Chapter 4

Deep Learning: Integrating Content, Process, and Product

[New feature: Playbill of educators/writers– to come for chapter opening on recto]

Linda's Experience: Learning to Leap

Ten years ago, I learned how to jump horses. Although I had had a lot of riding experience growing up, I had not actually been on a horse for over twenty-five years.

I started taking lessons and realized that, to be a good rider, I was going to have to invest time and money. My learning began in earnest and now, ten years later, I can say I understand better what it means to learn something deeply.

In the beginning, I made a lot of mistakes and I fell off numerous times. Being "launched like a lawn dart" was a necessary component of learning—the feedback was instant. Horses are strong, unpredictable animals. Soon enough, however, I improved my physical and emotional strength. My stamina grew, and I started to tackle small jump courses.

Several experiences supported my learning. I had to repeat the actions numerous times to arrive at any understanding. I had to visualize myself doing it the correct way. I watched myself on video and I talked in detail with my trainer about what I was trying to accomplish. My trainer was patient and kind, and gave me personalized feedback, pointing out what I did well and what I needed to improve on. My horse was also patient, but continued to throw me off when I did something wrong.

My trainer and I went over every detail after a jump course, a lesson, or a competition. I read books about good riding techniques and subscribed to magazines with pictures, riding exercises, and training tips. The support from my husband and daughter was strong even though committing to riding also meant sacrificing time away from them. Still, it took me a long time to feel successful. Despite many setbacks and lost confidence along the way, my motivation was high and I kept at it.

Now after competing in many horse shows, I have a drawer full of ribbons to prove my accomplishments. These symbols are more meaningful to me as an educator because learning to leap has made me a better teacher and learner. I often share this learning story with my own students as I encourage them to pose questions, to co-construct curriculum, and to stretch themselves as learners and people.

The Curriculum We Need

When considering how teaching and schools must evolve for the 21st century, we wanted to overcome the fragmented expectations of "covering" curriculum. We think our students deserve to be engaged in meaningful and relevant learning, even if it requires more time—learning that requires them to question, to wrestle with issues, to get inside an experience, and deepen their knowledge and skills. We want our students to engage with the big ideas of a discipline and to develop their knowledge and competencies over time.

Deep learning needs to be *about something*. We need to learn about ideas that are important, that we will remember, that relate to the world, and that are at the heart of subject areas. Such ideas connect the past, the present, and the future with our own individual and unique lives and experiences. When we work with big ideas, we can utilize our connections and deepen

our understandings with prior knowledge, even though we all follow different paths to this shared moment. Constructing understanding with our students, who hold such a rich diversity of experience, creates the foundation for this deep learning. Just following scripted routines and curricular outcomes leads to a one-size-fits-all classroom, which is not what we want from our classroom explorations during our unit of study.

To us, a successful unit is one that provides an immersive and shared experience for our students; one that requires them to question their beliefs and attitudes. Education must offer students opportunities to build their understanding by wrestling with the big questions that relate to our lives and the world. When we began to write this chapter, Leyton posed two questions:

What is the importance of deep learning?

Why is teaching with the big idea in mind important?

As we thought about these questions around the table, Linda wrote a narrative and Nicole drew a web to show how she connects the big ideas. Our different paths into the conversation reminded us that deep learning is also about having multiple access points and pathways to a shared understanding.

The Bigger Picture

Working with big ideas allows teacher and students to inquire and explore within a domain. Projects, activities, and mini-lessons pull together knowledge, skills, and experiences that together construct a new big picture. The curriculum in each discipline can be daunting and the number of learning outcomes for the content may seem overwhelming. By identifying and developing the big ideas, we give ourselves permission, as educators and learners, to not just cover, but to uncover, the subject content.

Backward Design

The first two books of the *It's All About Thinking* series (2009, 2011) introduced Backward Design as a framework that focuses on one big idea as a critical aspect of planning. We can use that big idea—a foundational concept—and develop an essential question for a unit of study and frame an inquiry project that helps us tease out enduring understandings. Planning and teaching this way helps to develop powerful topics of inquiry and engages learners in a quest, repeatedly tapping into background knowledge, making connections, and seeking diverse resources, information, and perspectives.

Over the years, the process of devising essential questions has changed as we learn more about a topic, as the world changes, and as we interact with different groups of students. We ask what concepts in the past, present, and future of the topic will resonate with our students, and what should they seek to understand. We want questions that require our students to engage in the human quest for knowledge. We have often planned an essential question

for a unit, but happily found that our students were identifying their own profound questions.

Collaboration

We find that more possibilities emerge when we work with colleagues to plan a unit of study focused on big ideas. Different people have different perspectives, and these differences are resources for strengthening our collective work , rather than sources of conflict. We—Leyton, Linda, and Nicole—have grown immeasurably through co-planning, co-teaching, and co-reflecting. Our collaboration has offered significant professional development to the benefit of our students. By working through the challenges of melding different perspectives, we ensure that our students have diverse opportunities for pursuing their tentative answers to essential questions, revising those questions, and sharing resources and ideas.

Choice

Through our collaboration and cooperation, we do not assume consensus. We instead confirm our belief that we must allow for diversity and individualized pathways for learning and build them into the design of our units.

Choice is a big motivator for students that allows them to both share their voice and take ownership of their learning—choice in student texts, choice in ways to organize and present information, choice in ways to investigate questions; choice in showing what they have learned. Open-ended instructional strategies like those outlined in chapter 3 engage students with choice through diverse pathways that support personal engagement. In addition, when we offer choice, we offer our students opportunities to guide their own learning and simultaneously facilitate students' self-regulated learning.

Cross-Curricular Integration

In chapter 2, we discussed how students benefit when we identify and focus on learning across curricular areas. When we coordinate our unit plans and collaboratively target particular thinking skills, our students become more aware and begin using and applying these skills in various contexts. Similarly, when we integrate curricular areas to explore a big idea or theme, our students have more opportunities to make connections from one subject area to another, as well as connecting themselves to society, technology, science—and to the disciplinary knowledge and communication skills required for lifelong learning.

Assessment for Learning

To determine the thinking skills necessary for our specific class profile, we rely on assessment. Assessment for learning occurs early in the school year and at the beginning of each subsequent unit of study. Assessment results provide insight into our students' needs and strengths, insights that help

focus our teaching throughout the unit. In addition, assessment allows us to differentiate learning sequences, so that all kinds of learners can be included. Assessment is one of the key tenets of "universal design for learning" (UDL).

Universal Design for Learning

When we consider diversity in each of our classes, we see the important relationship between big ideas and UDL. Rather than take the perspective that we should "fix" a child because they do not learn in a particular way, UDL takes a student-centred approach by redesigning the curriculum. This means designing many ways to engage students, many ways for them to access and process information, and many ways for them to express what they know and learn. We achieve this by using curricular materials and activities that provide multiple paths for students with differing strengths, interests, and abilities. These alternatives are *built into* the instructional design of educational materials; they are not added on after the fact.

There are three guiding principles of universal design. We might focus on one more than another within a unit of instruction based on the needs of our students. The principles of universal design challenge us to plan and use:

1. Multiple means to tap into learners' interests and background knowledge to activate prior knowledge and increase engagement and motivation.
2. Multiple means for students to acquire information and knowledge that helps them process new ideas and information
3. Multiple means for students to express what they know

We use UDL because it acknowledges and accepts diversity as a reality, and it helps us to plan and organize for teaching and learning with diversity in mind. In our approach to UDL we start from the concepts at the heart of the content, but we connect them to the heart of our class and the individual students in it. Teachers who differentiate learning sequences so that all kinds of learners can be included honour their students' strengths, stretches, and interests. By providing to all students a way of accessing the big ideas, we encourage them to learn from each other, and create a community of learners who rely on the strengths of everyone, while continuing to grow in their own areas of need. Many factors are involved in the promotion of deep learning in our students. Once activated, however, the classroom becomes a learning community in which questions are posed, thinking is extended, and ideas are provoked while everyone learns from each other.

Integrating Backward Design and Universal Design for Learning

As we use UDL to guide our teaching, backward design becomes the framework that supports us along the way. We find McTighe and Wiggins's backward design approach to be a helpful framework to focus our planning, assessment, and instruction so that we build both the thinking strategies

and content knowledge of all students. Backward design involves four key elements:

1. identify key concepts from learning outcomes and organize lessons and learning sequences around the enduring understandings we want students to develop by the end of a unit of study
2. identify what thinking strategies students need to develop and use to complete learning tasks and, in particular, summative assessment(s)
3. align formative and summative assessments so that students know what is expected of them
4. explicitly teach and assess thinking strategies as part of a unit of study so that students become increasing successful learners.

<FL>Combining these two frameworks helps us meet the needs of all of our learners. By believing in every student's ability, we see "inclusion" as learning-focused instead of just the physical proximity of students in the same classroom. One way we do this is by ensuring that the curriculum is accessible. When we plan with the end in mind (backward), we achieve accessibility by anticipating the choices and learning paths of our students and how they address the big ideas and outcomes. This framework helps us construct units based on the specific learning profiles of our class, including students with the most significant learning challenges.

Including Students with Significant Learning Challenges

Bridging the cognitive gaps between regular students and those with special needs means that teachers must develop appropriate literacy skills in *all* our students. The difficultly usually arises when trying to find age-appropriate resources for the range of students whose literacy levels are different from that of their peers. Professional collaboration is essential when including students with special needs fully in the content lessons. When two or more educators co-create unit plans and resources, they can draw on one another's expertise and experience to meet the range of abilities in one integrated classroom.

For a Social Studies 9 unit, Linda wanted her unit plan to include particular ways for Evan, a student with a developmental disability, to access the content and to demonstrate what he learned in the assessment. She asked Shelley Moore, a district resource teacher, to assist her because Shelley had extensive experience working with and planning for students with significant learning challenges. Linda and Shelley co-constructed a unit by modifying the content goals (learning outcomes) and offering multiple pathways to accommodate all learners. Another of their goals was to make the learning tasks meaningful and appropriate so that no student would have to be pulled out of the learning community in that classroom and be segregated to work on different and less-than-challenging activities.

Big Ideas and Essential Questions

Linda and Shelley met early to discuss the enduring understandings and essential questions related to the curriculum content in a unit they called "Let's go to Canada!" about early settlers and settlements. Together they looked for the big ideas that would be the basis of the lessons. They adopted a planning template to help them think about learners with the most significant learning needs (Figure 4.1). Both Linda and Shelley knew this research-based structure and design would help all learners in the class, including Evan.

Setting Goals and Designing Summative Assessment

Consistent with UDL and BD, Shelley and Linda first set down what they wanted their students to know (the goals), then considered how students could show what they had learned (summative assessment). They decided that the unit's summative assessment project would ask students to create a picture book telling, and illustrating with pictures, the story of an early group of settlers in Canada. Although they expected all students would develop their summative assessment project in the same format, they gave the students choice in selecting the group or explorer whose story they would tell and the format they would use to tell it—graphic novel, picture book, pop-up book, comic, or other creation.

After Shelley and Linda had designed the unit goals and the summative assessment, they focused on how they would develop the lessons. For this stage of their co-planning, they described what the students needed to "know" and what they needed to "do" to achieve the goals. It was clear, too, that students would also need to know the main elements of picture book design, which would necessitate revisiting the elements of a story from their language arts background and experiences. Students would also need to research information for their chosen explorer or settlers whose story would make up the content of their picture book.

To tie in the thinking and literacy skills that their students would need to use and develop, the teachers referred to their Class Profile. They saw that it would be best to focus on two skills:

1. determining main ideas and detail
2. making notes

To do so, they decided to include a lesson sequence specifically on the note-making strategy of building a mind map. Such a strategy would support the students in determining the relevant information about key players in the early settlement of Canada, and to find the information needed to develop the illustrated story—the summative assessment.

Figure 4.1 Co-planning for Social Studies 9 unit "Let's go to Canada"

<table>
<tr><td colspan="2">Subject Area: Social Studies</td><td>Unit: Let's go to Canada!</td><td>Grade: 9</td></tr>
<tr><td colspan="4">Planning Team: Linda Watson (CT), Shelley Moore (DST), Educational Assistant</td></tr>
<tr><td colspan="4">Essential Questions</td></tr>
<tr><td colspan="4">• Who came to settle Canada? Why did they leave their home country? Where in Canada did they go?
• What happened when they got there? How was the conflict handled? What happened next?</td></tr>
<tr><td colspan="4">Summative Assessment</td></tr>
<tr><td colspan="2">Goals/Outcomes
(What is important to know?)</td><td colspan="2">Extended Goals
(Modifications)</td></tr>
<tr><td colspan="2">• Identify important events in the early stages of European exploration and colonization of Canada.
• Explain the meaning of colonialism and mercantilism.
• Tell/represent the story of the early settlement of Canada, and all its elements.</td><td colspan="2">• Identify different groups that settled Canada:
◦ When given a verbal cue, select 3 of the following names/words to identify by a visual or symbol:
◦ France, Catholic, Jesuit, Acadian, England, English,
◦ Native, Viking, fishermen, fish, first, fight
◦ Answer the question "Who came to Canada?" verbally.
◦ Identify 3 story elements.</td></tr>
<tr><td colspan="2">Skills/Processes
(What is important to do?)</td><td colspan="2">Extended goals
(Modifications)</td></tr>
<tr><td colspan="2">• Identify main ideas and details.
• Determine importance while reading and researching information.
• Tell a story orally.</td><td colspan="2">• Identify the main idea of each settler group, and two details that make them unique.
• Share an adapted story with a small group of peers.</td></tr>
<tr><td colspan="2">Performance Task for Summative Assessment</td><td colspan="2">Extended Performance Task</td></tr>
<tr><td colspan="2">• Prepare a picture book answering the essential questions of the unit:
◦ Who came to Canada? (characters)
◦ Why did they leave? (rising action)
◦ Where did they go? (setting)
◦ What happened when they got there? (problem)
◦ How was it handled? (results/consequences)
◦ What happened next? (closure/ending)</td><td colspan="2">• Interact by reading aloud and sharing an adapted picture book that answers the essential question:
• Who came to Canada? (characters)</td></tr>
<tr><td colspan="2">Texts</td><td colspan="2">Extended texts</td></tr>
<tr><td colspan="2">Oma's Quilt, Pink and Say, Bully Pathways</td><td colspan="2">Modified: Let's go to Canada</td></tr>
</table>

Considering Diverse Texts

Linda and Shelley next considered how students would access the information needed for their stories. Recognizing how essential it would be to have access to diverse informational texts and resources for both the lessons and their project, Linda went on the hunt for existing materials appropriate for a range of abilities and also collected texts from colleagues. Evan was still at an emergent literacy level, and they realized that no books on settlers of that era existed at that level, so Shelley started writing. Her ability to write levelled, but appropriate, texts was a critical skill in creating the resources that Evan needed to access the curriculum.

The Lesson Sequence

Linda and Shelley worked with students, first to construct a rubric of the criteria that they would use for assessing the students' projects (Figure 4.2). While doing so, they referred to exemplar picture books (e.g., *Oma's Quilt, Pink* and *Say, Bully*) to describe the progressive levels of the criteria by which they would assess the project that each student would research and develop. They read and examined a wide range of publication formats that describe and combine text, text features, and different types and styles of illustrations that students might use to communicate the story of the settler they choose for their project book.

For the remaining lessons in the unit, the students used the various informational texts the teachers had collected to research their chosen settler person or group and to build mind maps for their picture book project. For Evan, Shelley had created a picture book with the key content, but with more illustrations and text at his literacy level. She had developed the book at two levels, one that Evan could read independently, and another that others could read to or with him. Using this text, although modified, still offered the benefit of rich, content-oriented material that other students could access if they, too, needed additional support in understanding the big ideas in the curriculum or the language. The step of revising the reading level of a text on the curriculum content meant that Evan's teacher, Linda, could add content (Social Studies) goals for him as well as the social, behavioural, and communicative goals traditionally included in individual education plans (IEP).

Figure 4.2 Summative assessment rubric for Picture Book project "Arrival in Canada"

Aspects	**Minimal expectations** • Good start. Spend more time. You can do it.	**Meets expectations** • Nice! You are there!	**Exceeds expectations** • Wow! This would knock anyone's socks off!!
Images	• The cover includes a title and image.	• The cover includes a title and image that relates to the story.	• The cover includes a title and image that relates to the story and entices the reader to pick up the book.
Pictures	• Images relate to the story.	• Images clearly relate to the story and reflect major elements of the plot to the reader/viewer.	• Images clearly relate to the story and reflect all the elements of the plot to the reader/viewer.
Visuals	• You have images throughout your story.	• The images are visually pleasing and incorporate important details.	• The images are visually pleasing and evoke an emotional response.
Story **Key Elements**	• The text considers some story elements (characters, conflict, setting, plot, and so on). • The plot is historically accurate and considers some elements of plot (rising actions, falling action, resolution, message). • The story addresses some of the essential questions presented in the unit (who, what, where, when, why).	• The text considers major story elements (characters, conflict, setting, plot, and so on). • The plot is historically accurate and considers elements of plot (rising actions, falling action, resolution, message). • The story addresses most of the essential questions presented in the unit (who, what, where, when, why).	• The text considers all major story elements (characters, conflict, setting, plot, and so on). • The plot is historically accurate and considers all elements of plot (rising actions, falling action, resolution, message). • The story addresses all essential questions presented in the unit (who, what, where, when, why).
	• Style and elements of the chosen form are mostly consistent. • Text is written, but needs to be edited.	• Style and elements of the chosen form are consistent and honour the individual unique characteristics of the each medium (e.g., graphics for a comic, illustrations for a story book, 3D for a pop-up book). • Text has been edited and revised, with care taken to consider grammar and spelling.	• Style and elements of the chosen form are consistent and honour the individual characteristics unique to the medium. Student has chosen a format that is a strength and helps them communicate their knowledge. • Text has been edited and revised. Spelling and grammar are accurate.
Teacher Comments			

Including Students with IEPs

Evan was included in the planning for every part of the unit and lesson, from enacting and assessing to building the performance criteria, from researching to sharing his story. The final part of the unit assessment invited students to share their final picture book project, and Evan shared his book in a group with his peers. Linda's grade for Evan was based on the content-specific goals in his IEP (Figure 4.3), a section often overlooked for such students in high school.

Figure 4.3 Individual Education Plan (IEP) for Evan

Student: Evan T. **Teacher(s):** Linda Watson **Educational Assistant:** various **Resource Support:** Shelley Moore		**Grade:** 9	**Course:** Social Studies 9 **Term:** 2 **Block:** 3 **Category:** G			
Goal Area/Topic: Social Studies Content						
Goal	Evan will identify the various groups that settled Canada by:		NYM	MM	FM	EE	NA
Objective	Identifying a symbol to represent words of the unit: France, Jesuit, Catholic, Acadian, England, English, Native, Viking, fishermen, fish, first, fight						
Objective	Building a mind map of major players and details about each one.						
Goal Area/Topic: Processes and thinking skills						
Goal	Evan will identify main idea and details by:		NYM	MM	FM	EE	NA
Objective	Identifying the characters and one or two details about them						
Goal	Evan will increase his reading fluency by:		NYM	MM	FM	EE	NA
Objective	Practising an oral reading of a given text						
Objective	Reading aloud a given text to a group of peers						
Teacher Comments:		Totals					
		Weighting	x 1	x 2	x 3	x 4	x 1
		Goal scores	+ + +				
		Total scores	# of goals x 4				
		Divide goal by total	/				
		Percentage	x 100				
		Term Reporting Mark	Letter Grade				

Figure 4.3 cont'd

Assessment Rubric for IEP Goals

Note: Use N/A when student has not yet been instructed in this area or when goal is not appropriate for this student.

Goals	Not Yet Meeting Expectations NYM	Minimally Meeting Expectations MM	Fully Meeting Expectations FM	Exceeding Expectations EE
Support Level What level of support is given?	• Student needs support to meet this goal.	• Student can meet this goal, with assistance and prompting.	• Student can meet this goal, without assistance within the context of the class; or • With some assistance, student can meet this goal within another context or with example.	• Student can meet this goal, without assistance outside the context of the classroom, and can generalize or make connections to other contexts or examples.
Independence Level Is student independent in responding?	• Student does not initiate a response.	• Student initiates responses sometimes.	• Student initiates responses most times.	• Student initiates responses every time.
Participation Level What does the student need in order to participate?	• Student can participate when provided with direct one-to-one matches (objects, pictures, or words).	• Student can participate when provided with 2 or 3 choices to select from (objects, pictures, or words).	• Student can participate when given more than 3 choices to select from (objects, pictures, or words).	• Student can participate without being given any choices to select from; or student uses AAC device independently to participate.

The lesson sequence plan (Figure 4.4) for the "Let's go to Canada" unit shows how the collaboration between Linda and Shelley resulted in a rich unit that addressed the needs of all the learners in the classroom. The plan includes the classroom lessons and the background support that Shelley provided by creating modified materials specific to the class and to Evan's IEP.

Figure 4.4 Plan of lesson sequence for "Let's go to Canada" unit

Lesson 1: Introduction			
Phase	**Lesson Activity**	**Modifications**	**Materials Needed**
Connect	• Read aloud a picture book of the history of Canada	• While searching through books, Evan is given a page filled with visual symbols (and some distractors) of story elements. • With a bingo dabber, he identifies the correct responses to the question: What makes a good story? • Using the prompt "Storybooks have _____," Evan writes sentences creating the criteria for his book.	• Picture communication symbol (PCS) board with story elements • Sentence strips
Process	• Students look through a collection of picture books to find common features and create categories; they develop criteria to distinguish historical picture books from traditional students' picture books. (use of visuals, emotion, detail, perspective of characters).		
Transform/ Personalize	• Introduce the "working rubric," which they will add on to during each class. This will become a working document over the course of the next few lessons and will then become the rubric used to assess their final performance task. • Students begin to add categories and criteria to a blank rubric.		

Lesson 2: The Mind Map			
Phase	**Lesson Activity**	**Modifications**	**Materials needed**
Connect	• Introduce mind mapping by making mini mind maps of a familiar topic, e.g., your house, cars, a colour and so on.	• Student uses a magazine (interest-specific, e.g., cats) to help make a picture mind map that focuses on 3 elements: topic, 3 main ideas, plus 1 detail for each idea. • Teacher scribes words to label pictures, once completed.	• Cat magazine • Scissors, glue • Picture mind map template • Black marker
Process	• Students are given a piece of text and follow the teacher modelling, being guided through the strategy of "magnet notes" that build mini mind maps of chunks of texts. • Student continues through text selection until all chunks have been mapped.		
Transform/ Personalize	• Students independently move on to create categories and compile their mini mind maps of the individual text chunks, into a larger mind map giving " the big picture" of the reading selection.		

Lesson 3: The Who and the What			
Phase	**Lesson Activity**	**Modifications**	**Materials needed**
Connect	• Introduce unit vocabulary with a word game.	• First reading of adapted text, "Let's go to Canada." • Reading purpose: identifying major characters. • Add pictures to a mind map of major characters.	• Adapted book • PCS symbols of major characters • Template of mind map for pictures • Scissors, glue
Process	• Given various texts, students use the mind map strategy using the content vocabulary (Vikings, fishermen, Cartier/ Iroquois, Champlain/French, Jesuits, Coureurs de bois, and relevant others). • Once the major players have been identified, students continue researching to determine what their role was in the settlement of Canada and add that to their mind map.		
Transform	• Exit slip: Which story elements have we addressed today (who/what)? What information can we add to our rubric to help us with our final project?		

Lesson 4: The Why, the Where, and the How			
Phase	**Lesson Activity**	**Modifications**	**Materials needed**
Connect	• Read aloud: A picture book about settlement	• Second reading of adapted text, "Lets go to Canada" • Reading purpose: identifying major characters and a detail about each one • Make a picture mind map of major characters and a detail	• Adapted book • PCS symbols of major characters • PCS symbols of details • Picture mind map template • Scissors, glue
Process	• Students chose which major player they will focus on for their summative assessment story. • Students continue researching using the various texts provided to answer the remaining essential questions on their mind map		
Transform	• Exit slip: In considering your strengths as a learner, what format e.g., comic, picture book, pop up, other) do you want to choose to show your understanding? Why? • What additional elements/ details should we add to our rubric to finalize it for our answer to the summative assessment question: What makes a powerful picture book?		

Lessons 5-6: Editing and Feedback			
Phase	**Lesson Activity**	**Modifications**	**Materials needed**
Workshop	• Students work on their stories through the format they have chosen • Students practise orally reading book to peers for feedback using the class generated rubric for reference	• Student continues to read adapted text, and practices reading aloud to build fluency for his final presentation • It is also videoed in case on the day of, Evan isn't comfortable sharing, he can chose to show just the video to his group • Continue to finalize picture mind map	• Adapted book • PCS symbols of major characters • PCS symbols of details • Picture mind map template • Scissors, glue • Video camera

Lesson 7: Showing what we know			
Phase	**Lesson Activity**	**Modifications**	**Materials needed**
Presentation day	• Break students up into groups to share their story in 2 rotations. • Students hand in their mind map for assessment.	• Student is included in a sharing group and reads his story aloud, identifying the characters and one detail about each. • Student hands in picture mind map for assessment.	• Adapted book • PCS symbols of major characters • PCS symbols of details • Picture mind map
Unit reflection	• Students reflect on the process of creating their book in a group reflection answering the questions: • What have you learned about yourself as a learner? • What steps did you take to be successful? • What did others say about your project? • What would you do differently next time?	• Select students are asked to provide some written peer feedback to Evan on his book on a post it note which are given to him during reflection time. • Evan is given a final picture quiz answering his essential question: "Who are the major players in Canadian settlement?"	• Picture quiz • Sticky notes • IEP checklist

Using Diverse Texts and Big Ideas to Enhance Student Engagement

Six educators from Dunsmuir Middle School, located outside of Victoria, BC, came together with the purpose of creating an engaging cross-curricular unit they called "Rock Stories." Hailing from different backgrounds and with varied teaching experience, these educators created a unit that engaged students in deeper thinking processes, and encouraged collaboration among both students and teachers. Using Information Circles and diverse texts as the catalyst, their Earth Sciences unit encouraged students to think about how rocks and minerals can "tell stories" about the past, the present, and the future.

The team included Lenore Clarke, grade 7 teacher and the curriculum support leader for the school; May Crompton, teacher-librarian and technology teacher; Justine Durrant, Aboriginal Education teacher; Barb Kersch, grade 7 teacher and Literacy Teacher; Jen Nixon, grade 7 Core Teacher; and Regan Rasmussen, Visual Arts teacher and a sessional instructor in Faculty of Education, University of Victoria. Working together as a professional inquiry learning team, these educators set out to create a collaborative cross-curricular grade 7 unit incorporating elements of visual arts, Aboriginal Education, science, and technology.

Earth Science unit "Rock Stories"

These six educators used diverse texts and Information Circles to engage all learners in accessing background knowledge, in seeking answers to questions that required deeper thinking, and in encouraging greater collaboration between students. They created an Earth Science unit for grade 7 that incorporated cross-curricular elements and perspectives centred on an open-ended, essential inquiry question. To scaffold student learning, the classroom teachers provided graphic organizers and strategy sheets, and they facilitated small-group discussions of the big ideas. "Rock Stories" is both process-oriented and product-oriented, The planners put great emphasis on student conversations during Information Circles and on thinking and instructional strategies. As a final performance task, their students had to create a mind map on which they were able to illustrate their varied understandings of the unit's big ideas and essential inquiry question.

When designing this unit, Lenore, May, Justine, Barb, Jen, and Regan used a backward design framework. The teachers collaboratively identified the overarching essential inquiry question, the big ideas that encompassed many learning outcomes, and the thinking strategies that they wanted their students to develop. Then they created the scope and sequence of the unit by planning individual lessons and various instructional strategies (Figure 4.5). As the classes progressed, the teachers adapted or changed the lessons when necessary to reflect the feedback they received from the students.

Figure 4.5 Unit plan for Earth Sciences "Rock Stories"

Essential Question: How can studying changes in the Earth reveal secrets from the past and impact our future?				
Big Ideas		• Rocks are made up of unique components. • Rocks can be recycled. • The Earth is made up of plates that move. • Movements of the plates cause both sudden and gradual change to the Earth's crust. • Rocks are important to humans in various ways (culturally, socially and economically).		
Thinking Strategies		Main ideas and details, Hypothesizing, Classifying, Synthesizing		
Lesson	**1**	**2**	**3**	**4**
Essential Question	What properties do geologists use to identify the minerals that make up rocks?	Can you identify unknown minerals by their properties?		
Lesson Topic	Properties of minerals	Identifying Minerals		
Thinking Strategy	Determining importance	Observing, classifying, interpreting, communicating	Observing, classifying, interpreting, communicating	Observing, classifying, interpreting, communicating
Teaching Strategy	Mini book	Lab: Indentifying Minerals 1st Block: Writing a lab report	Lab: Indentifying Minerals 2nd Block: Conducting lab	Lab: Indentifying Minerals 3rd Block: Analyze & Evaluate Results
Lesson	**5**	**6**	**7**	**8-9**
Essential Question	Are all rocks formed the same way?		How do rocks help us unlock the secrets of the past?	
Lesson Topic	Families of rocks		Formation of Fossils	Exploring Fossil Record
Thinking Strategy	Categorizing, Determining importance		Sequencing	
Teaching Strategy	Flow Chart with examples *Scaffold*	Create a Museum Box including pictures and descriptions	Flow Chart Graphic Organizer *Scaffold*	Fossil Trading Card

Lesson	**10**	**11**	**12**	**13-15**
Essential Question	How are rocks broken down and moved?		How can rock be recycled?	What would it be like to journey through the rock cycle?
Lesson Topic	Weathering	Erosion	Rock Cycle	Final Performance Task
Thinking Strategy	Sequencing, Determining importance	Sequencing, Determining importance	Sequencing, Determining Importance	Synthesizing, Communicating
Teaching Strategy	Magnet Notes *Scaffold* Compare and Contrast Chart	Magnet Notes *Independently*	Flow Chart Graphic Organizer *Independently*	Student choice for journey
Lesson	**1**	**2**	**3**	**4**
Essential Question	What is the structure of the Earth?	Does the surface of the Earth move?		
Lesson Topic	Layers of the Earth	Wegners's theory of continental drift		
Thinking Strategy	Main ideas & details	Main ideas & details	Interpreting	Synthesizing
Teaching Strategy	Place Mat in groups of 4	Graphic organizer for viewing DVD	Creating a model of Pangaea. 1st Block: Cut and layout	Creating a model of Pangaea. 2nd Block: Glue and label
Lesson	**5**	**6-8**	**9-10**	**11**
Essential Question	Does the surface of Earth move?			
Lesson Topic	Wegener's 1912 theory of continental drift	Theory of Plate Tectonics	Finding Patterns in Geological Data	
Thinking Strategy	Synthesizing Evaluating	Main ideas and details, connections	Hypothesizing	Interpreting Synthesizing
Teaching Strategy	Creating a model of Pangaea 3rd Block: Complete questions	Model Information Circles and Mind Map *Scaffold*	Lab 8.5: Plotting earthquakes, volcanoes 1st and 2nd Block: Hypothesize and plot	Lab 8.5: 3rd Block: Analyze, write a conclusion, apply and extend
Lesson	**12 Performance Task 2**			
Essential Question	Plates move, so what?			
Lesson Topic	Reflecting on your learning			
Thinking Strategy	What did you learn? How has learning about the theory of plate tectonics changed the way you think about i) the area in which you live; ii) Earth?			
Teaching Strategy	Journal entry and "Somebody thought.... then.... so..... " chart			
Resources	Activity sheet Journal on one side and chart on the other			

Diversity and Unit Planning

The team designed the unit to accommodate the different needs, interests, and backgrounds of their students by incorporating many opportunities for student choice into the unit design, and encouraging student ownership, particularly through the Information Circle process and the final performance task. Students could choose from a diverse selection of titles to work through individually and with their group. In addition, after teacher scaffolding and guided student practice, the students chose the graphic organizer they would use not only to approach the Information Circles and performance tasks but also to build the necessary skills, confidence, and feelings of self-efficacy. At several points throughout the unit, teachers used the fishbowl strategy, that is, inviting one group of students to engage in discussion within an Information Circle while the rest of the students in the class observed and commented on the process, generating criteria for effective process. This was a powerful form of student-to-student modelling, and it highlighted the collaborative inquiry method of learning.

The teachers brought various backgrounds, skills, and teaching assignments to this unit, which required a high degree of risk-taking, flexibility, and collaboration. During the Information Circles, more than one teacher was in the room at one time, promoting collaboration among the teachers, ongoing formative assessment, and increased descriptive teacher feedback, along with modelling for their students.

Establishing the Information Circles

Prior to starting the Information Circles in her class, Jen facilitated a discussion with the class about the differences between Information Circles and the Literature Circles they had recently participated in. Using a book talk format, Jen introduced a collection of short diverse informational texts (9 titles with 5 or 6 copies of each) that she had gathered for the unit. The following process took three to five lessons to complete:

- During the book talk, students are invited to choose three titles they are interested in reading and to record them on a slip of paper.
- Jen then collates the requests, working toward giving each student one of their three text choices.
- Students are given one of their book choices and time to browse and record on sticky notes any areas of interest, noting, initial observations and queries.
- After several minutes, students move into groups based on their choice of text.
- These newly formed groups are then asked to collaboratively decide their plan for reading the text and the strategy sheet they will use during their reading.
- They then prepare for Information Circle conversation.

Preparing for the Information Circle Conversations

- Students use a strategy sheet to help guide their learning. Although each strategy sheet is unique, they all follow the basic format—connecting, processing, transforming/personalizing.
- In their groups, students conduct a "think–pair–share" to brainstorm and record what they already know about the topic. This process of activating prior knowledge encourages students to record everything they know about the topic. They are then asked to share out within their group and add any new connections to their sheet.
- The process of reading the text is done independently using the strategy sheet to write down questions they may have, or points they need to clarify with the group.
- The strategy sheet becomes the "ticket in" to their Information Circle conversation the next day

Information Circles Conversation

- During Information Circle conversations, students share their key ideas from the reading. Students work together to discuss main ideas, pose questions, clarify information, and share connections. Together, they build a shared schema of the text as they offer their opinions, questions, and inferences.
- Students discuss and record their deeper understandings of the topic, and connect what they learned to the unit's essential question and big ideas.
- Reflecting on what they have learned, students personalize their understandings and record their ideas on the strategy sheet.

Formative assessment

- Students reflect on the Information Circle conversation by discussing key questions: "What was the most important information we learned today?" "What worked in our Information Circle? What could we change or get better at?"
- Students choose another section of the same text or choose a new text and work with a new group.

Synthesis and Summative Assessment

Through the subsequent two to four lessons leading to the summative assessment, students create a mind map to show how their learning connects to the unit's big ideas and the essential question. The centre of the mind map holds the essential question, and each big idea forms a branch or strand of the mind map

- Modelling and instruction are provided to facilitate the mind mapping process (images, words, use of colour, hierarchy). Samples of powerful

mind maps are shared, and students also view the YouTube clip <www.videojug.com/film/how-to-mind-map-with-tony-buzan>.
- The criteria for their mind map is then developed, and the rubric is reviewed by the class (Figure 4.6). The teacher responds to questions and shows more samples.
- Students meet in groups to brainstorm how they want their mind map to showcase their learning related to the essential question. They pull pieces together, making connections between the essential question and big ideas, and create their own individual mind map.
- Completed mind maps are showcased in a "gallery walk" within the classroom.
- The mind maps are then assessed using the co-constructed rubric

Information Circles Using Text Sets

Building on the excitement she saw in Jen's class, Lenore aimed to employ the Information Circle strategy with a twist. Throughout her ecology unit, she had numerous resources stationed in the room, including a number of books on topics such as biomes, food webs, ecosystems, and endangered species, but not multiple copies of the same text as in Jen's class. Rather than having groups read and discuss the same text, she set up groups according to a book series or a specific topic. Each group member read a different text that was based on a common group theme.

The ecology unit was designed around the essential question "How do I fit into the living world?" Students had been working on activities that guided them to consider how plants, animals, and humans depend on one another and how they interact with their environment. The big ideas in the unit were:

1. How ecosystems support life.
2. Energy flow and matter cycles in ecosystems.
3. How human survival depends on sustainable ecosystems.

Lenore had modelled strategies like magnet notes (see chapter 3) and double-entry journals giving students practice in determining main ideas and details. Students were well-versed in the schema of connecting, processing, and transforming/personalizing.

The goal of the Information Circle part of this ecology unit was to have students use their newly developed knowledge base to synthesize information from different texts and explore connections, guided by the essential question and big ideas for the unit. Lenore built in choice by allowing students to select the text they would read and the thinking strategy they would use— magnet notes, double-entry journals, or a more personalized adaptation of either.

Figure 4.7 Final assessment criteria and rubric for students' Mind Map

Final Mind Map Criteria

You must show how all the big Ideas are connected. Be sure to offer specific examples of the big Ideas. Remember your Mind Map must have the following parts:

- A central image that relates to the unit
  - Big ideas form branches that connect to the central image
  - Key ideas form limbs off the branches - ideas move from most to least complex
  - Images and words show a clear understanding of the content
  - Clearly use text, colour, images and links to show connections between ideas
- At the bottom of your mind map write a reflective piece that responds to our unit question:
  - How can studying changes in the Earth reveal secrets from the past and impact our future?
- Be sure to include any questions or wonderings that have yet to be answered.

	Beginning	Developing	Accomplished	Exemplary
Mind Mapping Process	• I can select a few important pieces of information that relate to the Mind Map • I'm not really thinking on my own yet; I need guidance from the teacher • I use one source to show all of my thinking; I generally copy text • I need evidence of using feedback	• I can select some specific pieces of information that relate to the Mind Map • I demonstrate straightforward thinking; I have yet to take some risks • I can think in concrete ways when I select/use pieces of information (paraphrasing the text) • I use some feedback from my peers and/or my teacher	• I can select and describe most important pieces of information that relate to the Mind Map • I demonstrate logical and predictable thinking and take few risks • I can think in some new and interesting ways when I select/ use specific pieces of information from multiple sources (use and apply information in a slightly different manner) • I use peer and/or teacher feedback to improve my work	• I clearly and accurately select and describe sophisticated and/ or unique pieces of information that relate to the Mind Map • I demonstrate flexibility, innovation and/or risk taking in my thinking • I can think in multiple ways when I select and use specific pieces of information from multiple sources (use and apply information in more than one manner) • I actively seek out peer and teacher feedback

Setting the Stage

Lenore introduced the Information Circle process with a fishbowl activity, inviting a group from Jen's class to model the conversation process.

- Lenore's class observed the Information Circle meeting and jotted notes as to what worked.
- The class debriefed the model group, asking questions about the process.
- Lenore worked with her class to create a list of guidelines and strategies for a productive Information Circle. Ideas were recorded

Figure 4.7 Continued

Mind Mapping Product	• I demonstrate partial understanding of the concepts; I require teacher or peer assistance to do this • Some key ideas show extensions, 1 or 2 limbs off a branch; a few supporting details have been included • I need more evidence of using text, colour, images and links that help clarify and highlight connections in this Mind Map	• I demonstrate basic understanding of the concepts; I might require some teacher or peer assistance to do this • Most key ideas show extensions, 2 limbs off a branch; some supporting details have been included & most make sense • I demonstrate a basic use of text, colour, images & links that help clarify & highlight some connections in this Mind Map	• I demonstrate solid understanding and application of concepts; I can do this on my own with little or no assistance • All key ideas show clear extensions, 2-3 limbs off a branch; most relevant and supporting details have been included and make sense; attempts to connect to daily life are included • I demonstrate a good use of text, colour , images & links that help to clarify & highlight connections in most parts of this Mind Map	• I demonstrate complete and in depth understanding of concepts through analyzing and evaluating; I do this independently • Extensions of key ideas (limbs) show a deep understanding of the concepts; multiple and insightful details have been included; relevant connections to daily life are included (past and present) • I demonstrate innovation and flexibility with my use of text, colour, images and links that clarify and highlight connections in this Mind Map

such as "be prepared" and "make connections" that promoted discussion and were posted at the front of the room.

Next, Lenore gave a book talk, highlighting the content and organization of the various books in the series or themed groupings. More than 30 different books were grouped as text sets under five or six topics.

- Using a document camera, Lenore introduced the books by projecting them for the students to see.
- Although there are five different books in the series (e.g., *Polar*, *Rainforest*, *Desert*, *Ocean*), she showed the table of contents of one to point out that all books had similar organization. (e.g., climate, geography, flora, fauna). She explained how the table of contents could possibly become the focus for them in planning their reading and discussion.
- Next, she highlighted books that had been assembled by theme (e.g., endangered species, climate change), reading a short excerpt from a book or two in each set.
- At the end of the book talk, she gave students a chance to browse the collection and submit a list of three books that interested them.
- Lenore sorted through their lists to establish groups based upon the students' requests.

Group Meetings

Lenore planned two blocks of class time to work through the first round of Information Circles. She focussed the first block on reading and note-making, and the second on the sharing and discussion component.

- Students met with their group and browsed the books. They negotiated which text each of them would read and decided on a focus for reading (e.g., "climate" from the table of contents in a series, or "disappearing habitat" in the endangered species theme)
  - ***Connecting*** — Students chose a note-making strategy, either a double entry journal or magnet notes. They began by silently skimming their text, looking at pictures and headings.
  - ***Processing*** — Students read independently and used a graphic organizer to select main ideas and details relating to the group's focus; they also recorded questions and points requiring clarification.
  - ***Personalizing (individual)*** — Students continued to complete the independent note-making strategy and reflected on what they found most interesting and what they would share with the group related to the essential question. Each group member arrived at the next meeting ready to share both the process and the personalization pieces of their notes.
  - ***Personalizing (group meeting)*** — Students were reminded to refer to the discussion criteria for tips on holding a successful meeting. Each member shared their ideas and thoughts about their chosen text. The group worked together to discuss similarities, differences, and wonderings that arose from their group's focus and discussion; Lenore reminded groups to make connections to the essential question asked them to think of five to eight key ideas they identified.
- ***Formative Assessment*** — As the discussion concluded, each group completed a placemat (Bennett and Rolheiser 2001). On their portion of the placemat, students independently recorded what they believed to be the most important ideas from the discussion related to the essential question/big idea for the unit. They then shared their portion of the placemat with the group. At the end of the sharing they negotiated one overarching statement for the centre of their placemat, synthesizing their understanding thus far. The placemat demonstrates their ability to synthesize the material. The placemat became an artifact of their thinking and discussion.
- ***Gallery Walk*** — Groups rotated around the class, viewing all the placemats and browsing the corresponding books to help them decide which text set they would like to use for their next Information Circle. Their ticket-out-the-door was a list of their next top 3 choices.

Art Component

As a visual arts teacher, Regan was able to build upon the learning in the grade 7 classrooms through art explorations. Depending on the time of year that students came to their art rotation, their exposure to the Earth Science units varied. Some had not yet started the rocks unit while others were in the middle of the process, or had completed it. Embarking upon this shared inquiry with grade 7 classroom teachers, students were afforded a richness and depth of learning by making connections across disciplines.

Establishing the Area of Inquiry

Students began by brainstorming the word *rock*, rotating in carousel fashion. They moved in groups of four from one chart paper to the next, elaborating upon what the previous groups had written. After sharing, students were asked to collectively brainstorm the word *inquiry*. When responses were posted, the class agreed that the phrase "To inquire is to wonder" reflected their consensus. Regan worked with the class to establish a shared inquiry question, extending from the essential question familiar to some from their Science classes. The essential art question became "What kinds of stories do rocks of the past and present reveal about our world and our place in it?"

Exploring "Rock Ideas" through Different Media

Students documented their process through writing and recording ideas and sketches in their Rock Journal. The following points summarize the journey they shared as they explored images, ideas, drawings, paintings, and clay media related to their inquiry:

- Viewing video clips about the ancient cave paintings of the world (e.g., Caves of Lascaux, Aboriginal paintings of Australia).
- Sketching some of the icons and patterns from the video clips.
- Writing stories about what the images might have been expressing (e.g., stories of creation, honouring Earth; images such as hunting animals, tools, and patterns that were important to early humans).
- Viewing contemporary rock paintings created by street artists on rock walls, buildings, subway stations, and similar. Students were particularly interested in the street artist, Banksy, known for his social commentary on international issues around the world.
- Writing stories about what contemporary street artists might be trying to tell us through their art.
- Looking at patterns and colours that occurred in rock faces over time from natural forces.
- Creating terra cotta clay tablets, using images from their Rock Journal sketches for the etchings.
- Writing art statements telling the stories, both historical and contemporary, associated with the images etched onto the clay.

- Learning about the chemical and physical changes of clay from plastic (wet state), to greenware (dry state); bisque-fired (initial kiln firing); and glaze-fired (final firing) processes.
- Brainstorming gemstones in carousel groups, during the final art rotation in the spring, many students asked to get their science binders to refer to vocabulary and processes they were studying during the Rocks unit. This was another ah-ha moment as students initiated making connections between their learning in Science class and their learning in the Art studio.
- Linking colour theory and exploratory studies to a favourite gemstone; students created large abstract paintings based on the chosen gemstone using only tints, shades, and complementary colour along with varied brush strokes and different amounts of water to alter the opacity of the hue.
- Writing a free verse poem to be placed either on or beside the painting, connecting something factual as well as something fanciful to their chosen gemstone.

Assessing the Learning

Teachers conducted formative assessments as their students explored, shared, and revised (through peer and teacher feedback), and expanded their understanding in discussions and written comments in their journals. The final assessment sheets summarized the steps in the process and allowed students time for reflective writing, including their thoughts on the art—the drawings, clay tablets, and gemstone paintings. Students also made connections to their Science class and notebooks, to the work of past and present artists, and to their own preferences and imaginative explorations. They shared their work by placing it on display for other classes to view, and they contributed to an electronic slide show documenting the process.

Working with a Teacher-Librarian

It was invaluable to have on the team the support of May, the school's teacher-librarian, who worked to develop a text set of Earth Science resources. Since this project was multidisciplinary, the focus had to be broad enough that everyone on the team could access several titles from the collection. May started by looking at the resources on hand in the school library, including diverse types of texts, hands-on materials, models, and nonfiction titles for Information Circle kits. She also supplied relevant website addresses and the school technologies available, which included animations and video, and age-appropriate materials that took student interest levels into account.

As the unit developed, May realized that they also needed First Nations texts and materials with an arts focus into their collection of materials. She also found additional online resources that were up-to-date and engaging,

so that May's full set of resources included both print and digital titles and online websites.

Conclusion

We nurture deep learning in our students when we build from the Class Profile and the individual learning styles of our students. We can tap into their strengths, stretches, and interests as learners. By identifying the big ideas of a unit and the knowledge, strategies, and skills that we want our students to demonstrate in summative assessments, we embrace inquiry and choice as fundamental to our planning and teaching. Collaborating with colleagues is the secret ingredient in crafting learning opportunities that intrigue and inspire students to explore a discipline's big ideas and develop 21st-century skills. We can embrace and support our learners when we work together to design engaging big idea teaching and learning.

Chapter 5

Creating Pathways by Integrating the Arts

[New feature: Playbill of educators/writers– to come for chapter opening on recto]

> Art involves molding of clay, chipping of marble, casting of bronze, layering on of pigments, construction of buildings, singing of songs, playing of instruments, enacting of roles on the stage, going through rhythmic movements in the dance. Every art does something with some physical material, the body or something outside the body, with or without the use of intervening tools, and with a view to production of something visible, audible, or tangible. (John Dewey)

Nicole thinks in terms of movement and, for her, movement through dance helps her express her thoughts and feelings. Linda has to act out or dramatize through improvisation and performance, to sort out her thoughts and feelings. Leyton translates thoughts and feelings into music, using rhythms to connect the ideas he wants to share. Karen makes meaning with her hands, shaping and creating her ideas in clay and other media. The arts have offered each of us varied pathways to learning, to creating our identities, and have helped us to be successful in the world.

When we think about our students' learning and how we can help them shape their own identity, we must work from the knowledge that people are diverse, that they learn in many different ways and at different times. The arts help us accept that we can never really be at the same place in our learning and social development at the same time as everyone else. The arts also guide us in how to tap into our potential and to recognize how each of us can make a unique contribution to a learning environment. The arts help us form natural connections to what we are learning. The arts should be integrated into our teaching and our students' learning—they offer us springboards for tackling the issues and ideas that matter. When students work with the arts to explore meaningful topics within new content, they have opportunities to access their prior learning, make connections, and pose questions that move them beyond the known to the unknown.

Each of the arts has its own forms of literacy. By integrating the creative and expressive arts into our units in core disciplines, we can offer our students varied entry points into challenging topics. Thereby, we help students strengthen their skill sets and build new ones. Learning through the arts requires alternative thinking. The creative process provides a way for students to relate to the content—they investigate their beliefs, they interact with concepts, and develop new ideas to create meaning. The arts create community. It is not by chance that societies and cultures are known by the arts they create and participate in.

Rationale for Integrating the Arts

It has been our experience that the arts provide more active learning experiences, which increases student involvement and engagement. They improve awareness of our senses, involve multiple forms of expression and feeling, including symbolic and non-verbal expression, and provide a basis for learning about the world from varied perspectives. We believe that

instructional strategies and approaches that include one or more of the arts equals good teaching.

The concept of supporting and enhancing student learning through arts education is not new. The benefits and potential created through integrating fine arts with other content areas are many. These benefits include stronger achievement, engagement and understanding, skill development, confidence building, and ownership (Darby Catterall 1994; Campbell, Campbell, and Dickinson 2004). When the curriculum of the content areas is combined with the arts, students have the opportunity to delve into ideas more extensively, access different styles of learning, and present their understanding in a variety of ways.

Typical classrooms focus on only two of the multiple intelligences—the logical-mathematical and the verbal-linguistic. Just like their teachers, not all students work or learn effectively or completely in these two modalities. We do not need to be experts to integrate arts-based learning strategies that provide more diverse learning opportunities. But we can expand our repertoire as teachers so our students can explore other ways of knowing and learning. Trying new approaches can empower us and become contagious—by extending ourselves into the unknown, we encourage our students to also take risks. Doing so, however, requires that our assessments allow for students to demonstrate their learning by using the arts (Stiggins 2005).

When teachers integrate the arts into academic areas, student engage in learning more fully. Confucius wrote "I hear and I forget. I see and I remember. I do and I understand" (*The Analects* 551–479 BCE). Aristotle, Dewey, and many other educational thinkers have expressed their belief in "learning by doing"—and here we extend the concept to self-expression through the arts. Gardner (2006) points out that each of us has strength in one or two of the intelligences and that our strengths may overlap others. Bodily-kinesthetic intelligence, visual-spatial intelligence, and musical-rhythmic intelligence are the three most closely connected with the arts, but are not limited to them (Campbell, Campbell, and Dickinson 2004; Gardner 1999). Arts integration offers students an opportunity to actively engage in meaning making using several intelligences.

Some students can surprise and move you by expressing their perceptions of their learning through the arts: MacKenzie, a quiet and withdrawn grade 9 student, drew us into the eighteenth century—literally. What we could see from his visual art representations took us much deeper than the social studies text could ever do. In representing the emotional impact of slavery by creating a movement piece, many English-language learners in Nicole's class (who had not responded to the stories and artifacts they had explored or shared) showed in their dances their aching for the lives destroyed and their perspectives on restitution. We must revisit the shameful events of our country's past and present by tackling tough issues, and recognizing their impact on people other than ourselves.

The arts can enhance student confidence and engagement. When Hannah reflected on grade 9 Humanities, she wrote about her experience in Linda's arts-infused classroom:

> [It] made me start to accept myself for who I am. Last year I couldn't stand who I was. I didn't think I deserved to take up any space…you gave me many moments to shine…you gave me a new view on the world. You changed my life. The hugest change is that now I know that I can achieve whatever I set my mind to—be it writing a memoir, making connections, determining importance, chunking a reading, or taking a risk.

With success in the classroom comes engagement (Heink and Farnau 2008; Repress and Lufti 2006). Many students who struggle academically have not had an opportunity to discover, understand, or use their particular strengths (Campbell et al. 2004; Repress and Lutfi 2006). Confidence in one's ability to learn and excel does not come easily when there is constant struggle and failure in the classroom (Campbell et al. 2004; Levine 2002). As middle years educators, we have a responsibility to nurture young people, help them develop belief in their abilities, and express their learning through their own strengths and talents. Exploring the arts provides students with another pathway to learning and increases their self-confidence, their sense of self-worth is enhanced, strengthened and supported.

Drama as a Pathway

Drama is about engaging in discussion, observing perspectives, navigating through numerous possibilities, making and supporting decisions, and taking personal risks to gain confidence. When we use drama as a tool, students learn how to:

- build relationships
- work in groups in a collaborative way
- accept and implement diverse ideas to create a shared experience
- become their authentic self and learn to nurture their own and others' creative ideas
- make meaning through democratic processes
- share thinking and feelings in a safe environment
- suspend disbelief by becoming willing to let go of limited thinking and constraints
- learn through representation how powerful symbol and metaphor can be
- appreciate the impact of their actions, what it takes to make change, and how hard it is to make a difference
- value critical thinking, self reflection, and taking action
- appreciate and seek out non-dominant perspectives

Teacher Responsibilities

- Get to know your students' confidence level, and what they are willing to risk in front of their peers.
- Build trust with your students, helping them learn to trust each other so that they do not feel at risk of embarrassment or criticism.
- Ensure students understand why you are asking them to step outside their comfort zone.
- Know your students' strengths and limitations, how to get the best work from them, by building their skills and developing their confidence.
- Become familiar with various dramatic forms and how to use them effectively for purposes of integrating them into the unit and theme.
- Provide structure to lessons when integrating drama into projects.
- Build time into lessons for student reflection on the activity.
- Provide students with choice within the dramatic activity.
- Provide varied opportunities for student leadership.

Forms of Drama

The Greek word *drama* was incorporated directly into English—it means *act*, *acting*, *business*, and "*an action represented on stage*." Many people have the impulse to re-enact life, to retell their stories and the stories of others—which might come from our natural need to give meaning and structure to our experiences. When we as teachers can connect our students to the experiences of figures past and present through dramatic activities, we can help them empathize with issues, and conflicts and understand their complexities, thereby making their learning personally relevant.

We have successfully integrated into content teaching many forms of drama:

- tableau
- physical theatre (mime)
- games
- choral speaking/reading
- readers' theatre
- puppetry (sock, stick, shadow)
- sketch/ scene
- role play

Among the numerous resources we have used in planning activities are *Improvisation: Learning Through Drama*, Booth 1990, 2005; *A Drama Approach to Reading Comprehension: Strategies and Activities for Classroom Teachers,* Kelner and Flynn, 2006; *Asking Better Questions*, Morgan and Saxton 2006; *Drama Worlds: A Framework for Process Drama*, O'Neil 1995; *Action Strategies for Deepening Comprehension*, Wilhelm 2002, 2008; *Building*

Plays: Simple Playbuilding Techniques at Work, Tarlington and Michaels, 1995. Teachers should feel free to adapt them to create their own learning sequences when planning lessons.

Linda and Leyton use dramatic techniques and action strategies including *tableaux vivants* [*Tableaux vivants* are "living pictures" of people motionless and silent in a scene evocative of a momentous situation.] to help students delve deeply into the lived experience of historical characters and events (Wilhelm 2002). Working in tableaux, students create both a visual and a visceral understanding of a pivotal moment in history—another pathway to learning and exploring. This technique takes the class beyond activities into deeper thinking and rich, personalized, and meaningful responses to the content. Tableaux are inductive and exploratory and require students to consider multiple perspectives and interpretations.

Tableaux

Tableaux can be a rehearsal technique used by theatre directors to engage actors in deconstructing physical action beyond what is already understood or assumed about a moment in time. Within a tableau, the director and actors play with that moment to emphasize particular emotions, relationships between self, others, and artifacts within the overarching theme. We have found that words alone cannot explain the meaning of a moment the same way that acting it out can. When Linda teaches a unit on the French Revolution she uses tableaux to engage students in the emotions of the time (e.g., various depictions of Marie Antoinette, Louis XVI, and Robespierre during the French Revolution).

Tableau can also be collaboratively created by a group as a form of cooperative learning used to communicate ideas and provoke critical thinking. The "actors" engage in a process of exploring, illuminating, and selecting from the content the compelling aspects to highlight. It could be teacher-guided to support aspects of the curriculum. Leyton and Linda have found great success with getting students to create tableaux and then record, journal, reflect, and draw on the experience. As they mentor the students in the technique, they help them develop skills for examining the situation from multiple perspectives. Using the gradual release of responsibility we engage our students in drama-related learning modalities and away from instruction and learning dominated by reading and writing. Students who are familiar with succeeding in school using only those modalities have to think differently. Those who learn hands-on, or through interpersonal and emotional means, or who are reflective and intuitive have a chance to shine. All students get an opportunity to access and develop these ways of knowing.

In essence, working on tableaux involves heightening aspects of a text and creating, inferring, and re-creating events in "pictures." We don't always know the layers of meaning within a moment until we stop that moment to explore possible relationships between the people and artifacts, and the

possible emotions, motivations, and outcomes. We ask questions like "*What would you do in this moment?*" "*What would you say in this moment?*" "*What might you be feeling in this moment?*" "*What do you think should happen next?*" Once students experience a physical connection to the content, we find their learning is more meaningful and deep.

The first building block for using tableau as an integrated teaching strategy is to build student confidence starting with parallel action. This entails having all students in class perform particular actions individually at the same time and as a whole class. Then move them into partner work, and finally small groups of four. Some students need support when working together, so we scaffold lessons as we go. Having an open space to work is also helpful, but we have done this work in regular, desk-filled classrooms. Give some thought to a control device: Linda uses her voice, but Leyton likes to use a drum—it's an individual choice.

Warm-up

1. Freeze Tag

Students move around an open space, and you appoint one student as "It." It tags students, when tagged, the students must "freeze" and remain in control until It has tagged all players. Appoint a new It, and continue the game. Linda usually debriefs the game by asking students to reflect on the nature of cooperation versus competition. (You might allow variations by suggesting how a tagged player can be "thawed." One caution: this could add a competitive feel to the game and counter act the purpose of building cooperation.)

2. Freeze / Act

The entire class moves around the space in a random manner (walking by changing direction and pace). The idea is for students to catch themselves in a very random and unique pose when Linda calls out the word "FREEZE." A different signal can be used as well (e.g. a drum, tambourine, classroom lights flashing). On the command, students freeze their position and then, on the next command "ACT," bring their position to life and act out what their position suggests to them, for example, an animal, object, or action the person is poised for.

This strategy develops the skill of reacting spontaneously to a stimulus and develops some confidence with each other. The activity can be varied, depending on the group, to allow for groups of student to "FREEZE" and then "ACT" in a scene or by the teacher being more exact in the commands.

Control

At first, students find it challenging to control their movement and their emotions, but by focusing on control, they develop skill and confidence and their tableau work is of a higher quality. Have the entire class move randomly around the space, and call out the following command sequence:

- *"Move around the room. Avoid eye contact and physical contact."* Be patient and coach them to remain in control: hands to themselves, no bumping into each other, avoiding collisions, remain neutral by not laughing, smiling, or talking.
- *"Move around the room. You can make eye contact"* (coach control and cooperation) *"Do not break focus and control"* Challenge them to control their emotions and their physical selves.
- *"Move around the room. You can nod and make eye contact and add a handshake. Still no words, control your laughter."*
- *"Repeat and add a verbal greeting to your handshakes and eye contact. Try greetings like 'Hello', 'Good day', 'Cheers', "What's up?"* Encourage them to be brief and pleasant.
- A final challenge is to add compliments (fun gushy words which push them to break concentration) to the verbal exchanges, or to add other verbal and non-verbal exchanges.

In our experience, students struggle to remain in control and positive toward each other, which provides opportunity for discussion or for reflection in journal writing. They need time to debrief the experience, to understand the physical and emotional skills involved, and to realize that by playing these games, they have been building relationships, skills and confidence in taking risks .

Sculptures in pairs

The premise of this activity is that students will "sculpt" their partner into a statue, first following teacher suggestions. One partner plays the role of the "sculptor"; the other is the "clay" taking shape by cooperating and following instructions. Partner work raises the level of difficulty for students and requires a greater level of trust between partners. It is important not to start pair work until students begin to experience success in performing the freeze/act sequences. Because pair work involves some physical contact, students need to feel safe, so it's best to allow them to adapt the sculpture activity to their own level of comfort. Linda suggests they could just use voice commands instead of touching. Leyton has students use imaginary puppet strings, that is, students don't touch each other but pull on the imaginary puppet strings demonstrating the desired actions. Linda always starts with what feels most safe for her students, then gradually adds more challenge. Teacher modelling is the key here—introduce gesturing, pointing, and modelling what you want as helpful techniques.

While students are working in pairs, instruct them to stay focused on controlling their emotions and remaining "in character."

- The sculptor manipulates clay into a statue position suggested by the teacher (e.g., a sports-related activity, an occupation, an emotional moment).
- Reverse the roles of clay and sculptor.

- Allow partners to create their own topic using concepts from the content units of study (e.g., mitosis, melting, landforms, king, lord, ratio, a poetic device). You might have pairs do so in parallel action, then share in small groups or for the entire class. Next, move from pairs to small groups for selecting and preparing the tableaux scenes they will represent—from suggestions from the "sculptor," the teacher, or from the unit content. Linda uses all of these stimuli depending on the situation and confidence level of the class. This is the beginning of tableau work.
- Move to slightly more complex concepts from the curriculum that require more layers and students (e.g., revolution, feudal system, double replacement reactions, succession, solving for x in a polynomial)

Statue Museum

The next step in the sequence activity brings students back to working on their own, then in pairs, and finally in groups of four, as they begin to add creative interpretations to their work.

Guided imagery

- Linda uses creative imagery as she leads a closed-eye activity, having her students imagine their journey through a museum from the entrance doors, sensing the floors, the lighting, the temperature, sounds, and smells to heighten attention to the senses.
- As they return to reality, show pictures of statues from actual museums (content- related or theme related). Then ask students to write or draw their reflections and images in their journal.

Creating museum statues

- Ask the students to imagine that the classroom has become a room in a museum, a room full of statues that are all variations on a theme, themes that start out concrete and move to abstract. They are to become the statues, and to use creative thinking as they assume a pose representing the characters or concepts you call out:

  the traveller, the opera singer, the scientist, the pop star fan or groupie, the artist, studying, shopping, eating, hunger, pain

- During the entire sequence, students engage silently in their pose, exhibiting the self-control they have been developing from previous activities. Linda counts down from 5 as students find the pose that best expresses the title. The countdown builds in student self-control.
- When they are ready to share their work, we split the class in half so that one half can demonstrate their poses while the other half watches and interprets. We have found that when students see others' statues, the level of their subsequent work deepens. Seeing a group all together provides perspective, but also reduces the students sense of risk and exposure.
- Eventually, we work toward solo sharing and performances.

Increasing complexity

- Repeat the sequence, this time in pairs with different titles, but still asking for silence. This helps students to react spontaneously and decreases self- and peer- censorship.
- We give more time during the count down (count back from 10) to assume a pose and freeze, and we encourage partners to lead and follow each other. They have to figure out how to fit in to, or relate to, each other's ideas without talking about or planning an image completely. For example, if one partner poses as a baseball player up to bat, their partner completes the picture. Some titles to consider are:

  at the dentist, the driving lesson, the first date, the proposal, the secret, the interview, the accident, the argument.

- Linda sometimes uses book, story, or poem titles, depending on the purpose of the lesson or the skill level of the class. Introducing a content-specific concept can focus students' thinking on key ideas in the unit.
- The next step is to form groups of four or more, depending again on the class. We challenge the students to work from silence. With these tableaux the goal is to refine the skills of control, cooperation, trust, and risk-taking. The titles are more suited to a group picture as opposed to pairs and the concept of interrelationship and dependence is emphasized to a greater degree. Some titles to consider:

  lunch in the cafeteria, visit to Grandma's, feeding the animals, math exam, the fishing trip.

- At this point, students will find it challenging to capture all their ideas in one tableau, so introduce the idea of multiple tableaux that "tell the story." This works well in science and math because concepts are progressive (cell reproduction, factoring, growth cycles, neutralization, changes in eco systems, algebraic patterns, etc).

Pulling it together

- The final step in this sequence comes when students are ready to create multiple tableaux to tell a simple story based on a title.
- Planning out the story requires discussion and time for trial and error (rehearsal). Linda introduces basic story elements or simple stories, picture books, or fairy tales to support students in creating original stories. Leyton show four successive imaged of a transformation process like the water cycle. Some classes need these samples first before they feel confident enough to create their own.
- We start by asking students to create a series of three tableaux. We use the formula "beginning, middle, end" or "before, during,

after" to help students pick dramatic moments from the unit's content. Possible titles:

the scene of an accident, the wedding, the trial, the bus ride, graduation, the market, the operation, the robbery.

Invite students to think carefully about how many tableaux they will need to effectively demonstrate their concept. The tableau sequence prepares students for tableau work as a pathway for learning and then can be used to connect curriculum in many areas.

Dance and Music as Pathways

Nicole began dancing at the age of 3, and her world was consumed with dance for many years. Nicole still experiences great joy to see how people of all ages enjoy dance and find ways to communicate thoughts and feelings in movement. Nicole believes that dance offers something for everyone as a way to express feelings and explore the creative process through shape, sound, texture, and rhythm.

Dance is a language in which the body does the talking; "the concepts that dancers translate into movement may be extremely complex, possibly beyond their capacity to express in spoken or written forms" (Newbald and Goodwin 2004, p. 105). Nicole knows how dance makes her feel, whether through performance or choreography for self and others. But it wasn't until doing professional reading that she felt that she could bring non-dancers into the conversation.

What is dance? Physical and Health Education Canada (2012) suggests "dance is a forum for collaboration…it is a site for deep learning for everyone." In the arts, we sometimes forget the social and communicative importance of the process and focus only on the performance. As a dancer, Nicole knows that dance requires teamwork and a common understanding of the message to be shared. Reflecting on dance as a teacher and learner, she now realizes that dance was always about feeling —her personal feelings and the feelings evoked in others. Yet dance is something that is rarely done alone. A collaborative piece involves making meaning together. We get ideas from inspirations, events, other dancers and share and question with audience members who watch us. In dance, deeper learning comes from within. Our personal feelings and interpretations deepen further through discussion with other dancers or audience members that help us to make connections and ask self-reflective questions.

Dils writes that "dance underscores the importance of bodily experience as an integrative agent in learning" (2007, p. 107). Bodily experience requires us to pay attention in new ways. It is important to address individual learners who need other ways to show their learning. The emphasis on using the body kinesthetically to show understanding is crucial and honours this way of learning as well as the needs and strengths of certain students.

Integrating dance into content area learning requires music and language (non-verbal and verbal). We work between these forms to enrich student learning. Newbald and Goodwin (2004) explain that "children need a foundation from which to develop their work…when setting out to respond or create through dance, teachers should aim to use other art forms to engage all the senses to assist children's understanding and guide their responses" (p. 107). We see dance as a natural way to provide learners with a new pathway to showing and sharing their understanding of a concept or issue. We believe this is wise practice. In this book, we stress the need to model experiences with all learners because we believe in the gradual release model of supporting students to become successful. As with literacy, adults should model and share experiences alongside the learners before expecting independent work to take place (Newbald and Goodwin 2004).

Dance as a tool provides students with opportunities to:

- appreciate the aesthetic inherent in dance
- develop critical-thinking skills through the creative process of dance
- communicate information, ideas, understanding, and emotions
- develop self-motivation and enhance self-esteem through participation
- appreciate the role of dance in society
- strive for physical well-being by developing our bodies
- develop qualities of cooperation and respect for diversity through a knowledge and understanding of dance in various cultures and time periods

British Columbia Ministry of Education, 2010. *Dance Curriculum*

Reading Tina Hong's *Developing Dance Literacy in the Postmodern: An Approach to Curriculum* (2000) excited Nicole as a passionate literacy teacher. She took Hong's ideas about dance literacy and compared and connected them to learning in English language arts (Figure 5.1).

Pink Day flash mob to Lady Gaga's "Born This Way"

On February 29, 2012, one hundred and sixty grades 6 and 7 students from Ferris Elementary School in Richmond, BC, performed to Lady Gaga's "Born This Way" to recognize and build awareness around the International Day of Pink. Students met together in the gym to rehearse and learn choreography for six 45-minute blocks. Nicole choreographed the piece so that a flash-mob surprised the rest of the students and staff at a school assembly. Performers used the lyrics and movement to portray their understanding of how to appreciate our differences.

It was an engaging way to help students make meaning, but it was also an example of how dance can be used to send important messages. Students were fully engaged and excited about portraying to the entire school their thoughts on acceptance through dance. Students could be seen at recess or lunch practising the steps and working on incorporating their own dance style. Nicole truly believes that the emotional and kinesthetic aspects of dance

Figure 5.1 The relationships between dance and English Language Arts

Speaking	**Listening**
• Discussion, collaboration, negotiation • Working as a member of a group (contributing to the discussion, hearing voices and opinions) • Recognizing and celebrating success through think-pair-share	• Listening and responding to others' ideas respectfully • Working as a member of a group by piggybacking off of others' ideas
Reading (Viewing & responding to the dance) (The performance)	**Writing (Choreographing the dance) (The creation)**
• Building background knowledge prior to the dance • Making connections from the dance to self, texts, and the world • Determining the importance of the movement piece • Asking questions about the dance • Inferring what the movement might mean • Synthesizing the performance	• Recognizing and celebrating success through exit slips or quick writes • **Meaning:** the dance is enhanced through communication and expression that is personally or socially important • **Style:** contributes a sense of images, ideas, and feelings that are personally and socially significant • **Form:** representing patterns and sequences in the dance and considering transitions between each • **Mechanics:** the technique of the dance steps as they are executed

will help students remember this event later in life—perhaps even more than if they were to explore the topic in more traditional ways and settings. The audience members were able to take away a powerful message from the dance; the experience took the audience beyond language and other barriers. The school's culturally and linguistically diverse students were able to read the dance movements and music in multiple ways. Nicole's work with 150 students in grades 5 to 7 to create the anti-bullying flash mob helped students understand what Pink Day was all about.

Slavery mini-musical (Classroom approach)

In 2004, Nicole taught a grade 5/6 class at Cook Elementary School in Richmond, BC. Many of the students had recently immigrated to Canada and needed support with language acquisition and building background knowledge. Nicole began to integrate the arts with language arts and social studies in her units and lessons. As a summative assessment for the unit of study on slavery, her students developed a mini-musical that showed how they could make connections and more deeply understand the injustices of slavery. Figure 5.2 shows the weekly lesson sequence of how the class collaborated to develop the musical with teacher support. Part 1 outlines the music taught. Part 2 describes how dance was incorporated. Part 3 describes the synthesis of the whole unit. Lessons from music and dance are described week by week.

Figure 5.2 Weekly lesson sequence *(or, "Three-part music and dance lesson sequence"? - title in chapter)*

<table>
<tr><th colspan="2">PART 1 – Music</th></tr>
<tr><td>Week 1</td><td>Building Background Knowledge through Sensory Images</td></tr>
<tr><td>Listening and Responding to "Kumbaya"

Materials:
• Four quadrants template
• Song on CD, "Kumbaya"</td><td>Lesson:
• Listen to the song "Kumbaya."
• Ask students to fill in their four quadrants (see Figure 6.2) while listening to the song more than once. Students should pay particular attention to the images, words, questions and feelings the song evokes.
• Ask students to share their four quadrants in small groups and decide on one image, word, and feeling that describes the song for your group.
• Share small group ideas in large group share and teacher records thoughts on to chart paper.</td></tr>
<tr><td>Week 2</td><td>Building an Understanding of Schema</td></tr>
<tr><td>Listening and Responding to "Jump Down Turn Around"

Materials:
• Four quadrants template
• Song on CD, "Jump Down Turn Around"</td><td>Lesson:
• Review the last lesson of "Kumbaya." Listen to the song again and ask students to quickly suggest images, words, questions, and feelings that the song evoked.
• Listen to the song "Jump Down Turn Around."
• Ask students to fill in their four quadrants while listening to the song more than once. Students should pay particular attention to the images, words, questions, and feelings the song evokes.
• Ask students to share their four quadrants in small groups and decide on one image, word, and feeling that describes the song for your group.
• Share small group ideas in large group share and teacher records thoughts on to chart paper.
• Begin learning the lyrics to "Kumbaya" and "Jump Down Turn Around"
(Note: Provide students the lyrics to all of the songs).</td></tr>
<tr><td>Week 3</td><td>Building an Understanding of Schema/Imagery</td></tr>
<tr><td>Learning to Sing New Songs

Materials:
• Lyrics to "Kumbaya"
• Lyrics to "Jump Down Turn Around"</td><td>Lesson:
• During this lesson, the students and teacher sang in various ways with both pieces of music to get used to the song. We tried practicing the songs in a variety of ways:
◦ In rounds
◦ With one person singing the first line then all join in at the second line
◦ Solos/Duos
• Learning the songs early on was important for the final mini musical</td></tr>
</table>

<table>
<tr><td>Week 4</td><td>Building Questioning Skills</td></tr>
<tr><td>Questioning the lyrics of a song

Materials:
• Music books with current lyrics to the songs practiced in class</td><td>Lesson:
• Ask the students to sing “Kumbaya” and then “Jump Down Turn Around.” While they are singing, ask them to listen for words and feelings that make a good song to capture the lives of the slaves.
• Some students may choose to record their thinking during singing while others may wish to record their thoughts after singing.
• Have a whole class discussion to get a feel for what students think makes a powerful song about the life of a slave. Record student thinking
Note: If there is time, allow students to create their own songs depicting what they think life for a slave would have been like. Remind them of the chart the class made together to guide them – think of it as class generated criteria.</td></tr>
<tr><td>Week 5 & 6</td><td>Building Questioning to Determine Importance</td></tr>
<tr><td colspan="2">During these two weeks, we spent time on practising the lyrics to “Swing Low, Sweet Chariot,” “Nobody Knows the Trouble I’ve Seen,” and “Plantation Boy.”

Students needed this much time to become comfortable with the lyrics, but they also needed the time to learn how to move with the rhythm of the music and show emotions to the lyrics of the song.</td></tr>
<tr><td colspan="2">PART 2 – Dance</td></tr>
<tr><td>Week 1</td><td>Building Background Knowledge through Movement</td></tr>
<tr><td>Listening and Responding to “Kumbaya” through movement

Materials:
• Four quadrants template completed from Music, Week 1: Lesson 1
• Song on CD, “Kumbaya”</td><td>Lesson:
• Listen to the song “Kumbaya.”
• Ask students to review their four quadrants in small groups and decide on one image, word, or feeling that describes the song for your group.
• Teacher models what image, word or feeling describes the song for her. For instance, for “someone’s crying Lord,” show students how you can move and cry by moving the body slowly across the floor with shoulders and head contracted over the chest; show that it’s okay to move your body at different heights, speeds, and patterns (ie. include turns).
• Students work in pairs to show one another their movements and they interpret them to the lyrics.
• Pairs can come together to share with one another.</td></tr>
<tr><td>Week 2</td><td>Building an Understanding of Schema through Movement</td></tr>
<tr><td>Listening and Responding to “Jump Down Turn Around”

Materials:
• Four quadrants template completed from Music, Week 2: Lesson 1
• Song on CD, “Jump Down Turn Around”</td><td>Lesson:
• Review the last lesson of “Kumbaya.” Listen to the song again and ask students to quickly show images, words, or feelings that the song evoked through movement.
• Listen to the song “Jump Down Turn Around” again and review four quadrants from last class.
• Teacher models what image, word or feeling describes the song for her. For instance, for “jump down turn around pick a bale of cotton,” model the action of jumping down to the ground, touch the floor, turn around while coming up to a half standing position to lean over and reach forward with the right hand as if ready to “pick a weed.”
• Students work in pairs to show one another their movements and how they interpret them to the lyrics.
• Pairs can come together to share with one another.</td></tr>
</table>

Week 3 & 4	Building an Understanding of Schema, Imagery through Movement, and Building Questioning Skills
Learning to freely move while showing emotion by questioning the lyrics of the songs **Materials:** • Lyrics to "Kumbaya" • Lyrics to "Jump Down Turn Around"	**Lesson:** Return to the words and feelings list that make a good song to capture the lives of the slaves. This comes from Music, Week 3: Lesson 1. Begin to model emotions to the class through facial expressions combined with body movement (sad, tired, angry, hurt, lost, worried, ashamed, surprised…) using instrumental music that evokes the particular emotions. The teacher may wish to model what this looks like for her, one emotion at a time, so that students can have a chance to explore and discover what that might look like for them Continue exploring this idea of showing emotions in pairs and allow time for pairs to share with other groups to get feedback or to "borrow" movement ideas
Week 5	**Building Questioning to Determine Importance**
During this week, we spent time practising movement to "Swing Low, Sweet Chariot," "Nobody Knows the Trouble I've Seen," and "Plantation Boy." Students needed this time to become comfortable with the meaning behind the lyrics as well as to become familiar with the speed of the music. We also allowed for time to learn how to move with the rhythm of the music and continue to show emotions to the lyrics of the song. A continuation of the previous weeks' lessons to take place, but with new songs.	
PART 3	
Week 6 & 7	**Synthesis to Tying It All Together**

Together we planned the format of the mini production together. Nicole began by asking students to brainstorm scenes that they thought should be included in the musical.
• On chart paper, Nicole wrote all of the ideas down
• Together we categorized the ideas into big ideas to help us create scenes
• In the end, our plan looked like this (with consideration of the songs we already knew):
  ◦ Scene 1: Opening, "Nobody Knows the Trouble I've Seen" (solo)
  ◦ Scene 2: Cotton fields "Jump Down Turn Around" (all; scenery & props)
  ◦ Scene 3: Slave quarters "Kumbaya" (solo and all; scenery)
  ◦ Scene 4: Escape to Canada (no music just drama; forest scenery)
  ◦ Scene 5: Freedom "Plantation Boy" (all; props)
Note: Props and scenery were done during Art class. Small groups worked together to create the scenery. Groups signed up for what they were interesting in pursuing.
Rehearsal: We rehearsed the whole thing without costumes about 5 times. It was truly amazing to see how students used their emotions and body to move to the music. You could tell that they really embraced the thoughts and feelings of slaves and what injustices they felt.
Nicole videotaped the performance. The class celebrated by watching the video together.	

Sometimes movement and feeling precede words and it is important for students to have a chance to work together in other forms and languages. The musical was a chance for students to use music and movement—exploring and representing the big ideas and their response to what they learned in their unit of study.

Figure 5.3 Four Quadrant template to describe response to "Kumbaya"

Name:_____ Date:_____ Title: _____	
What I See…	What I hear…
What I wonder…	What I feel…

Within both examples, music also offered a rich collection of practices and modalities to make meaning, to explore and challenge their own and others' perspectives, and to represent their new understandings. Just like drama and dance, music can deepen students' perceptions of themselves, the world around them, and the knowledge they are acquiring. Participating in and creating music, drama, dance, and art together enhances their sense of belonging in their classroom community.

Visual Arts

As a child, Karen [insert surname] played with clay dug from her garden. In elementary school, she struggled a great deal with most of her academic classes. But in secondary school, her art teacher allowed her the freedom to pursue art in a variety of media, and she began to experience feelings of success. As Karen became more confident, the many positive results of her art spilled over into her other areas of learning. Opportunities to become involved in different forms of art provide some students with alternative means to succeed.

The following quote from Einstein illustrates one of Karen's firm beliefs:

> "Not everything that counts can be counted, and not everything that can be counted counts."

Karen believes that integrating the arts provides opportunities for students to strengthen their confidence, engagement, and achievement—traits, attitudes, and emotions that cannot be easily measured but are essential in the pursuit of a meaningful and relevant education. Currently, Karen is teaching at Parkland Middle School in Cranbrook, BC, where she has an opportunity to work with students from different grades and collaborating with teachers outside of middle school.

Cross-Curricular Unit: Using clay to enhance the study of Japan

Topic: Sushi dishes and traditional ceremonial tea-bowls

Lesson Objective: Students will study the lifestyles of the Japanese people. Students will become familiar with the customs associated with the tea ceremony, and with the history of Japanese culture. Students should have an opportunity to celebrate by making sushi and having a traditional tea ceremony in their classroom.

The lessons in this unit address different cultures and their beliefs and values about integrating the arts into student learning. On countless occasions, educators have noted that incorporating the arts in a unit of study increases the level of a student's self-confidence and engagement. For some, art has helped them understand a concept more in-depth. Yet, for others, working with art has offered an opportunity to become completely engaged in one's learning because they had an enriched learning experience. The key focus here is cross-content learning with clay.

Teacher responsibilities

Be prepared. The opportunities and experiences for the students will be intensified, strengthened and much more positive when all the materials are easily available and there is a clear lesson objective and direction. Let the students know what the project is, and what the desired outcomes are and invite students to ask questions related to the new project early on and throughout.

Teacher collaboration

When team-teaching, set aside time for a meeting to clarify goals of the project. Address each teacher's responsibilities and which responsibilities the teachers will share. Tentatively schedule the start and end dates, however, do consider and allow for shifting of the scheduled dates to take place.

Materials

- paint brushes, sponges, wooden knives, plastic knives and forks, pin tools, pencil crayons, pens, scissors, small containers
- paper for designing the work (photocopy discards; recycle when you can)
- plastic bags (from grocery shopping, dry cleaners)
- card stock for templates (e.g., old file folders)

- 1 box of clay (e.g., 20 kg to 25 kg per box; keep extra box available, just in case)
- several sheets of 3-in. foam (approximately 16 in. x 20 in.). The foam makes a great surface to work on and allows the dishes to be shaped easily. Have several "foam stations" set up although students use the foam sheet for about 5 min.
- glaze (4 to 8 colours)
- boards cut to approximately 9 in. x 12 in. (22 cm x 28 cm) Note: Pieces of cardboard or mat board (picture framing) might save cost or time. Check with galleries or framers for leftover pieces.

Make the sushi dishes on a bed of plastic so that the work can be slid (with care) onto the board. This will lessen the chances of the dish warping.

Suggestion: This lesson outline is best suited for the study of Japan in connection with Social Studies at the grade 6, 7, and 8 level. Yet, it is not limited to this grade range or subject area. This lesson idea can be modified to include various other grades and/or subject areas. Think of it in connection with a food science class or a study on culture, race, or heritage.

Summary: Students have an enhanced learning opportunity to explore and "experience" both the ancient and modern culture of Japan through the medium of clay. Student planning, reflecting, and evaluating are all important steps in art-integrated activities (Figure 5.4).

Lesson 1: Japanese customs

Through discussion, address the study of the Japanese culture. Introduce the project to the students. Let them know they will have an opportunity to create a sushi dish and a ceremonial tea bowl from clay.

Allow time for research, on both ancient and modern Japanese culture. Include a mini report on the culture (both ancient and modern) to ensure student accountability with respect to the research portion of the project.

Lesson 2: Research continues

Invite students to focus on tea ceremonies. Invite them to discover and discuss the difference between summer and winter tea-bowls. Have the students plan the type of pinch-pot tea-bowl they would like to make by making a mini sketch. Also have students investigate and obtain information about sushi and sushi dishes.

Lesson 3: Introduce examples and demonstrations of the work

If student exemplars are not available, search the Internet for images of tea-bowls and sushi dishes. Allow approximately one hour to complete demonstrations of the tea-bowls and dish sets. Use the remaining class time to research design ideas or a Japanese symbol to use later as part of the design on the sushi dish.

Figure 5.4 Student planning sheet for a cultural study of Japan

Name: _____ Date: _____

1. Something I learned from the student exemplars and teacher demonstration.

   _____

   _____

2. What were some ideas that interested you? Complete three mini-sketches.
   This is just a starting point!

3. The idea I am most interested in doing for the sushi dish set is sketched below!

   Include dish, wasabi dish, chop stick rest, tea-bowl – OTHER?

4. Three or more steps I will need to follow to achieve my goal:

   _____

   _____

   _____

5. Things I may need to remember:

   _____

   _____

   _____

6. Things I will need to bring from home:

   _____

   _____

   _____

Lesson 4: Planning and making templates

Review the steps necessary for a successful project. Have students complete a plan and pattern for their sushi dish set; they should include a sketch of their planned tea-bowl. However, the tea-bowl might change as the clay is molded and formed with the fingers and thumb. Organize the items the students will need for the projects. Have students review their planning sheet. They may need to bring items from home to complete their plans (Figure 5.4).

Lesson 5: Creating the tableware

I recommend several classes, back-to-back, for this stage. Have the students make the tea-bowls during the first session using their plan. Otherwise, have the students create their tea-bowls during the first class, and the sushi dish in the second class.

To make the ceremonial tea bowls use a ball of clay slightly larger than a golf ball, but not as large as a tennis ball. The ball of clay should fit comfortably in the palm of the hand. The clay can be gently pinched and turned until the tea-bowl is formed. The shape of the tea-bowls may vary. If student plans a square tea-bowl, follow the process for making a round pinch-pot and then use a wooden paddle to alter the shape.

With all items and clay ready, approximately 50 minutes to one hour (including setting up and clean-up) should be adequate for students to build beautiful tea-bowls. Remind the students to be gentle and gradual with the shaping of the clay for the tea-bowl. Gradual and gentle pinching and turning of the clay will produce better results. If students work the clay too harshly, it may crack. If the clay shows any sign of cracking, have the student blend in one drop of water at a time. Too much water in the clay can cause a problem; but so can not enough water.

Note: When students' hands become hot, have them cool their hands under cold running water. Hot hands tend to draw the moisture from the clay too quickly, which can cause cracking. Before students set their tea-bowls set aside to dry, ensure they mark their work with initials or another identifying mark.

Time-saver: Have the slabs of clay rolled out ahead, perhaps inviting parent helpers. The average size of sushi dishes may range between 5-in. x 5-in or 6-in. x 6-in. for a square set and 5-in x 6-in. or 5 in. x 7 in. or 4 in. x 8 in. for a rectangular dish set. Dishes shaped as a leaf, fish, flower or other organic item should also fall into these size ranges. Of course, a smaller dish for the wasabi (a condiment made from a root plant) can be made much smaller and from scraps of the clay.

Lesson 6: Making the tableware

Once the tea-bowls are made have the students proceed with their sushi dish set. Remind them they may want to include a chopstick rest or a separate wasabi dish. The time for making the sushi dish may be between one and a half and two hours. Yet, some students who are particular about detail will likely require a little longer to follow up on the detail.

Lesson 7: Creative and descriptive writing and research on Japan

During the final lesson, share information about Japan. Since drying time for the clay pieces is required, the students can continue their research on Japan.

Lesson 8: Glazing the tableware

Unlike the shaping of the pieces (which should be completed in a day or two at the most), the glazing stage can take place over two or more periods. However, allow between one and a half to two hours to glaze the pottery. If applying glaze by brush, ensure complete coverage by having the students use 3 or 4 coats. If you plan to dip the items in the glaze, have the students wax the bottoms of each piece first.

Lesson 9: Presentation and celebration

Students present their findings about the Japanese culture. The class could hold a traditional tea ceremony, prepare or purchase sushi to serve on the newly created sushi dish sets.

Pulling It All Together

Self-reflection and assessment involves students judging their individual work and progress. Their judgment (reflection) and evaluation (self-assessment) are based on the specific set of criteria set out at the beginning of the assignment. Self-evaluation leads to improved student learning in assignments and project work in subsequent units of study and future grades. Self-assessment helps students understand the main purposes of their learning and thereby grasp what they need to do to achieve (Black and Wiliam 1998). This stage of student reflection and evaluation helps them connect to the important concept of "becoming better learners." (Figure 5.5)

Service learning connection

This project can also completed with a connection to personal planning curriculum. One class of Karen's students made a number of sushi dish sets, which were then sold through the school and through a local (and very popular) sushi bar. They raised approximately $500 which they donated to two local charitable agencies in the community. Teachers can vary the connection to education and the curriculum to learn about and address a social issue in the community.

Conclusion

Learning through the arts engages our students. We learn to tap into our senses; we think with our bodies. Integrating the arts into our teaching fosters student creativity, helps students to take risks, and deepens their understanding of important concepts. Perhaps most powerfully, the arts reinforce and extend community. We begin to see and understand how many ways there are to explore, contribute, and learn when we work in new expressive and creative ways.

Figure 5.5 Student Reflection and Evaluation Sheet

Name: _____ Date: _____

Sushi Dish Ticket

Please complete the following to the best of your ability.

1. What did you find important about making the sushi dishes?

   _____

   _____

2. How did this opportunity enhance your learning with respect to understanding more about the Japanese culture? Explain.

   _____

   _____

3. What did you enjoy about making the tea-bowls and sushi dish sets?

   _____

   _____

4. What difficulties did you encounter when you were working with the clay? Explain.

   _____

   _____

5. Did you understand the explanations and class demonstrations?

   _____

   _____

6. What else could have been done to have helped you be more successful or to have helped you learn better? Explain.

   _____

   _____

7. Please include any other relevant comments, questions (concerns) about the project. Such as: What worked for you? What DID NOT WORK, Why?

   _____

   _____

8. Finally use this rubric to assess your project(s).

	4 **You did better than your PLANS! Powerful use of techniques**	**3** **Pretty special results! You can be proud of your work.**	**2.5** **Solid effort, with room to grow.**	**2** **On your way. You have some room to improve.**	**1** **Good start More planning, and effort will help.**
DETAIL on all pieces included in the set!	Details are easily viewed. PLANNING and care evident.	Project details work together well. Pieces are attractive and functional.	Most details are successful. Some areas need improvement.	Results of details not strong or not effective. More effort overall required.	Results not complete, strong or effective. Room to improve.
ATTRACTIVE and positive results on all pieces. Glazing results too!	The project shows the student was focused and concerned with details The work is NEAT (pride). Construction is strong effective!	The dish set shows the creator took pride in the project. The design & construction look planned and executed well.	Designing and assembling the dish set was completed, yet flaws are evident (bumps, uneven work, poor joins). More care was required.	The dish set looks rushed and/or thrown together. Little thought, planning or care evident. Much more effort over all was required.	The project looks rushed and/or is incomplete. Messy or careless work is apparent. More work and effort over all was required.
CREATIVITY of the tea-bowl and dish set.	Very original thought was used to create the project.	Some original ideas & some borrowed ideas were used.	Creative aspects noted.	Little individuality or creativity shines through in the final results.	Lacks creativity. None of the pieces stand out as being creative.
Classroom Growth Work ethic and contribution to the classroom community	Class time used wisely. Effort & strong focus evident. Helpful and cooperative! "Classroom community minded."	Time was used wisely and carefully. Clean-up help was also good Willingness to wait, share, and help was very evident.	Some time was used wisely; some was wasted. Clean-up effort was minimal. More effort overall.	More focus and effort overall in use of time, effort, and cooperative working required.	Much more focus and effort required overall in use of time, effort, and contribution to a "community". More focus on cooperative work required.

9. My OVERALL RATING for my SUSHI DISH SET is _____

because _____

Chapter 6

Creating Pathways Using Inquiry and Project-Based Learning

[New feature Playbill – to come for chapter opening on recto]

It may be hard to believe, but even today, we can walk into a classroom and see students sitting in desks in rows, listening to teacher presentations, answering the same questions, in the same way, at the same time. Where is the engagement, the critical thinking, the creativity? How can we break through this out-of-date approach to teaching and learning? Our answer is—through inquiry and active project-based learning (PBL). We want our students to be actively posing questions, planning projects, and drawing upon prior and new knowledge to explore concepts and issues. We want our students to be generating new and personalized perspectives and plans of action. Ultimately, we want them to take action and to make a difference in the world around them. It can all start from a wondering mind. Inquiry can spark curiosity, deep learning, and advocacy. Through inquiry, we can help students learn to think critically and creatively.

Project-Based Learning

We asked Matt Rosati, who has been thinking about and exploring project-based learning for years, to share his wisdom and experience. He co-authored the opening section of this chapter.

Learning through projects is certainly not new—teachers have always used projects to engage learners and create more authentic learning experiences. However, we now have more research on PBL, and that research recognizes it as a very powerful method for teaching and learning. Matt's initial foray into PBL was prompted by his concern about the power dynamics in his classroom. Simply put, he no longer wanted to coerce students into engaging with the curriculum; he felt there had to be a better way, something that was more natural and authentic.

He knew that *his* learning and understanding are products of his experience, and believed that the same must be true for his students. Matt initially struggled to find strategies that he could implement in his teaching to allow his students to demonstrate their learning in their own way—their "constructs of knowing." He now points out that the most important contribution project-based learning has, as a teaching and learning approach, is that it invites and encourages students to demonstrate their learning in ways that they understand and are comfortable with but that also requires them to go outside their comfort zone.

Project-Based Learning and Inquiry Learning

Although project-based learning isn't an all-or-nothing approach, teachers can use it with their students in any content area. The key is to provide appropriate instruction in the skills of inquiry and guide students in personal development of those skills through inquiry projects. For example, the teacher must teach the skill of time management before expecting students to learn and do it on their own. Teaching using PBL can take longer than traditional methods, but the rewards for students are immense.

- The power dynamics in classroom communities can be crucially important to student success. We want them to take control of their own learning gradually, and PBL allows students to acquire some power over what and how they learn.
- Learners engage in solving meaningful questions about real-world problems led by their natural curiosity. The projects also offer choices so that students can follow their own passions and interests to greater or lesser degree.
- In a group, the students exercise and further develop their abilities in collaborative problem solving and critical thinking skills—making decisions about what they will learn, how they will learn it, and how they will demonstrate their learning in the assessment. Doing their research, the students have to make critical decisions about the merit and relative value of the ideas and content in the texts and other resources they use—which makes PBL the perfect framework for 21st-century teaching.

Implementation of PBL and Inquiry Learning

Many teachers worry about how the day-to-day activities will play out, and about how it will all come together. But it is important to allow the projects to progress naturally, to be led by the wonderings and connections that students bring to the collaboration. The role of the teacher is in no way reduced; rather, within this framework, the teacher must adopt a more responsive approach. Teachers can plan major topics, how to bridge between them, what skills might have to be strengthened in order to deal with the next challenge, but how and when such teachable moments present themselves comes from the students.

In Matt's experience, mapping out the skills and content that he wants the students to encounter and use is very important. Matt peruses curriculum outcomes, mapping out the topics that relate to the enduring understandings or essential questions for particular units of study. From that map, he focuses on what content should be covered, how much has to be presented by direct instruction—the things that students may not know they need to know; what skills the students need to use or strengthen; what activities will engage the class in using their skills to investigate and understand the content; and what kind of assessment, both formative and summative, will best reveal what the students have learned.

His planning template (Figure 6.1) is anchored in curriculum outcomes, but also offers the flexibility needed when introducing PBL. Some students might ask for more structure because they are not used to following their own path, but over time they become comfortable directing their own learning. PBL's open-ended structure allows for a great many possibilities and for the students to make their own meaning.

The projects start with one or more questions that are essential for exploring the curriculum topics. Developing essential questions is a skill that

Figure 6.1 Template for curriculum mapping

Template for Curriculum Mapping

	Subject/Course/Unit
Essential Questions and Enduring Understandings (What content is worthy of understanding? What *enduring* understandings are desired?)	
Content (What facts, concepts, principles are most important to know and understand?)	
Skills (What processes, procedures, strategies should we implement?)	
Activities (What activities will equip students with the needed knowledge and skills?)	
Explicit Teaching (What will need to be taught and coached? How should it best be taught, in light of performance goals?)	
Assessment (How will we know if students have achieved the desired results? What will we accept as evidence of student understanding and proficiency?)	
Resources (What materials and resources are best suited to accomplish these goals?)	

becomes easier the more you do it. Essential questions should relate to the human condition, be open-ended, and be subject to debate and research; for example: *How do our prejudices affect us? What happens when ideas are more important than people? How do our environments shape us? How are statistics used to influence society?*

Teachers can conduct PBL in many different ways—there is no *one* way. The key to PBL is not the exact process but the recognition that students are making their own meaning and constructing their own learning out of the curriculum content—and they have choice in what to learn, how to learn it, and how to demonstrate their learning.

Matt devises a focus question to present to his students as the inquiry that will shape the project they will work on with his help. As a class, the students discuss what the question means and how it can be interpreted, sharing some examples. He then asks the students to develop their own focus question from the overall theme. For example, if his focus question is "How do our environments shape us?" he encourages his students to develop their own question about "environment." Students need lots of help with this process, especially in the beginning. It's advisable to have some general questions available to adapt, modify, or use. Students who are new to this very different way of teaching and learning will need some time and support to become comfortable and trust that these methods will be beneficial to them. In this situation, it's best to introduce PBL first as a class project (co-inquiry), then follow up with individual student inquiry projects on related topics.

Teachers should direct and model aspects of the class project, demonstrating (and teaching, as needed) the skills, abilities, and content mastery that they expect students to use in their individual projects. Ensure that the students are also learning and applying all the elements set out in the curriculum map for the unit of study. This method also has an effect on creating genuine, student-based content that merges with the teacher's required content. When the students are engaged in their own projects, everyone generates content and examples. The teacher is no longer the sole supplier of topics; everyone's work has the potential to influence everyone else's work and ideas. It's very powerful and very exciting to see in action.

As PBL starts to take shape in your learning community, there are a few things to keep in mind.

- Find out initially through assessment for learning what the students already know about the topic, skills, or content. In PBL everyone, teacher included, is both a learner and a teacher—there may be experts about particular topics sitting in your class.
- Make the first few assignments or activities easily accessible and always open-ended. Plans should have entry points that allow all students in the class to participate and have some connection to the topic. Suggest that students take a picture or draw or write about their current understanding of the topic.

- Do formative assessment in the moment. Use the abilities in the room to give students examples of your expectations. If Matt's students are writing an inquiry question or statement of topic to be researched, he circulates and reads as they are writing. When he sees a model example, he stops the class, shares that student's work, and asks the class to reflect on what makes this example a strong one.
- Keep student reflection a part of every class. PBL works best when metacognition is embedded within it. Have the students reflect often about what they're doing, why they are doing it, how they could do it better, what they want to know next, and the steps of the process in which they are engaged.
- Teachers should constantly be modelling the skills and abilities being used and developed during the class project, so that the students will know how to apply them to their individual projects.
- Ask students often who their audience is and how they might demonstrate what they are learning.

Lessons in Decoding Texts and Constructing Meaning

The following is a sequence of lessons Matt uses with his students to support them in their inquiry learning.

Lesson 1 — Introduce the Focus Question

In this example, the focus question is an essential question for the unit. The focus question is the most important piece for both the class project and individual projects. It provides an important guide as the projects become complex and, possibly, chaotic. Introduce the focus question to the class: "How do our prejudices affect us?"

Facilitate a class discussion (whole group or small group with reporting out) about possible answers and examples based on their experience and understanding of the question. As part of respectful teaching, every serious attempt to address the question must be accepted as a legitimate example of what a student knows or understands.

Scaffold for support

Teachers may also choose, depending on their students, to structure more of a discussion. A possible prompt could be:

> *Tell about a time that you decided something about a person or situation you just encountered. As you got to know the person or the situation better, was your initial decision right or wrong?*

This is also a great opportunity to introduce skills and content from your curriculum map.

Practise skills, focusing on outcomes

To include descriptive writing in this unit, ask the students to write a descriptive paragraph about the situation in the above prompt, which also provides practice in critical thinking and metacognition.

Lesson 2—Decoding Text

Set the stage for a shared learning experience in which all students feel their contributions are meaningful and that they matter. This activity introduces the activities cycle of "teacher introduces and demonstrates; students practise skills."

Choose a text to read together

As a class, read your first text together. Matt recommends children's literature regardless of the age group. It can be read in a relatively short amount of time and the text features are easily identifiable. Some examples are *The Sneeches* (Seuss), *The Island* (Greder), *Sister Anne's Hands* (Loribecki), or *Voices in the Park* (Brown).

Invite students to summarize understanding

From the text, as a class, choose the most powerful image. Then, ask students, in small groups, to address the focus question in relation to the image. As in this example, curriculum content is offered and used as opportunities to apply or practise the learning skills

Read the book pausing every few pages to ask what students are learning that is related to the focus question.

After the book is read, ask students how the whole book related to the focus question, and what other books, experiences, and current or past events also relate to the book and the focus question.

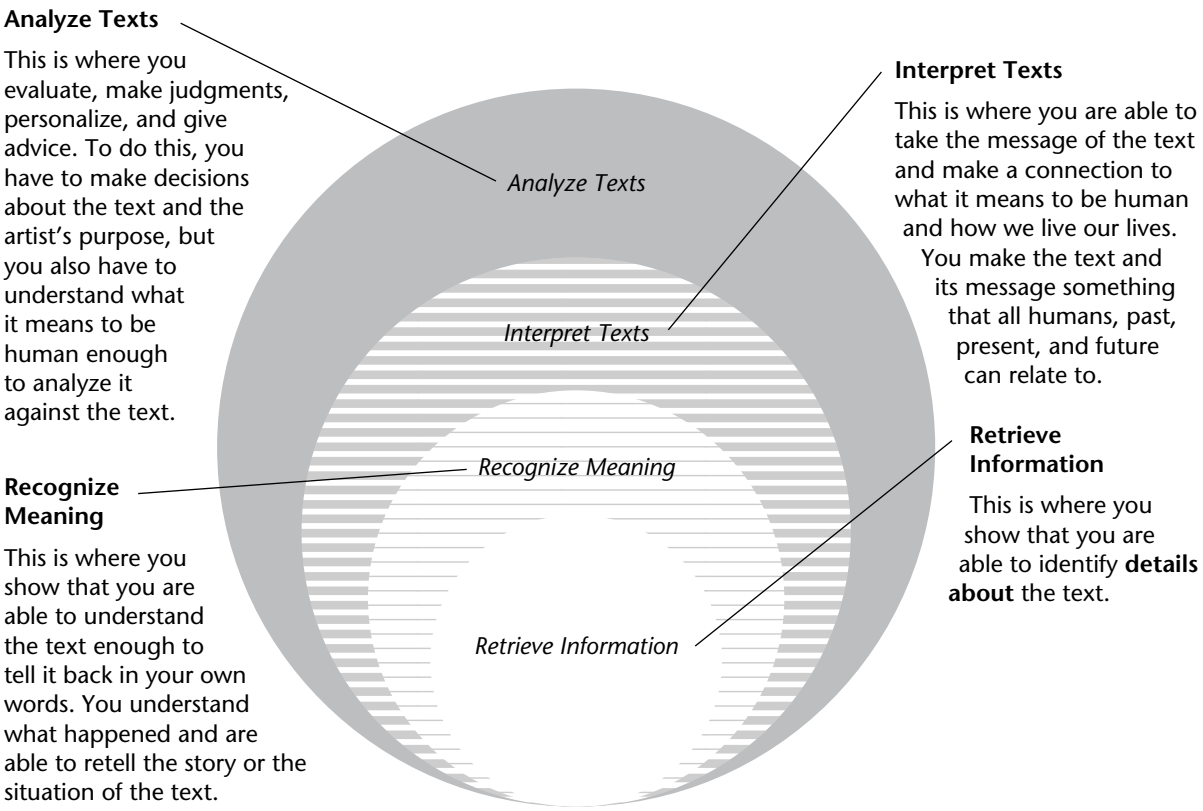
Lesson 3—Set Targets for Reading Comprehension

The class project is a model or a standard toward which each student should strive. Teacher feedback and student self-assessment and reflection are crucial because they let students know where their efforts stand and how they can improve. Still using the story image that the class agreed upon, introduce the reading handout (Figure 6.2). Introduce and discuss the terms "Retrieve information" (remember), "Recognize meaning "(understand), "Interpret texts," and "Analyze texts." With the class, apply these four skills to the image. With students in pairs or trios, have them pick one of the skills and use it with the picture. Have students share out their responses.

Have some additional images ready on which students can use these skills. The more diversity in the images the better. Give each pair or trio their image, a transparency (overhead) sheet, and a fine-tipped erasable pen. Have them choose one of the reading skills to write their responses on the transparency. Students can put the transparency sheet over top of the image.

After 5 or so minutes, have them trade pens with another group to get another colour pen. Then have students choose another of the reading skills and use the new coloured pen to write, diagram, or jot down their responses.

Figure 6.2 Categories of reading skills



Practise formative assessment

Find examples from pairs or trios whose responses demonstrate the skill they were using and share those examples with the rest of the class, using an overhead projector or document camera. Using a metacognitive approach, ask the students what is good about the exemplar, how it compares to their attempt, what is needed to improve. Allow the students time to reflect on their work and set goals.

Use authentic and meaningful exemplars to set goals

Initially, what the class produces might not be the very best examples, but by choosing exemplars from within the learning community and sharing them in the moment of doing, a teacher gives students more immediate and authentic feedback that makes the goal of being a model become approachable for all.

Lesson 4—Transfer Skills to Personal Projects

Students are developing the skills necessary to engage in a project based on their own question.

This lesson leads students to expand and incorporate ideas and skills into their own projects while still learning important expectations from the class project. Ask students to locate and bring an image of prejudice, as they understand and interpret it, to class. Be prepared for lots of different ideas and explanations.

Gradual release of responsibility

Students will be able to speak as an authority on their own ideas and understandings. Teachers may also notice, and can certainly point out or expand upon, some powerful cross-curricular connections from what the students have chosen. Lesson 4 can be about practising the reading skills developed in the previous lesson and gradually releasing more responsibility to the students. Organize students in small groups of three. One student is the interviewer, one is the interviewee, and one is the recorder. The students will rotate roles.

To start the lesson ask the students to generate examples of effective questions to ask their peers in an interview about their image. Once there is a sufficient diversity of sample questions recorded on the board at the front of the class, it's time for the interviews to begin. Sample questions may include *"Why did you select this image"" "How does it relate to the focus questions?" "What does it remind you of" "What do you wonder about the image."*

The interviewer interviews the interviewee for approximately four minutes about their image. The recorder takes notes. The interviewer has to keep the interview flowing by asking follow-up questions.

After all three interviews have been completed, ask students to look for commonalities in all three interviews. This is an excellent opportunity to reinforce how to work with information to find confirming evidence of an idea or theme. Trios then meet with another trio to share and compare what they have learned. Ask groups of six to share out their common themes and two of the groups' images that they believe communicate these ideas.

At the end of the class, have students reflect on (1) what makes for an effective interview, (2) what their personal strength and stretch was as interviewer, recorder, and interviewee, and (3) a burning question they have about the prejudice and how it affects us.

Future Lessons: Self-Assessment of Applied Knowledge and Skill

The next steps in this PBL process involve allowing students the time, space, and freedom to develop their own understandings within the context of the classroom models and exemplars. More model texts can be introduced or sets of texts related to the focus question. Students use these texts collaboratively to develop their knowledge and understandings related to the topic. These are the skills that students will apply to their own projects. The teacher makes it

clear that the expectations established in the group project should be applied to each student's project.

Next steps

- In a co-inquiry or individual inquiry, as work on projects continues, the methodology should remain consistent:
  1. The teacher introduces new skills or content (from the curriculum map) to apply to the project as a modelling activity.
  2. The students respond and practise, then demonstrate their skill with the content in their own project.

  Remember that teaching and lessons now occur in the context of student learning and teachable moments and opportunities, so teachers need the flexibility of a strong curriculum map that provides choice from a variety of lessons and topics that fit overall unit goals.
- Community is a crucial component of PBL. Start building community early and keep building it throughout the year. It can take the form of ice-breaker activities, or even just working with and supporting each other. This method of PBL relies a lot on shared understandings and meanings. If all the projects share a theme, every student's project and every student's understanding have the potential to fuel every other student's project and understandings. Students must trust and feel a sense of belonging to achieve the ideal cooperative environment.

At the end of the unit, consider having the students present their projects as a culminating activity. Because the projects have been constructed together, presentations should be considered a celebration of the new learnings and understandings that each student has made. For this summative assessment, teacher and students can work together to develop a rubric with clear, student-friendly, descriptive language that helps the teacher give helpful feedback about what each student has achieved (Figure 6.3).

Inquiry-Based Research

Marna Macmillan, a Humanities 8 teacher, and Jacquie Moniot, teacher librarian, who teach in a grades 6 to 8 middle school in Coquitlam, collaborated on many student research projects for over twelve years. Grade 8 students are at a perfect age, developmentally, to question the world around them, take on contentious issues, and argue for what they believe to be right. Marna was struck by the curiosity and engagement her students had when discussing current news events, issues from a global perspective, or issues connected to their personal lives. She wanted to create a classroom culture that invited that kind of energy and discussion on a daily basis, providing an opportunity for students to explore important issues and events through personal investigation and connection.

Figure 6.3 Sample rubric for summative assessment of student projects

Aspect	Not Yet Within Expectations 1	Approaching Expectations 2	Fully Meets Expectations 3	Exceeds Expectations 4
Focus Question	Did not fulfill the project's proposal; unclear thesis; information included does not seem to support the thesis; sources not credited.	Minimally fulfilled the project's proposal; some information is not clearly connected to the thesis; credit for sources not complete.	Adequately fulfilled the project's proposal; sufficient information that relates to the thesis; many good points made but there is an uneven balance and little variation; credited sources.	Completely fulfilled the project's proposal; an abundance of material clearly related to the thesis; points are clearly made and all evidence supports thesis; varied use of materials; credited sources.
Research Skills and Time Management	Time not used well; used few or no resources; little evidence or examples; spent little time preparing.	Time could have been used more efficiently; used minimal resources; used little evidence and examples; minimal preparation time.	Managed time well; used several reliable primary sources; used several reliable secondary sources; used appropriate evidence and examples; used preparation time well.	Managed time very well; appropriate primary sources; used many reliable appropriate secondary sources; used appropriate evidence and examples; used preparation time to go beyond basic research.
Creativity	Repetitive with little or no variety; insufficient use of multimedia; few connections; no personal interests	Little or no variation; material presented with little originality or interpretation; few connections; few personal interests	Originality apparent; good variety and blending of materials and media; makes connections; taps into personal interests/passions	Very original presentation of material; uses the unexpected to full advantage; captures audience's attention; makes connections; taps into personal interests/passions
Visual Elements of the Project	Produced a product that is disorganized, and difficult to see and understand; produced a product not related to the purpose of the project; exhibited little effort; little or imbalance of multimedia	Produced a product that is somewhat interesting but difficult to see; somewhat supported the purpose of the product; minimally supported the main idea; exhibited a fair effort; multimedia not clearly connected	Produced a product that is interesting and easy to see and understand; supported the purpose of the project; communicated main ideas; exhibited excellent effort; use of multimedia not as well connected	Produced a product that is creative, interesting, and easy to see and understand; supported the purpose of the project; fully communicated main ideas; exhibited outstanding effort; balanced use of multimedia materials
Coherence and Organization	Presentation is choppy and disjointed; does not flow; development of thesis is vague; no apparent logical order of presentation	Concepts and ideas are loosely connected; lacks clear transitions; flow and organization are choppy	Most information presented in a logical sequence; generally very well organized but better transitions from idea to idea and medium to medium are needed	Thesis is clearly stated and developed; specific examples are appropriate and clearly develop thesis; conclusion is clear; shows control; flows together well; good transitions; succinct but not choppy; well organized

Marna's collaborations with Jacquie on the research process made it clear how important "questions that matter" are in motivating students to search for answers, Many of the articles, novels, and books that most engaged this age group of students were those that dealt with complex moral and ethical issues (i.e., bullying, child labour, human rights, slavery, war and genocide, and women's equality) Therefore, Marna and Jacquie provided their students with a chance to explore a wider, more global perspective of "persecution and compassion" by having them develop and pursue their own questions and their own topic areas that connected back to an overarching, essential question.

It was also important for the students to acquire the specialized literacy skills of "reading for information." They needed help to navigate the digital world where information is so easily accessible, ever-changing, and expanding into multiple formats. Students need to locate and select appropriate information from a variety of sources, to read for key ideas, and to ensure that the information they use is reliable. From their new learning, they make connections to their own lives, begin to recognize dehumanizing language and understand its impact, or understand how to nurture compassion and empathy by seeking to understand others.

Investigating Persecution and Compassion

Essential question

- What are the factors that lead people to acts of persecution or acts of compassion?

Enduring understandings

- Effective readers make meaning using a variety of reading strategies to connect new information to background knowledge (process).
- Effective research starts with engaging the curiosity of the researcher, who then asks their own questions in order to search for deeper understanding. This includes determining importance of information, synthesizing information to build knowledge, and reflecting on new understanding (process)
- Good researchers check sources and determine reliability of their sources (process)
- Dehumanization can lead to acts of persecution, both large and small (idea)
- Listening to and understanding other perspectives nurtures compassion (idea)

The following lessons are organized under "The Points of Inquiry" from a BCTLA document that includes outcomes for grades 4 to7 inquiry skills <http://bctf.ca/bctla/pub/index.html> . Marna and Jacquie chose the outcomes most relevant to their lessons, and included them in checklists,

like that below, or rubrics when assessing students for each section of their project.

Connect and Wonder

- Ask focus questions related to aspects of the topic or issue.
- Ask a question that will generate meaningful inquiry and that is interesting and worth answering (inquiry-based learning).
- Recognize that differences in interpretation of stories are important aspects for discussion and consideration (inquiry based reading).

Working with questions

It is important to nurture a classroom where asking questions becomes the norm. Students need to trust that they will not be ridiculed for asking questions, no matter how simple or complex. It is helpful to empower them with a better understanding of types of questions and the purpose each serves. For example, reading a novel aloud to provoke, scaffold, and practise the asking of questions is a wonderful, quick way to encourage students to have discussions about categories of questions, and to raise students' awareness about how a question can signal confusion or ask for inference, or lead to more discussion.

See pp xx-xx for Nicole's set of lessons on how to develop more powerful questions.

Many read-aloud books embed the themes of persecution and compassion, but Marna's favourite is *Iqbal*, by Francesco D'adamo. Initially, Marna facilitated some simple activities to define "thick and thin" questions and to categorize questions so that students begin to think about effective questions. (Harvey and Goudvis 2007, *Strategies that Work,* chapter 7)

Marna read aloud for 10 to15 minutes each morning, and asked her students to write three questions that came to mind as they listened. They could write on sticky notes or on an organizer that has room for questions before, during, and after the reading.

- Compile the students' questions (no names attached) into a list in no particular order. Present the list to class the following day, and have students work in partners to categorize them.
- Debrief the class as a whole, and have students discuss their reasons for their choice of category.
- After the class has followed this process a few days and students have become comfortable with question categories, challenge them to develop one discussion question or research question out of the three questions they wrote down during each read-aloud session.
- At the front of the classroom, keep a running record of the student-generated discussion and research questions as a reminder of what they look and sound like. Marna used those questions to model to the class how one might begin to find information that might contribute to the answers. For example, if the question were "Why would a family give away their child to a carpet factory?" Marna might bring in a short

article explaining the effects of poverty, modelling a think-aloud, and show a section of text while describing how to determine importance of information and discover possible answers to this question (Harvey and Goudvis 2007).

Provocations

Use a text set to further develop student questions and possible topics for research. In order to expose students to a variety of topics or issues quickly without dense text, Marna and Jacquie used a text set, a collection of texts (books and/or articles) with a common genre, theme, author, topic, or purpose. This text set had mostly sophisticated picture books, articles, and nonfiction text pieces about a variety of events, people, and issues—both current and historical (Figure 6.4). Photos, artifacts, quotes, films, music, or stories are all effective ways to provoke students' curiosity and inspire questions.

- Students sit in an Information Circle with the text set books spread out in the middle.
- Students choose a book of interest to them to start with. They have a few minutes to examine it, then pass it to the right. The process gives them a sense of the range of events, issues, and stories included.

Figure 6.4 Inquiry text set on theme "Persecution and Compassion"

Inquiry Text Set

"Persecution and Compassion"

One Hen by Katie, Smith Milway

Planting the Trees of Kenya: The Story of Wangari Maathai, Claire A. Nivola

Brothers in Hope: The Story of the Lost Boys of Sudan, Mary Williams

The Carpet Boy's Gift, Pegi Deitz Shea

Shi-shi etko, Nicola Campbell

Shin-chi's Canoe, Nicola Campbell

Fatty Legs: A True Story, Christy Jordan-Fenton

This Child, Every Child: A Book About the World's Children, David Smith

Anne Frank, Josephine Poole

The Story of Ruby Bridges, Robert Coles

Rosa, Nikki Giovanni

Martin's Big Words: The Life of Dr. Martin Luther King, Jr., Doreen Rappaport

Confessions of a Former Bully, Trudy Ludwig

The Bracelet, Yoshiko Uchida

My Freedom Trip: A Child's Escape from North Korea, Frances Park and Ginger Park

(We added many more articles and non-fiction books, and often added to the text set according to the students in our classroom and the areas they expressed an interest in.)

- Debrief the students about the themes and issues they notice as they skim the books. Generate a list of themes and issues with the class (e.g., racism, bullying, segregation, courage, poverty, displacement, kindness, slavery, freedom). Discuss what they might learn when they actually read one or more of these books. The big ideas/concepts of "persecution" and "compassion" may surface through this discussion.
- The Frayer model (Figure 6.5) helps a class begin exploring big ideas or concepts. Give students time — individually or with a partner — to come up with examples and non-examples of one of the themes or issues they identified. The essential question can be introduced after students have completed and shared their Frayer models. (You may want to limit the focus to persecution and compassion.). This is a key step in setting up safe processes for student sharing in order to begin an ongoing, open dialogue about personal connections and new learning.

Using the text set, students choose a book or article that interests them in order to read and respond in more depth. This allows students to practise and apply thinking skills while reading, and further develop skill in shaping effective questions. It also gives students time to explore topics they might be interested in pursuing further. Marna provided time in class to read and respond, using a response organizer with categories as in Figure 6.6. She asked them to complete a response for a minimum of three pieces they had read; many students read more books and articles than that, but weren't asked to complete a response for every book. It's important to model how to use a Reading Response Organizer and allow students to practise each reading response skill. Then students use the back of their Organizer page (Figure 6.6) to note the examples of persecution and compassion they find in the articles and books they read.

Figure 6.5 The Frayer model for analyzing big ideas

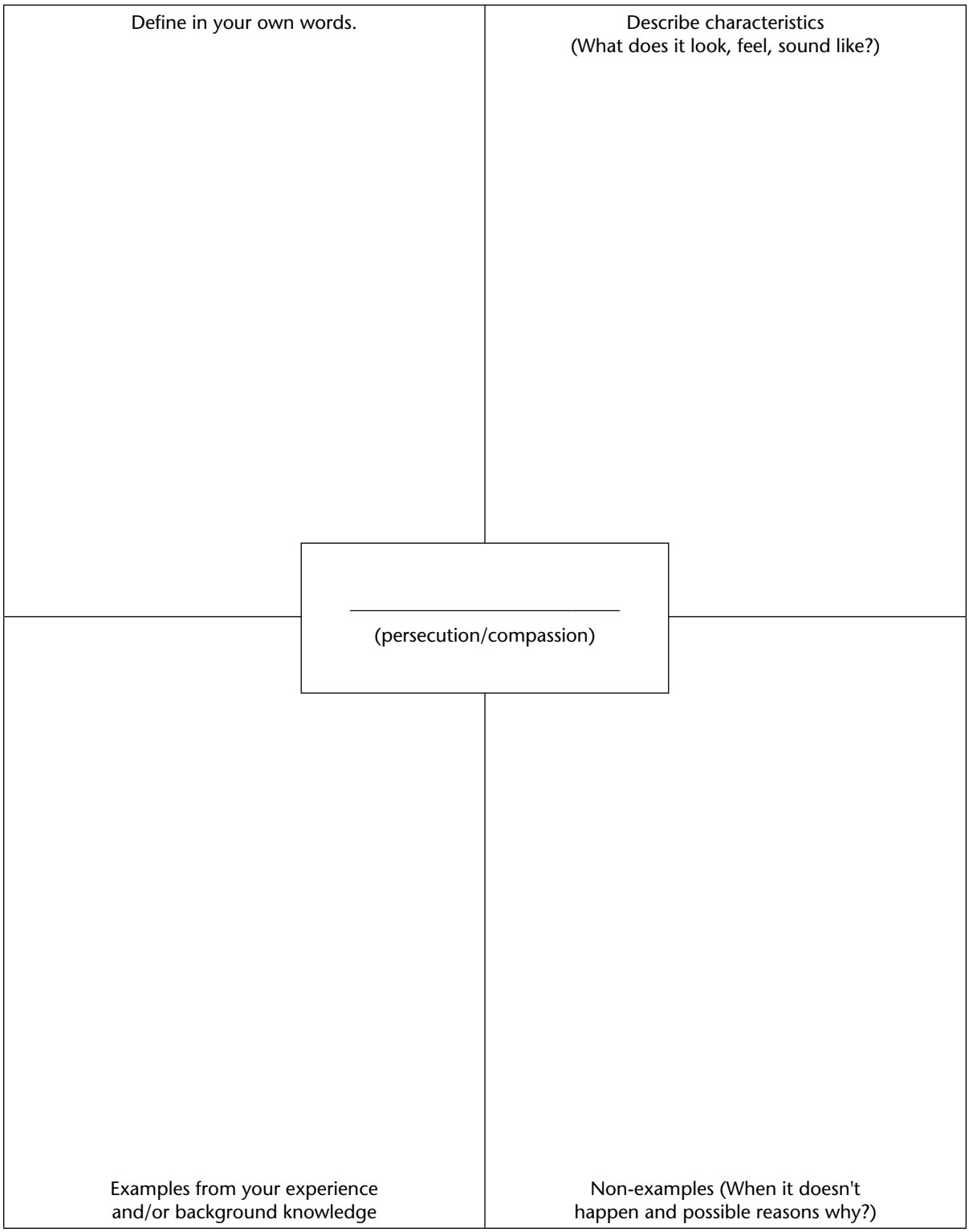


Figure 6.6 Layout for a Reading Response Organizer (front and back) for student notebooks

Activating prior knowledge: What do I already know about this topic?	
My questions (I wonder):	**My connections:**
Images that stay with me:	My response / reaction / opinion:
On the back of this organizer, have students start to collect evidence of the concepts, noting the examples they find in the articles and books they are reading.	
Examples of Compassion (quote and page #)	**Examples of Persecution** (quote and page #)
p. ___	p. ___
p. ___	p. ___

Building criteria

- Build a set of criteria with your students for their responses. Don't make it onerous, but be clear about what you want them to demonstrate.
- Choose examples of good responses (or aspects of those responses) to share with the students on a regular basis. Discuss why each response "fully meets" the criteria, or ask them to tell you why they think it demonstrates the criteria. Give students an opportunity to improve on their own responses after these sessions. The class spent two weeks with the text set and, at the end of each week, Marna asked each student to choose their best response to hand in for assessment.
- It is important to give students regular feedback on the response skills they demonstrate and have regular conversations or individual conferences with them about what they are learning. A class Information Circle helps build class community, and lets you hear from everyone to get a sense of what students might be interested in pursuing.
- During a conference or in a circle, students bring their favourite book (or response) from the week, and share highlights of their learning (e.g., *What is the book about? What was the most interesting thing you learned? What sticks with you and why? What questions do you still have?*). It is during these conversations that students begin to get a sense of what their peers are interested in, hear about books they might want to read next, and talk about questions that they might want to develop.
- After four or more responses, have students list the topics and questions they feel most passionate about.

It is important to listen and encourage students to find such a topic. Sometimes, the text set is only a jumping off point for other topics that weren't included in the text set. Often, students will discover issues of persecution that have happened in their own family (e.g., Japanese internment camps or residential school experiences), or want to find out more about an organization that helps people (e.g., Doctors without Borders, Free the Children). In an authentic inquiry experience, students have to be allowed to investigate questions that they care about and are motivated to research and answer.

Locating, Selecting, and Evaluating Sources

Students best develop the following skills from The Points of Inquiry (BCTLA) in the context of their inquiry with the teacher-librarian and teacher:

- Evaluate resources and information critically for perspective, purpose, currency, authority, relevance, coverage, and quality.
- Check for reliability and credibility of a source.
- Understand the differences between the various tools and resources for searching, and use each appropriately.
- Prioritize resources by usefulness.

- Use different kinds of resources to expand and verify information.
- Use a graphic organizer to keep track of sources of information.
- Interpret information from graphic representations, statistics, and media sources.
- Use information responsibly.
- Report sources cited in appropriate format.

Before any research took place, Jacquie explicitly taught some of these skills—such as how to check for reliability and credibility, searching for and keeping track of many useful sources, and understanding various tools and resources for searching. However, students learned these skills best in the context of their own search for information, when both Jacquie and Marna could support their decisions around prioritizing, evaluating, and interpreting the sources and the information found. Sometimes, as a result of their observations, Jacquie and Marna would plan a follow-up mini-lesson or reminder lesson on key inquiry skills. Their collaboration was important in responding effectively to their students' needs, and for ensuring that they had the tools needed to find reliable information.

Finalizing individual topic questions

To support students in narrowing down their topics and their final questions, remind them that their question should reflect their real interests. Brainstorming sub-questions supports them in the process of developing the bigger research question. Again, Marna and Jacquie found it easiest to set up conference times with each student, and meet with them during a time while others finished their responses, developed and finalized their questions and began to locate and select relevant information that might contribute to their research. They had students use an organizer with headings:

Final Questions: Narrowing the Focus		
Question #1:	Type	Question #2: type
	Sub questions	Sub-questions

Student examples of inquiry questions

- What was a residential school? Why did these schools exist? What was their impact on First Nations communities?
- What is bonded child labour? Where does it occur? How can it be stopped?
- Why were Japanese Canadians taken to internment camps during World War II? What impact did the internment have on them?
- Who is the Dalai Lama? Why was he exiled to India?
- Who are Craig and Marc Kielburger? What have they accomplished and why is it important?
- Who was Martin Luther King? What did he accomplish and what was his impact as a leader?

Determining importance and citing sources

Students worked in the library for double blocks of time (two 45-minute blocks) twice a week. By this point, teachers should have signed off on students' main questions. Students should also have a list of at least 4 or more sources of information. They used a two-column fact/response sheet to record important ideas, samples of evidence, and the sources they were using.

Source Title: _____ Author: _____ Date: _____	_____ _____ _____
Facts/Important quotes p___	My connections, questions, reactions, thoughts

Marna used the class time between library blocks for mini-lessons on how to determine the importance of information, modelling strategies such as Marking Text. This strategy involves students marking their thinking on the text using sticky notes or an overhead transparency sheet. They could use a code such as: K for key idea; I for inference, Q for question, S for surprise, T:T for a text-to-text for connection, T:S for a text-to-self connection, and T:W for a text-to-word connection). Students' notes became the focus of their research for their next library time, and connected the information they were learning to their main questions (Figure 6.9). They wrote a summary of their findings to help them reflect on what they had learned, and to consider what they still needed to know.

Synthesize understanding

Students were expected to demonstrate their ability to mark their text as a strategy for determining its importance, to write a detailed response, and to provide evidence of their learning. Both half way through and at the end of the research for their project, students were also expected to:

- choose the best information article read so far, and provide a photocopy of the article that showed their marked text
- cite the source properly
- write one paragraph summarizing the article
- write four paragraphs working through reflective questions like *What did I learn? Why is this information important? How does it connect back to my questions? What do I still wonder about? What are my opinions about this information?*

- This process helped them ensure that they met all the criteria, and provided evidence to support their efforts. They included this self-evaluation along with their article and response.

Self-evaluation

- How did "marking text" help you better understand the article for this response? Explain.
- Select your two best sentences from your summary, and explain why you think they are the best.
- Give an example of new learning that helped answer your questions.
- Give an example of a thoughtful part of your response. Explain why you consider it "thoughtful."

Finally, Marna used the following criteria to assess each student's response:

Organization

- Typed
- Photocopied article
- Rough draft
- Good copy with all parts of response included

Knowledge and Thought

- Marked text of article
- Summary captures gist of article
- Response is detailed and thoughtful
- Uses evidence from article to support ideas and opinions
- Response clearly connects important learning back to your questions

Writing Skills

- Response has been proofread (by a peer) and edited (by you!)
- Ideas are organized into paragraphs

Marna prepared feedback and a number of mini-lessons for the whole class after she marked the first set of responses—areas she felt they were strong in, and areas they needed to work on—so that they had an opportunity to improve their second response.

Sharing what we know now

Marna and Jacquie wanted students to be able to share their learning and exchange ideas and connections to the essential question with their peers. They asked students to prepare a five-minute talk with visuals for a small group of their classmates, with reference to the following:

Reporting out: My sharing outline

- Introduction: What are my major questions? Why did I become interested in them?
- First question and the answers/information I found out
- Second main questions and the answers/information I found out
- My response to what I learned: My thoughts, opinions, reactions to my learning and why
- Conclusion: What do I understand now about why people persecute others? What leads people to compassionate acts? How did my research help lead me to these conclusions?

As an optional part of the final presentation, Marna and Jacquie gave students an open-ended challenge to prepare a creative project that synthesized their learning and their conclusions about the essential question. The class brainstormed questions that would help them consider what to create: *Why do humans hurt each other? Why do they help each other? How does it feel to be persecuted? What is the impact? What does an act of kindness feel like? Why is it important?*

Encouraged to tap into their passions to represent their learning, students produced paintings, sculptures, poems, songs, short stories, structures, skits, and even movies that helped explore the essential question. When they presented their final product, they were asked to explain what they were trying to capture, and their peers shared positive feedback. This part ultimately takes more time, but asking students to tap in to other ways of showing what they know evokes powerful responses, honours different strengths and talents in each student, and demonstrates the many other ways that they can represent their learning.

Inquiry in a Differentiated Math Class

Something had to change for Brenton Close. Brent's classes were always diverse but as a group his class had a shorter collective attention span and greater disparity of pace and expertise than he had previously encountered in his rural school. Brent has been working to build open-ended teaching into his classroom, but this year several students struggled even with simple computation and the meaning of basic symbols; others showed signs of boredom almost every day; and in one lesson a grade 8 girl held a model of a cylinder, described the process for finding its surface area, and derived the surface area formula —— all before he had set up the task! Two other students really benefited from repeatedly assembling and disassembling an actual model of the figure to determine how a cylinder is represented by a net drawing.

He realized that he needed an approach that allowed all students to work inductively with the big math ideas, to work at their own pace, but also to work in small groups of students to reinforce key concepts. Brent had heard

about "flipped classrooms" (that is, providing students with electronic access to lessons and working with teachers only when they have questions), so he did some investigating. He saw promise in aspects of this approach, but wanted to ensure that he met the learning needs of all his students by using a variety of instructional techniques.

To do so, he created a website and started to record short lesson segments, then asked his students to work through the lessons at their own pace and do the assigned practice questions. Brent encompassed this within the framework of units of study designed to keep the class together as a cohesive social group. His intentions were to:

- help students focus during times of direct instruction to facilitate greater concentration.
- allow students to engage in and practice their learning at their own pace.
- encourage students to aim for mastery rather than bare-minimum passing grades.
- make better use of adults' time by providing more individual and small-group assistance for students.
- encourage inquiry study for students able to work through curricular material quickly and independently.

To implement this new approach, Brent designed a basic weekly structure (Figure 6.8) that allowed individual self-paced study through the middle of the week, with Mondays and Fridays focused on whole-class activities. Within the first week, he found that some adaptations were necessary. Many students embraced the idea of more accessibility to individual help, but others took the implicit freedom as an opportunity to escape mathematics, especially when they could find individual spaces to access Facebook or digital games.

Figure 6.7 Brent's weekly structure for grade 8 Math class

Monday (Whole-class or small-group activity)	• Problem solving: challenging, realistic problems • Vocabulary: word wall, personal math dictionary, modelling on mini-whiteboards
Tuesday **Wednesday** **Thursday**	1. Introductory exercise: multiplication drill, 1-question or 2-question quiz, question of the day on mini-whiteboards 2. Independent study: students work on curricular assignments at their own pace, either viewing lesson recordings or completing practice questions as quiet seatwork
Friday (Reserved for 5-day weeks, so that if we miss a day at any time, the activities are shuffled accordingly)	• Games Day – logic games, strategy games, problem solving games, First Nations traditional games ... all played either in small groups or as a whole class *None* of the games we played were technology based *All* of them involved students moving in the classroom, interacting with each other.

Brent divided the students who either struggled to work on their own or avoided any assigned work among himself, the classroom assistant, and the First Nations support worker so that each student had one adult monitoring their progress quite closely. He asked a small group of students to abandon the recorded lessons altogether, and to work through lessons and assignments with direct assistance from Brent himself.

During the independent study part of the week, Brent expected students working at all levels to be engaged in mathematics on a continual basis—watching recorded lessons, completing practice questions, working with a teacher or classroom assistant, or working independently. He spot-checked completed practice assignments for accuracy, and worked with students to have them correct errors in methodology before they considered each assignment finished. At the end of each unit of study, the class wrote the unit test together at the same time.

Brent invited the students who had worked quickly and accurately through curricular assignments to use their class time on an inquiry project of personal interest that involved mathematics, to expose students to some of the applications of mathematics in real life, as outlined as outlined in the inquiry in Figure 6.8.

Developing Powerful Questions in Humanities

When Nicole began to introduce her grade 6/7 class to the inquiry process for the first time, she felt that it was important for the whole class to work on a common theme, so that her modelling and their learning would occur in a community of learners.

When the class was working in social studies on the theme of persecution, Nicole had them begin reading the novel *Iqbal*, by Francesco D'Adamo (2001), during their Reader's Workshop block of time. *Iqbal* is a powerful, true story that often hooks readers right away. It tells the heroic story of a young boy from India who stood up for his rights as a bonded child labourer in a carpet-making factory. Often, students are shocked to hear that this kind of treatment happens in our world today. They become passionate and want to know more. Their wonderings are genuine and caring.

To help develop the students' questioning around this idea, Nicole created lessons to identify different kinds of questions and determine which are more powerful. She began her own research on questioning by looking closely at Jeffrey Wilhelm's *Improving Comprehension with Think-Aloud Strategies* (2001). Wilhelm provides a lovely visual of question types for the inquiry approach. Nicole began to think about the following four kinds of questions:

"In the Text" Questions	"In Your Head" Questions
• Right There	• Author and Me
• Think and Search	• On My Own

Figure 6.8 Inquiry project for Mr. Close's Math classes

Inquiry in Mathematics

Your project is intended to extend your mathematical thinking into one or more areas of personal interest, and to help you learn something beautiful about mathematics. Your choice of topic can be personal and individual to you, but your teacher must approve its relevance to the study of mathematics. The following ideas might help you select a topic for inquiring into the use of mathematics:

Number systems (e.g., binary, hexadecimal, dozonal)	Cryptography	Art (e.g., painting, sculpture, origami)
Architecture	Music (music notation or a musical instrument)	Nature (e.g., patterns in nature, plants, landforms, water)
Fractals	Space (e.g., natural order of celestial bodies)	Space travel and technology
Microbiology	Computer programming	Business and accounting
Finance	Investment	Stock markets
Publishing	2-D or 3-D Animation	Trades (e.g., carpentry, electrical system, instrumentation, fabricating, machining)
Flight (e.g., kites, airplanes, helicopters)	City planning	Demographic study
War (e.g., logistics, movement of troops and equipment)	Water treatment (e.g., personal, municipal, or systems in developing countries)	Economics
Farming	Genetic engineering	Tessellations
Nanotechnology	Robotics	

Writing an Inquiry Question

The question you phrase as the topic of your research is the most important part of your project because it states your purpose and provides the focus for your final presentation. Your question must be thoughtful and challenging to answer. In some cases, you might not end up with an "answer," but the process of trying and learning about the topic can still make a great project. Your inquiry question must be approved by your teacher. The following might help guide you to a great question:

- What is it that most interests you about the topic you have selected?
- What do you most wonder about when you think about that topic?
- Does the question you are wondering about have a simple answer or will it likely lead you on a path of discovery?

Final Product Options

Your final product is your chance to present the results of your research and what you learned along the way, and to share your learning with your teacher, support workers, and classmates. Your final product should respond to the following:

- What is the topic, and how does it relate to mathematics? (Describe it and define it for people who might not know anything about it.)
- What made you choose this topic? What aspects of the topic are of personal interest to you?
- What did you learn about your inquiry question?

Here are a few options. You are welcome to use an idea of your own, as long as your idea is approved by your teacher before you put hours of work into it.

- Poster
- PowerPoint slide show
- Illustrated essay
- Construction project with oral or written explanation
- Product of choice, with teacher approval

Self-Assessment

Your self-assessment should include a brief written reflection on each of these questions:

- What aspect of the project do you believe you have done well?
- What you would like to change or do differently next time?

Assessment

In the final assessment of your project, I will consider both the time and the effort that you put into your work, and the quality of your final self-assessment reflections. Here is a breakdown of how your inquiry project will be assessed.

The question for Nicole, then, was how to represent these in her lessons so that students could use the information in a thoughtful way. She began by providing the students with an essential question to consider for the entire unit:

> *What experiences does Iqbal have and what choices does he make that shape who he is?*

Nicole decided that the final performance-based assessment would have to be a question-gram and, with that end in mind, she decided it was important to develop lessons that supported her students in two ways:

1. in their understanding of different kinds of questions
2. in understanding how research/responses lead to success with the final assessment.

To do this, she wanted to model the skills that students would need to build in order to be successful, and outlined steps that would lead to just that.

- Each week, students will work in small Literature Circles.
- At the beginning of the week, they will read together and develop a two-column note-taking organizer with headings "My Thinking" (on left) and "Evidence" (on right).
- Students will return the following day and use the organizer as an aid in their Literature Circle discussion. In addition, students will use the "Say Something" strategy (Brownlie 2005) in which students take turns sharing one quote from the book and describing their thoughts about it. After everyone takes their turn sharing, the conversation will open up and be more fluid.
- During the third class of a weekly cycle, students will continue working in their Literature Circle groups to compose a "response-write."

This routine continued for 3 to 4 weeks to allow lots of practice, both collaboratively and independently, and of modelling (gradual release) before Nicole began the questiongram performance-based assessment. This gave students the time to develop the skills required for the questiongram; for example, students were required to support their thinking with evidence and a quote from the novel.

My Thinking/Evidence

Before digging into the novel, Nicole built background knowledge with her students by using the picture book *The Carpet Boy's Gif*, by Pegi Deitz Shea (2006). She provided chart paper to each desk grouping of four students and asked them to write, as she read the book aloud, their thoughts and questions all over the chart paper—which Nicole referred to as a "graffiti wall." She had previously noted that there were no right or wrong thoughts or questions, and it was okay to scribble them all down. After the end of the story, she asked the groups to pick out what they thought were the most important ideas on

the graffiti wall. As the groups shared, Nicole recorded their thinking. During the next class, she returned to this list as she modelled how to insert their thinking into a graphic organizer like a T-chart:

Book Title	
My Thinking/Questions	Evidence

Students were to record their list of thoughts and questions from the story in the left column. Then they were to look for specific evidence that they could quote and that supported their thinking in the right column. Nicole's modelling of how to use the organizer gave students the chance to explore this process both in small groups and as an entire class. The picture book, with its small amount of text at an entry reading level and its pictures, was suitable for all learners. When students asked her "How many do I have to do?," Nicole suggested they find 3 to 5 points, allowing students to make their own decisions based on what they felt they could thoughtfully contribute. This lesson purposely prepares students for the questiongram performance-based assessment.

Understanding Question Types for Inquiry Approach

Nicole also wanted her class to explore different types of questions and help them learn to apply this knowledge across curricula. She developed a table (Figure 6.9) to help them organize the names of question types (in the left column) and brief descriptions and examples (in the right column). Together the class modelled what they thought each question type might sound like and added it to the chart. Wanting to take student thinking further, Nicole modified Figure 6.9 by covering the examples provided on the right side and copying the page again for her students to try coming up with their own examples, either together with a partner or the class or alone. By allowing her students time to talk, she further benefitted their learning. It was Nicole's way of not only reinforcing the skill but also assessing student understanding.

Response-Write

The response-write activity pulled together the idea of shaping powerful responses and of stretching student thinking to provide evidence that supports that response—the skills needed for the summative (performance-based) assessment. Nicole modelled the following example in front of the class; later, she provided a copy to the students who found the exercise difficult and

Figure 6.9 Kinds of Questions/Now You Try

Question	What you need to know…
Right-There Questions	• Factual questions • Answer is found in the text • Yes or no answer **For example:** What is the Master's name?
Think-and-Search Questions	• You need to infer, that is, think about it, then try to piece together the details from the book (search) to come to an answer (*inference*). • Try to fill in important gaps in the text by searching to find evidence for a hunch you may have. **For example:** Why do the child slaves think life will be better with Iqbal's arrival?
Author-and-Me Questions	• Connect your own life experiences and beliefs with the text **For example:** How would you react to Iqbal when he says, "Have you ever seen anyone pay off their debt?" (p. 20) What does the author want me to think about Salman's response to Iqbal when Iqbal tries to tell them that Hussain Khan is not a nice man?
On-Your-Own Questions	• Questions usually stirred by the events, topics, or theme of the text. However, the answers to these questions are not found in the text. • Think about the book's issues in a much wider context (the world) and raise questions about those issues. **For example:** What are the causes of and solutions to child labour? How would it feel to be a child slave? What can I/we do to help end child labour?

needed a sample to support them. Most students started off by relying on the sentence starters modelled, but by the end, most grasped the concept and were able to write without the structures put in place.

I think I will use the question: ***"Does the kite represent the idea of freedom to Fatima"*** **(p. 57)?**

I will try to use specific evidence from the novel as I write. "On page 57, the quote I found connects my thinking to the idea of a kite being a possible symbol of freedom:

> "You run and the kite rises higher and higher in the sky; sometimes it even touches the clouds, and it soars and veers with the wind. You have to be very careful, though. If you let go of the string, you lose the kite and after a while it floats away."

Now that I have some evidence, I think that I can interpret it.

Some suggested sentence starters might include:

> *I think … because …*
> *This connects with … because …*
> *This is important because …*

I think the kite is important because Fatima thinks of it as her key to freedom. I know this because she explains how the kite "rises higher and higher…and veers with the wind." This makes me think that Fatima may compare herself to the kite.

End with a connection, a thought, a feeling.

I feel hopeful for Fatima because freedom is what every child deserves instead of being required to work long, hard hours for a master.

Figure 6.10 Literature Circle questiongram

Literature Circle Questiongram

"Thinking about Our Essential Question"

Process:

1. In thinking about the Literature Circle books you have read, record the following essential question in the middle of your paper:

   What experiences does Iqbal have and what choices does he make that shape who he is?
2. On the inside ring, attach quotes from the novels you read that provide evidence relevant to the essential question. Choose a character from one or more of the novels you read when thinking about how to respond to the essential question. You have read at least 3 novels, so try to include a character from each of them.
3. On the middle ring, include images that reflect your thinking. The images can be drawn, taken from the computer, cut from a magazine, and so on.
4. On the outside ring (the perimeter of your paper), include connections (T-S, T-T, T-W) or the wonderings you still have about to your essential question.

Example:

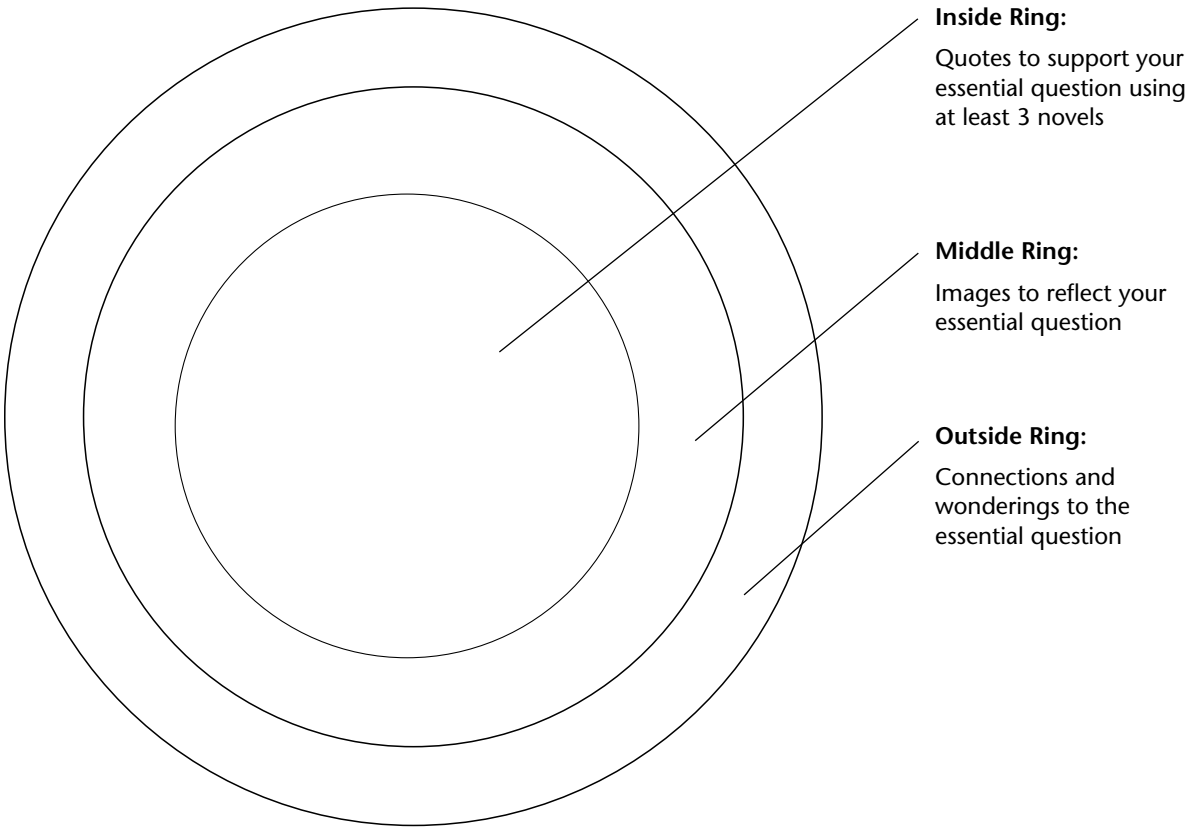


Figure 6.11 Literature Circle questiongram criteria

Criteria for Literature Circle Questiongram

What choices does Iqbal make and what experiences does he have that shape who he is?

Mark	Criteria
4	5 or 6 quotes support your essential question 4 or 5 powerful images that reflect the essential question Strong connections and/or wonderings relate to your essential question
3	3 or 4 quotes support your essential question 3 or 4 powerful images that reflect the essential question Some connections and/or wonderings
2	Few quotes Few images Few connections and/or wonderings
1	Limited response; few quotes included Few to no images Few to no connections and/or wonderings

(Adapted from Student Diversity, Brownlie and Feniak, 1998).

Deep Inquiry Learning: An Integrative Unit

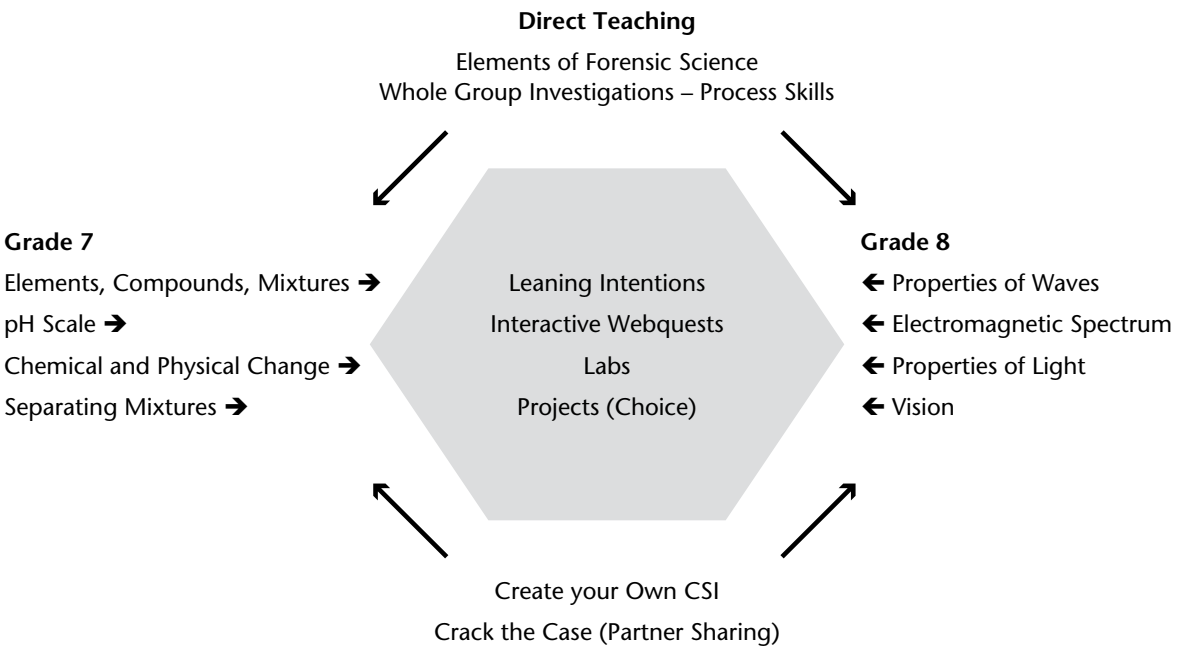
Open-ended learning through inquiry invites more than one question, more than one answer, and more than one way of thinking. Instead of arriving at the same place at the same time, we want to generate multiple approaches and ideas within an activity or a task. Darcy McNee, Nadine Stofer and Sandi Johnson, all classroom teachers, have worked together at North Saanich Middle School for several years. Sandi and Nadine have team-taught in an open classroom model for eight years, while Darcy has had her own classroom. For the past four years, these three teachers have collaboratively planned their units across all core subjects, often integrating the disciplines to facilitate deeper and broader learning and to meet students' diverse needs. Their collaboration has allowed all three teachers to deliver the same curriculum and assessments, and allows each to bring her own strengths to the planning and instruction, creating a rich foundation for their students.

Forensic Science

North Saanich recently moved to a model of ten combined grades 7/8 classes. In order to accommodate them and ensure students were not repeating curriculum, the teachers created a Forensic Science unit, integrating the grade 7 and grade 8 Prescribed Learning Outcomes (PLOs) in Chemistry and Optics. In a highly engaging unit with numerous hands-on activities, their backward design plan provided an opportunity for students to choose how to best demonstrate their learning, and to meet the widely diverse needs of students within these classrooms.

They decided which big ideas were needed to solidify student learning (Figure 6.12), and decided that the final product would be a Crime Scene Investigation.

Figure 6.12 Crime Scene Investigation (CSI) Unit Map



Big Ideas Phrased as Questions

- What is forensic science?
- How can we use forensic science to understand and solve problems and issues?
- How do we use forensic science to develop understanding in the curricular areas of chemistry and optics?
- How can we use forensic science to reinforce the science process skills?
- How can we examine forensic science to understand how science is used in the real world?

Direct Teaching of Elements of Forensic Science

They began the unit with direct teaching of forensic science skills—processing a crime scene, interviewing witnesses, handling evidence, and documenting the crime scene. Students used labs for hands-on explorations of topics such as fingerprinting, hair analysis, bite marks, and tire track impressions to practise and solidify these process skills.

Grade 7—Separating mixtures

To demonstrate prerequisite skills for separating mixtures, teachers gave groups of students baby-food jars filled with two or three different items (from *BC Science Probe 7*, 150). Students followed the inquiry method by brainstorming methods they could use to separate the items. For one jar that held marbles and nails, one student group used a magnet to extract the nails, another used a pair of tweezers to pick apart the mixture. Students further explored the concept using interactive sites online.

Hands-on application of skill and knowledge

Students then used their knowledge and skills to complete a hands-on, concept-based crime lab (Figure 6.13).

> **Note to Teacher:** Prepare your evidence jars ahead of time. Wide-mouth Mason jars work best. They should contain water, mud, iron fillings, tar, grass, blond hair, sand, wood chips, salt, and oil in differing combinations and quantities Each group should receive a jar with a different label. Only one of these jars should have all of the substances—this is the guilty party. You also need ice cream buckets, magnets, paper filters, mesh filters, tweezers, evidence bags, labels, magnifying glasses, and petri dishes.

Planning for project

Students chose how to demonstrate the knowledge they acquired while researching the essential question. The teachers allowed them to complete a project, either independently or in small groups, and gave them a copy of the Forensic Science: Project Planning Guide and Rubric with evaluation terms for self-assessment (Figure 6.14). They discussed with their students the different ways they could demonstrate their learning —including Glogster, Prezi, PowerPoint, mind maps, models, written stories, songs, taped interviews, and YouTube. As well, they provided time and support during class, as needed, and encouraged the students to work toward their strengths. When projects were completed, students shared their projects during a presentation process for the whole class, and received feedback from both their peers and their teachers. From beginning to end, the process inspired and motivated students to try new ways to represent their learning, take risks, and take their learning deeper.

Figure 6.13 Project: Crime Scene Investigation

Project: Crime Scene Investigation of death in Gowland Todd Provincial Park

Part One

Your challenge

To think like a CSI Scientist while examining evidence collected, plan a method of separating your mixture, and come to a conclusion (based on your evidence) to prove the innocence or guilt of the suspect.

Your team will be provided with a water sample from inside the suspect's boot that you are to investigate. Prior to extracting and separating the substances from your mixture sample, devise a plan for separation so that you do not destroy any evidence. Once you extract each substance, you need to preserve it in a labelled evidence bag because it is needed as evidence when the case goes to court. Then, examine your evidence to conclude whether the suspect could have committed this crime.

Preliminary collection of evidence

Saturday, April 18, an assault occurred on the edge of a salty marsh in Gowland Todd Provincial Park. The victim, a 5' 4" blonde, Caucasian female, had been struck by a hard object, presumably a metal bar. When the police arrived, they found a suspect in the area. Gowland Todd is a popular trail used by hikers and, therefore, many sets of footprints were found, but with no distinctive footwear. However, the police did find that the suspect's boots had water in them.

Secondary evidence

The salt marsh where the assault occurred is accessible on foot by a public hiking trail through a golf course. The hiking trail's surface is woodchips while the ground where the assault occurred is fine white sand. The only access to the hiking trail is through the parking lot at the nearby golf course. The golf course parking lot has recently been resurfaced with asphalt. While walking through the parking lot, police notice an oil stain, perhaps a leak from a car's engine. There is a small blacksmith's shack on the perimeter of the golf course close to where the victim was found.

Part Two: Plan

Observation: What do you see in your sample?

Identify the PH (acidity or alkalinity) of your sample

Separation techniques

Substance	Method

Conclusion

Could this suspect be the guilty party? Why or Why not?

How do you explain all the materials present in the sample?

Figure 6.14 Forensic Science: Project Planning Guide and self-assessment

Forensic Science: Project Planning Guide

Learning Intentions

I can explain how forensic science is used in the real world.

I can explain how _____

_____

_____

_____

Ways to Show What You Know	**My Plan: Sketch, list or describe the end result of your project.**
• Create 2D art (ie cartoon, painting, drawing or diagram). • Perform a dramatic piece. • Create something with technology (movie, prezi, glogster, powerpoint etc). • Write a newspaper article. • Create 3D art (ie : pottery, paper mache, sculpture etc). • Write a song. • Negotiate another project with the teachers.	

Project Due Date: _____

Reality Check:

☐ Do I feel confident in my overall plan? Is it realistic?

☐ Do I know what materials I need? Do I know where to find them?

☐ Can I manage my time so that so I can work at a comfortable pace without cramming it all in at the last minute?

Figure 6.14 (Continued)

Forensic Science: Project Rubric

Good Start!	On Your Way!	You Are There!	Wow!

Learning Intentions

I can explain how forensic science is used in the real world.

I can explain how _____

_____

_____

Demonstration of Knowledge and Learning Outcomes	Demonstration of knowledge is under developed. May contain vague or inaccurate information. Product demonstrates a minimal understanding of learning intentions.	Demonstration of knowledge is generally straight forward and clear. Unevenly developed. Product demonstrates a basic understanding of learning intentions.	Demonstration of knowledge is fully developed and shows depth. Product demonstrates a thorough understanding of learning intentions.	Demonstration of knowledge is fully developed and shows depth and originality. Product demonstrates an insightful understanding of learning intentions.

Grade 8—Inquiry Using Online Interactive Websites

Optical illusions

Students went to computer stations to explore and discuss different illusions like Blind Spot and Size of the Moon from <www.indiana.edu/~ensiweb/lessons/unt.illu.html> and others from <www.opticalillusions.com>.

Eyeball dissection

This webquest (Figure 6.15) allowed all students to engage independently with the concepts , while enabling easy adaptations such as closed captioning, text reader, and others.

Hands-on Application of Skills and Knowledge

Students then used their knowledge and skills to complete a hands-on, process-based lab in which they follow a procedure to dissect a cow's or sheep's eye. The point is to gain an understanding of the eye, of dissection skills, and of forensic pathology (Figure 6.16).

Figure 6.15 Webquest Activity 8

C.S.I. Investigator Training

The Eye and Dissection Skills

Go to this website: <studyjams.scholastic.com/studyjams/jams/science/human-body/seeing.htm>
Observe and listen, filling in the blanks in the following statements.

1. The parts of the eye work together to _____ light and send _____ about it to our brain.
2. Pupils are the _____ , _____ part of our eye that lets light travel _____ it. They control the _____ of light that _____ the eye. In the dark, our pupils are _____ and in bright light they _____.
3. The coloured part of the eye is called the _____. These are usually _____ , _____ or _____.
4. _____ in the iris control the _____ of the pupil.
5. We need our eyes, _____ and _____ in order to see.
6. The light passes through the _____ , the transparent outer layer of the eyeball that covers the iris and pupil.
7. The _____ is under the cornea and together they _____ the light rays that pass through them, like a _____ in a movie theatre.
8. It projects an _____ image on the retina.
9. The _____ is the lining at the back of the eyeball. It is _____ to light. When light hits the retina, it _____ off the things you see to the brain through the _____.
10. The optic nerve is a _____ of nerves that sends _____ between the retina and the _____.

Click on "Close" and then "Test Yourself"
Go to page two.

My Mark: __ /7

Figure 6.15 Webquest Activity 8 (continued)

Page Two

Go to the following web site: <www.brainpop.com/>

Click "Log in" then username: northsaanich password: vikings

Click Health > Body Systems > Eyes

How is your eye like a film camera?

1. The lens _____ it _____ , depending on what you are trying to focus, just like a camera _____ .
2. The retina acts like the _____ in the camera.
3. When a camera lens focuses an image on film, it ends up _____ . When the lens of your eye focuses an image on your retina, it also ends up _____ .

Draw it:

Pick an object in the room. Daw the object the way you see it in one square. Draw it in another square the way you think it might appear on your retina.

Take the Graded Quiz. Record your answers here:

1.	_____	6.	_____
2.	_____	7.	_____
3.	_____	8.	_____
4.	_____	9.	_____
5.	_____	10.	_____

My Mark: __ /10

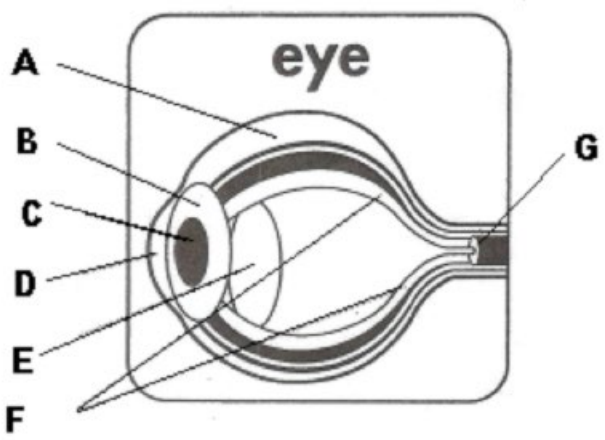
Figure 6.15 Webquest Activity 8 (continued)

Page Three

Go to the following website: <www.eschoolonline.com/company/examples/eye/eyedissect.html>

Click on the Eye Anatomy to help you identify the following parts of the eye.

You can click on the view of sliced eye to help you as well.



A: _____ B: _____ C: _____

D: _____ E: _____ F: _____

G: _____

Close the window and try the virtual eye dissection. Go to the following website: <www.exploratorium.edu/learning_studio/cow_eye/index.html>. Click "Watch Online," then click "Watch Step One Video." After each step, click on "Next Video."

Figure 6.15 Webquest Activity 8 (continued)

Page Four

Video 1: Why do they do cow eye dissections at the Exploratorium?

_____

Video 2: How are the muscles in cow eyes and human eyes different? How does this affect the movement of the eyes?

_____

Video 3: What does the fat around the eye do?

_____

Video 4: What comes out of the cornea when you make your first incision? What is the purpose of this aspect of the eye?

_____

Video 5: What is the white part on the side of the eye that you cut in order to cut off the cornea?

_____

Video 6: What is the iris? What shape is it?

_____

Video 7: What does the vitreous humor look like, what is it made of, and what does it do?

_____

Video 8: How is the lens like an onion?

_____

Video 9: What does the lens act like?

_____

Video 10: What does the retina do?

_____

Video 11: What is the spot that the retina is attached called?

_____

Video 12: What does your retina become?

_____

Video 13: How is the back of human eyes different from the back of a cow's or a cat's eyes?

_____

Figure 6.16 Investigator training in dissection skills

Investigator Training: Dissection Skills

A forensic pathologist is a specialized CSI investigator who performs dissections in order to solve crimes. In this lab, you will dissect a cow's eye in order to gain an understanding of dissection skills and of the eye.

Safety first!

You will use a scalpel or a razor to cut the cow's eye. Be careful. These tools can cut you just as easily. Whenever you handle raw meat, you must wash your hands thoroughly afterward to wash away any bacteria you picked up from the meat.

Materials

- One cow's eye for every two participants
- One single-edged razor blade or scalpel for every two participants
- Scissors and tweezers
- Wax paper and paper towels
- Dissection tray
- A sheet of newspaper
- Gloves
- Eye protection

Diagram of eye before dissection

1. Examine the outside of the cow's eye. See how many parts of the eye you can identify. Draw a diagram and label it.
2. Use the scissors to cut away the fat and muscle.
3. Use a scalpel to make an incision in the cornea. (Careful! Don't cut yourself!) Cut until the clear liquid, the aqueous humor, under the cornea is released.
4. Use the scalpel to make an incision through the sclera in the middle of the eye. Then use your scissors to cut around the middle of the eye, cutting the eye in half, so you have two halves, with the front half having the cornea. Draw a diagram with these labels: Front half with Cornea; Back half of Eye
5. Remove the cornea and place it on the tray; then cut it with your scalpel. Your scalpel will crunch through layers of clear tissue.
6. The next step is to pull out the iris. The iris is between the cornea and the lens. It may be stuck to the cornea or it may have stayed with the back of the eye. Find it and pull it out. It should come out in one piece. Draw a diagram of the dissected Iris.

Figure 6.16 Investigator training in dissection skills (continued)

7. Remove the lens. It's a clear lump about the size and shape of a squashed marble. Hold the lens up and look through it. Put the lens down on a newspaper and look through it at the words on the page. Draw what you see, using these titles: Looking through Lens; Lens on Newspaper
8. If the vitreous humor is still in the eyeball, empty it out. On the inside of the back half of the eyeball, you will see some blood vessels that are part of a thin fleshy film. That film is the retina.
9. Use your finger to push the retina around. The retina is attached to the back of the eye at just one spot. Can you find that spot? That's the place where nerves from all the cells in the retina come together. All these nerves go out the back of the eye, forming the optic nerve, this bundle of nerves carries messages from the eye to the brain. Draw a diagram of the retina
10. Under the retina, the back of the eye is covered with shiny, blue-green film. This is the tapetum. It reflects light from the back of the eye.
11. Look at the other side of the back of the eye. Can you find the optic nerve? To see the separate fibers that make up the optic nerve, pinch the nerve with a pair of tweezers or your fingers. Diagram of Retina

Clean-up

Follow your teacher's directions for disposal and clean-up procedures.

Conclusion

Reflect and respond to the following questions:

1. How did this dissection add to your understanding of the parts and functions of the eye?
2. Why is it very important to document (draw labeled diagrams) as you complete the dissection.

Project Based on Learning Outcomes

The Project Planning Guide and Rubric (Figure 6.14) for the grade 7s can also be used for the grade 8 project. At this point in the unit, the grade 7s and the grade 8s had been working concurrently to solve crimes (based on the learning outcomes for their grade) via the online interactive webquests, labs, and student projects. These outcomes were framed as focus questions for students to answer.

Grade 7 Learning outcomes as focus questions

- How can we use our understanding of elements, compounds, and mixtures to explain the behaviour of matter?
- How can we use our understanding of the pH scale to explain the properties of acids and bases?
- How can we use our understanding of chemical and physical changes to explain the reactions of matter?
- How does our knowledge of the behaviour of matter allow us to separate mixtures?

Grade 8 Learning outcomes as focus questions

- How can we use our understanding of the properties of waves to explain the behaviour of waves?
- How can we use our understanding of waves to explain the electromagnetic spectrum?
- How can we use our understanding of the properties of visible light to explain the behaviour of visible light?
- How can we use our understanding from dissecting an eyeball to explain how the eye functions?

Interactive webquests were created using a number of web-based materials such as Brain Pop, Study Jam, and BBC Bitesize Learning, among others. These sites gave students opportunities to interact with the concepts independently—watch videos, play games, and take self-marking quizzes. Teachers could easily adapt these webquests to meet diverse learning needs. Students solidified the concepts they learned through the webquests in the hands-on labs, then took this learning further in their projects.

The CSI labs

Sandi, Darcy, and Nadine ran labs concurrently for students to explore further the grade-specific PLOs in non-violent crimes. The students had to use the forensic process skills previously learned and combine them with what they learned from the webquests to solve the crime. These labs offered students a chance to see real-world applications of the skills they were developing.

Cumulative Project

Throughout the unit, students were reminded of the summative assessment for which they would have to create their own Final Scene, independently or in partners. The assignment:

> *"Choose a CSI topic (impressions, fibres, fingerprinting, chromatography) to explore.*
>
> *Create a CSI crime scene and present it to a partner and together use CSI skills to solve the crime."*

In order to prepare the students for this final project, the teachers created mini crime scenes for them to solve (Figure 6.17). This highly engaging activity demonstrated how to combine the process skills with the learning objectives. It also gave our students choices in how to frame their own crime scene.

Figure 6.17 CSI Scenes to examine and determine applicability to suspect

Assessment of Project

The structure of the unit allowed for assessment *of* learning through completed webquests, lab reports, and the culminating project, and for assessment *for* learning through the projects, in which students could self-assess and receive peer and teacher feedback. As students worked their way through these assessments, they showed tremendous growth in both their learning and the ways in which they represented their understanding. Their repeated exposure to the curriculum brought deeper understanding of each concept studied.

This Forensic Science unit proved to be very engaging for the students, and they gained a deeper appreciation for the application of science in our world.

Figure 6.17 CSI Scenes to examine and determine applicability to suspect

Examining Evidence

Station #1

A torn T-shirt was found in the back seat of a suspect's car. Two pieces of torn cloth were found at the scene of the crime.

Are the two pieces a match to the t-shirt found in the suspect's car? Explain your thinking.

Station #2

A note was found at a crime scene at a bank. A notepad with a similar type of paper was found in the desk drawer of the prime suspect.

Can the note be traced to the pad? Explain.

Can fingerprints on the note be traced to a person? Explain.

Station #3

A shoe print was found at the scene of a hit-and-run automobile accident.

How can a suspect's shoe be matched to a print? Explain.

Station #4

Some powder was found in a plastic bag in the suspect's pocket. A similar powder was found on the victim.

How could you determine whether the two powders are the same? Explore and explain.

Station #5

A piece of duct tape was taken from a victim of a Break and Enter. This piece of duct tape had hair fibres stuck to it. A roll of the same brand of duct tape was found at the suspect's home.

How can you determine if the piece of tape came off the roll found at the suspect's home? Explain.

Station #6

A glass with a lovely lipstick pattern was left at the crime scene. There were several women who had entered the victim's apartment over the last week. They have all willingly given a lip print.

Does the lip print on the glass match any of the suspects?

Figure 6.17 CSI Scenes to examine and determine applicability to suspect (continued)

Processing Evidence

As you work through each station, read the evidence card and determine if the evidence collected by the investigators can be matched to the suspect in custody.

Station #1

What is the evidence?

_____

Can the evidence be linked to the suspect? Explain your answer in detail.

_____

_____

_____

_____

Station #2

What is the evidence?

_____

_____

_____

_____

Can the evidence be linked to the suspect? Explain your answer in detail.

_____

_____

_____

_____

Station #3

What is the evidence?

_____

Can the evidence be linked to the suspect? Explain your answer in full detail.

_____

_____

_____

_____

Figure 6.17 CSI Scenes to examine and determine applicability to suspect (continued)

Station #4

What is the evidence?

_____

Can the evidence be linked to the suspect? Explain your answer in full detail.

_____

_____

_____

_____

Station #5

What is the evidence?

_____

Can the evidence be linked to the suspect? Explain your answer in full detail.

_____

_____

_____

_____

Station #6

What is the evidence?

_____

Can the evidence be linked to the suspect? Explain your answer in full detail.

_____

_____

_____

_____

Conclusion

Learning through inquiry can be messy, but it helps us rethink what is taught, how it is taught, and how learning is assessed. Learners learn from posing questions, investigating those questions, and working with multiple resources offering different perspectives. Project-based learning requires us to know our students and help them develop their passions, their skills, and their capacity for research and representation. All forms of inquiry are best served by students being in the driver's seat for their own learning—by having *choice* in what they inquire into, in the resources they access, and in their methods of documentation and representation. Students work toward creating their own understanding instead of guessing the responses their teachers might want or of replicating what has been handed to them.

Yet, in all the examples of inquiry in this chapter, there is a role for teacher-led instruction. Matt guides learners in developing their inquiry skills and helps his students create a schema of what inquiry is. Marna and Jacquie use think-alouds and model learning strategies. Nicole teaches students about different kinds of questions, and supports them in developing this key skill. Brent uses inquiry as an extension in mathematics. Students choose topics of interest to them, and Brent conferences with them to support them in developing their questions and inquiry plan. Darcy, Nadine, and Sandi take science back to its roots—they teach their students content-specific inquiry through inquiry.