be used to create rigorous learning opportunities for students. As before, these conversations ultimately led us to two additional projects. The first was to create an updated version of the original publication. This second edition of PCM was completed in spring, 2008, and is called *The Parallel Curriculum: A Design to Develop Leaner Potential and Challenge Advanced Learners.* The second edition extends our understanding of how this framework for curriculum development can be used to create, revise or adapt curriculum to the needs of all students. In addition, it explores the concept of ascending intellectual demand for all learners in today's heterogeneous classrooms.

The second project was the creation of a series of curriculum units, based on PCM, for practitioners' use. To address the varying needs of teachers spanning Years P–12—as well as different content areas—we decided to create a series of five publications. The first publication is dedicated to the primary years, P–6. It features lessons and curriculum units that have been designed to address the needs of primary learners.

The last four publications span Years 6–12. Each of the four publications focuses on a different content area: English, social studies/history, science and mathematics. It is our hope that the lessons in each not only underscore important and discipline-specific content, but also illuminate the four parallels in unique and enduring ways.

Cindy Strickland and Marcia B. Imbeau joined the original PCM authors and contributed to 2nd edition publication in 2009, and Strickland also created *The Parallel Curriculum Multimedia Kit.* Imbeau is also a longtime user and trainer in PCM.

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THE PARALLEL CURRICULUM MODEL (PCM): A BRIEF OVERVIEW

A wonderfully illuminating fable exists about seven blind men who encountered an elephant. Because each man felt a different part of the beast, none was able to figure out the true nature of the gigantic creature.

Did you ever stop to think that students' perceptions about their learning experiences might be as limited as the perceptions the blind men had about the nature of the elephant? Perhaps, like the blind men, students learn only bits and pieces of the curriculum over time, never seeing, let alone understanding, the larger whole that is humankind's accumulated knowledge.

What if we were able to design curriculum in a multifaceted way to ensure that all learners understand: (1) the nature of knowledge, (2) the connections that link humankind's knowledge, (3) the methodology of the practitioner who creates knowledge and (4) the "fit" between the learner's values and goals and those that characterise practising professionals? How would classrooms be different if the focus of curriculum was *qualitatively differentiated curriculum* that prompts learners not only to accumulate information, but also to experience the power of knowledge and their potential role within it?

The Parallel Curriculum Model suggests that all learners should have the opportunity to experience the elephant and benefit from "seeing the whole". Moreover, as students gain more expertise in their understanding of all the facets of knowledge, the curriculum should support this development through *ascending*

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levels of intellectual demand. The following overview of PCM provides readers with a very brief summary of the model and an opportunity to see how the sum of the model's component parts can be used to create qualitatively differentiated curriculum for *all* students.

THE PARALLEL CURRICULUM: A UNIQUE CURRICULUM MODEL

What is a curriculum model? Why are there so many models to choose from? A curriculum model is a format for curriculum design developed to meet unique needs, contexts, goals and purposes. To address specific goals and purposes, curriculum developers design or reconfigure one or more curriculum components (see Figure I.1) to create their models. The Parallel Curriculum Model is unique because it is a set of four interrelated, yet parallel, designs for organising curriculum: core, connections, practice and identity.

Figure I.1 Key Curriculum Components

Curriculum Component	Definition
Content	The knowledge, essential understandings and skills students are to acquire
Assessment	Tools used to determine the extent to which students have acquired the content
Introduction	A precursor or forward to a lesson or unit
Teaching Methods	Methods teachers use to introduce, explain, model, guide or assess learning
Learning Activities	Cognitive experiences that help students acquire, rehearse, store, transfer, and apply new knowledge and skills
Grouping Strategies	The arrangement of students
Resources	Materials that support learning and teaching
Products	Performances or work samples that constitute evidence of student learning
Extension Activities	Enrichment experiences that emerge from representative topics and students' interests
Differentiation Based on Learner Need, Including Ascending Levels of Intellectual Demand	Curriculum modifications that attend to students' need for escalating levels of knowledge, skills and understanding
Lesson and Unit Closure	Reflection on the lesson to ensure that the point of the learning experience was achieved or a connection to the unit's learning goal was made

Source: Reprinted from *Teaching for High Potential* (Vol. IV, No. 1, April 2002), published by the National Association for Gifted Children, Washington, DC. www.nagc.org.

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Plants Alive

Christy D. McGee

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INTRODUCTION TO THE UNIT

Overview of Unit

This plant unit emphasises the importance of allowing students to discover scientific concepts and principles through hands-on exploration. In science, it is important to emphasise the concept of thinking like scientists. In this unit, students conduct experiments, create hypotheses and record results just as scientists do in their laboratories. To encourage students to think like scientists, they wear lab coats and carry clipboards to record their observations of plants under a variety of circumstances.

In each of the lessons, students explore the basic concepts of living and nonliving things, seed germination, plant requirements for living, plant growth, seed dispersal and plant parts. This unit culminates with a plant fair, allowing students to demonstrate what they learned throughout the unit. They create displays for each lesson that include a demonstration and a poster explaining their research. For the display, they also create a small, room-size plastic "bubble" (Resource 1.15) that serves as a greenhouse. The students fill the greenhouse with a variety of plants that they have categorised.

The purpose of this unit is to teach children how to think like scientists. Students explore the world of seeds and plants, and keep a detailed record of their findings and observations in their science notebooks. Learning how to use technical writing allows them to understand that they write for many purposes and that writing styles change to support these purposes. Students are exposed to a variety of science skills including observation, inference, measurement, communication, description, prediction, experimental techniques and research design.

In this unit, students explore plant life through the use of the Parallel Curriculum Model (PCM). The Core Curriculum is dominant in that students work with key

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concepts and principles of science. Students also learn the importance of investigations in science. Keeping a precise account of the protocol used during their experiments teaches them the fundamentals of science inquiry. Posing questions and conducting experiments are essentials in the field of science.

Because science and maths are closely correlated, the Curriculum of Practice is also of key interest. Science and maths both depend on systematic procedures and precise language to examine the world around us. Students use mathematical concepts when they use measurement to describe the growth of their plants and when they precisely measure the soil and water used when planting.

English is another strong component in this unit. Scientific writing is technical in nature. Throughout the unit students are required to write about their observations, inferences and predictions, recognising that technical writing requires clear, concise and detailed descriptions of events and observations.

The Curriculum of Practice is central in any investigative science unit. Students in this unit conduct experiments, record and follow protocol, learn the importance of a control in an experiment, and write down precise descriptions of observations. These activities emphasise that science is about doing, and the practice parallel is key to learning the scientific concepts and principles that practising professionals use in a study of plants.

The Curriculum of Identity is also set forth in this unit, assisting students in finding their place in the world. Change, growth and the importance of systems are central to understanding themselves and the world in which they live. In this unit, students begin to make the connection that the plant system is similar to their own system, in that growth and change are a part of all living things.

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Guiding Questions for the Parallels

Core Curriculum

1. How do seeds differ in size, shape, colour and texture?
2. What are the various ways that seeds are dispersed?
3. What do plants need to grow?
4. What is the function of the parts of the plants?
5. How does a seed turn into a plant?
6. Can seeds sprout without soil?
7. What's inside fruit?
8. How are vegetables and fruits different?

Curriculum of Practice

1. What do we know about plants?
2. How do scientists do their work?
3. How does experimental design work?
4. Why do scientists have to be so precise when recording their findings?

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Unit Sequence	Reflection
Closure Students repot the plant and complete their drawings (Resource 1.9). They also record reflections about the activity in their science notebooks. **Day 2 and Day 3 Activity** In the jigsaw activity, the teacher divides the class into groups of four. One person from each group becomes an expert on one plant part (stem, leaf, root and flower). After researching, the student returns to the group and explains each plant part's function. The students then complete their research log.	Depending on the age of the students and their readiness levels, this part of the lesson can be as easy or as complex as the teacher sees fit. A variety of plant reference books varying in complexity provide helpful resources for the students. If computers are available, students can use the Internet resources provided here. A simple search of the Internet also reveals many additional student-friendly resources for teachers.

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LESSON 1.7: THE NEEDS OF EVERY LIVING THING

Length: One 45–50-minute session

Unit Sequence	Reflection
Concepts • Growth • Systems	
Principles • Plants grow from seeds and need water, soil, air and nutrients to grow. • The details of a life cycle are different for different organisms. Observations of different life cycles are made in order to identify patterns and recognise similarities and differences.	
Skill Investigative inquiry	
Guiding Questions • What do plants need to grow? • How does experimental design work? • How do scientists do their work? • Do people share some of the same needs as plants? • What role does mathematics play in the study of plants?	

(Continued)

(Continued)

Unit Sequence	Reflection
Materials Needed • Six of the bean plants previously planted by the students to serve as a control • Plastic pellets or packing pellets • A dark place to keep the plants	
Standards SC-P-UD-U-1, SC-P-UD-S-1, and SC-EP-3.4.1; SC-P-UD-U-2, SC-P-UD-S-1, and SC-EP-3.4.3; SC-P-UD-U-4, SC-P-UD-S-5 and SC-EP-3.4.4	
Introductory Activity The teacher asks students, *How are your plants doing? Why do you think they are growing so well?* A discussion follows explaining that to find out the needs of plants, scientists conduct experiments that test the conditions in which the plants live. In scientific terms, these requirements are known as *variables.* In order to test a variable, the conditions must remain exactly the same for everything else that affects the plant. The teacher then asks, *What would happen if we changed some of the conditions in which the plants are growing? What conditions could we change? How do you think we could test these conditions?*	During this discussion, students review the growth of their plants. By asking what conditions the plants are growing under, the teacher encourages them to think about what the plant needs to grow. Once they have named some of the conditions, the discussion about what to change gleans that light, water, soil and nutrients have helped them grow. Students brainstorm ways they might test the variables guiding them to reasonable tests.
Teaching Strategies and Learning Experiences In groups arranged by readiness levels, students use brainstorming and inquiry-based learning. The teacher brainstorms with students about what conditions they want to change for their plants. (Students should mention light, water and soil.) The students then conduct the following experiments: 1. Two groups place one of their plants in a dark place. 2. Two groups withhold water from one of their plants. 3. Two groups repot one of their plants in plastic pellets. 4. All groups ensure that every other condition remains exactly the same.	It is important to make sure the students understand that all other variables remain constant during this experiment. For example, the plant placed in the dark should continue to be watered and the plant receiving no water should continue to receive sunlight. This activity takes at least two weeks of observations. When the plants begin to change, the teacher leads a discussion about what they found and what they can infer from their findings. Students should also infer that soil provided more than a medium in which to anchor plants; it also provides nutrients to the plants. Students record their thoughts in their science notebooks by drawing what they see happening to each of

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RESOURCE 1.10: LESSON 7 LAB REPORT

Experimenting With the Basic Needs of Plants

My prediction for the experimental plants:

No soil	No light	No water

Draw what happened to each plant after one week.

No soil	No light	No water

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