Introduction to the Water Audit Lesson 1

Grade 8, Science and Technology

Critical Learning

- Although 75% of the earth is covered in water, very little is both fresh and accessible.

Guiding Questions

- Do you believe that every living thing has enough fresh water to meet its needs? Why or why not?
- How much water is "enough"?

Curriculum Expectations

Developing Investigation and Communication Skills

2. Investigate factors that affect local water quality

2.6 use appropriate science and technology vocabulary, including water table, aquifer, potable, and freshwater, in oral and written communication

2.7 use a variety of forms (e.g. oral, written, graphic, multimedia) to communicate with different audiences for a variety of purposes

Learning Goals

Students will be able to:

- graphically represent how much fresh water is accessible
- use scientific and technological vocabulary in oral and written work

Instructional Components and Context

Readiness

- Quantity of measure and unit conversions, e.g., L versus mL
- Proportional reasoning

Terminology

- Estimate
- Percentage Ratio
- Conversion
- Groundwater
- Freshwater
- Potable

Materials

- Access to the Internet
- Pictures, objects, and Internet sites for the gallery walk
- 1 litre bottles (per 3-4 students) filled with blue water
- Measuring cups or graduated cylinders
- Salt
- Small glass containers
- Tubular pasta
- Paint – dark blue, light blue, white, turquoise
- Stickers of fish, whales, starfish, water plants, ships, penguins, polar bears, etc.
- String

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Minds On (Elicit and Engage)

Small Group/Whole Class → Accessing Prior Knowledge

Display visual prompts at centres: (1) pictures, e.g., from magazines, newspapers, books, and objects, e.g., toilet dams, water flow regulators, a brick, hand soap, a toothbrush, and (2) bookmarked Internet sites related to where we get and how we use water. Groups rotate around centres, identifying and recording information under the following headings: Sources of Water, Uses of Water, and Water-saving Devices or Strategies.

Debrief with the whole class, referring to visuals as necessary. Build a **Word Wall** from prepared cards of key words. Give time for groups to discuss what they still want to know. Facilitate sharing, recording *Want to Know* on chart paper and posting for reference during the unit. Share learning goals.

Action! (Explore and Explain)

Whole Class → Using Proportional Reasoning

Demonstrate an example of using proportional reasoning, e.g., record the ratio of female students to male students in the class, and reduce to its simplest form. **Model** the thinking necessary to determine the ratio. Provide groups of 2-3 with a plastic snack bag filled with multi-coloured, hard-shelled chocolate candies. Groups determine the ratio of one colour to another colour and reduce to its simplest form.

Whole Group/Small Groups → Conceptualizing on the Amount of Freshwater

Using a map or a globe of the earth, students estimate the percentage of the earth covered in water. (*Nearly 75%*) Express this amount as a ratio. Pose the question: *What conclusions might we draw from the fact that so much of the map is blue?*

Students estimate what percentage of the blue represents salt water, and what percentage represents fresh water. *(Most is salt water. Only about 3% is fresh water.)* Express this amount as a ratio.

Display a piece of cardboard to which is attached 100 pennies. Ask: If the 100 pennies represent all of the water in the world, how many represent fresh water? A volunteer removes 3 pennies and re-attaches them to a piece of blue cardboard. Discuss the significance of these proportions. Students represent proportions of salt and fresh water in other ways, e.g., in a pie or circle graph.

Groups estimate how much of earth's fresh water is accessible. (1%) To illustrate this amount, groups need: 1 litre of blue-dyed water to represent all the earth's water, measuring cups or graduated cylinders, an empty container, and salt.

Students:

- remove 25 millilitres from the 1 litre of water (to represent all the earth's fresh water)
- remove 17.5 milliliters from the 25 millilitres (to represent inaccessible fresh water)
- note that the remaining 1 % represents total accessible fresh water on Earth

Suggestion: Add salt to water remaining in the 1-litre container to emphasize that salt water is not drinkable (not *potable*).

Whole Class → Representing Information in a Bar Graph

Using **modeled writing**, list percentages of each type of water, and set up x-axis (types of water) and y-axis (percentages). Prompt students to create bars to represent the relative percentages of each kind.

Consolidation (Elaborate, Evaluate, Extend)

Individual → Consolidating and Personalizing

In a **Think-Pair-Share**, students respond to the lesson's guiding questions. Cue students to provide reasons and evidence for their thinking. Volunteers share with the whole group. Introduce the *Why do I care? Water Portfolio*, in which students, like scientists, document their process by collecting a variety of activities and reflections during the unit. Model writing a sample entry in response to the guiding questions. Students respond and add responses to their portfolio.

Students create a **water necklace**. Students can wear their "necklace" as a reminder of how rare and precious fresh water is.

Pause and Ponder

QuickTip
Structure Minds On activity with a **KWL**. Support posing of questions with a **Question Matrix**.

A for L Use information from observation of centre activity and debriefing, and Want to Know from KWL to inform instructional planning.

A for L If students require more practice, extend the activity with additional examples.

A for L Review *percentage*, *estimation*, and *conversion to ratios* as necessary, or note which students require guided practice.

A for L Check for understanding and, if necessary, model drawing and labeling axes (y -axis as measurement scale in percent, x-axis labeled as salt water, fresh water, or accessible fresh water), using bars to indicate percentages of each type of water.

A for L Collect portfolios and provide feedback on their responses to guiding questions.

QuickTip
Students will use their portfolios as a writing resource in the culminating performance task.

Minds On

K-W-L (I Know-I Want to know-I Learned)

The Know-Want to Know-Learned strategy (Ogle, 1986) is linked to the before, during, and after framework. KWL is a generative strategy that structures thinking processes.

The "Know" column prompts students to activate and inventory prior knowledge. It can be completed individually or collaboratively.

The "Want to Know" column prompts students to generate inquiry questions that provide a purpose for reading. It provides an opportunity to anticipate learning, to focus on inquiry as a habit of mind, and to learn about and practise posing effective questions. Learning about questions can be scaffolded, e.g., by working with the categories of Bloom's taxonomy or by providing question words, question prompts, or a question matrix. These scaffolds could be posted in the classroom as **anchor charts**.

The "Learned" column prompts students to summarize and consolidate their learning. K-W-L's can be completed individually or collaboratively.

KWL variations include

- reconfiguring the usual 3-column organizer as a 3-part square, with "Know" across the top and "Want to Know" and "Learned" juxtaposed beneath
- adding columns, e.g., "Future" ("How I will apply this learning in the future").

Link to prior learning by connecting the activity in today's lesson to previous use of the K-W-L strategy. Doing so explicitly helps students recognize how the thinking structure in the strategy transfers to other situations, a critical aspect of becoming a self-directed and self-regulated learner.

The K-W-L strategy reflects key Literacy GAINS parameters, e.g., exposing and evoking students' thinking in order to respond with appropriate levels of challenge and support. The strategy also supports an inclusive classroom environment and differentiated instruction by permitting a range of access, or entry, points for students along a continuum of difficulty, depending on the questions asked.

Online resources include the following:

Instructional reading strategy: KWL (Know, Want to Know, Learned). L517: Advanced Study of the Teaching of Secondary School Reading.

KWL. North Central Regional Educational Laboratory. Learning Point Associates.

Strategies for Reading Comprehension: K-W-L. ReadingQuest.org.

Question Matrix

A question matrix is a chart of question words and verb forms that scaffolds skill development in posing questions. Question words signal different types of information being requested. Verb forms signal a variety of tenses and moods. See the question matrix in **Think Literacy Subject-Specific Examples: Library Research, Grades 7-12**, pp. 10-11.

Word Wall

Build a word wall of water vocabulary. During centre activity and debriefing, note "water" vocabulary students generate, and post cards to begin building a word wall. Have blanks available for additional vocabulary suggested by the students. Word cards that are not posted are vocabulary that needs to be addressed by the teacher. Add words during the unit.

A word wall is an organized array of words important to the topic being studied. To be effective, word walls must be:

- visible
- accessible
- selective
- incremental, adding only 5-7 words at a time
- explicitly taught

A word wall can serve as:

- a focus for vocabulary building
- a scaffold for conversation and reading and writing activities
- a visual map to show relationships among words

Teachers need to incorporate words from the word wall regularly into instruction, cue students to use the word wall, and integrate the word wall into vocabulary building activities. In other words, the word wall is interactive, more than a display. It is possible to maximize this aspect of word walls by creating laminated word cards that can be moved around, removed, and used.

See **Think Literacy Subject-Specific Examples: Science and Technology**.

Anchor Charts

An anchor chart is a strategy for capturing students' voices and thinking. As such, anchor charts are co-constructed by the teacher and students. By making students' thinking visible and public, anchor charts "anchor," or stabilize and scaffold classroom learning. Anchor charts should be developmentally appropriate, clearly focused, accessible, and organized.

Action

Model

Modeling is a component of explicit instruction that is particularly helpful for struggling learners. According to the gradual release of responsibility model for instruction, modeling is done by the teacher and students observe (I do, you watch). This is followed by shared practice (I do, you help) and guided practice (you do, peers help), and finally independent practice (you do, I help if necessary). See the **Strategy Implementation Continuum** for a detailed chart of this framework.

Modeled Writing

Students can be supported in developing writing skills if they first see sample writing and teacher modeling, then collaboratively help the teacher write (shared writing), work collaboratively with peers and teacher support (guided writing) before independent practice. See the **Strategy Implementation Continuum** (gradual release model). If necessary, review for small groups of students by modeling and shared writing before moving to guided and independent practice.

Consolidation

Think-Pair-Share

Bennett and Rolheiser (2001) describe Think-Pair-Share as "one of the simplest of all the tactics" (page 94). As pointed out by Bennett and Rolheiser and Think Literacy (page 152), students require skills to participate effectively in Think-Pair-Share, for example:

- active listening
- taking turns
- asking for clarification
- paraphrasing
- considering other points of view
- suspending judgement
- avoiding put-downs

These skills can be modeled and explicitly taught. During group work, teachers can provide oral feedback and reinforce expectations.

Bennett and Rolheiser (2001) note additional considerations:

- the level of thinking required in a Think-Pair-Share
- accountability and level of risk, e.g., are all students expected to share with the whole group? (page 94)

See **Think Literacy Cross-Curricular Approaches, Grades 7-12**, pages 152-153.

Bennett, Barrie, and Rolheiser, Carol (2001). *Beyond Monet: The artful science of instructional integration.* Ajax, ON: Bookation.

Water Necklace

- Provide each student with 100 pieces of large tubular pasta, paper strips, or beads.
- Students paint 97 dark blue to represent salt water and decorate them with fish, whales, starfish, water plants, and ships.
- Students paint 2 of the remaining pieces white, print "ICE" on them, and draw penguins or polar bears.
- Students paint the remaining piece pale blue, print "GROUNDWATER" on it and, at the bottom edge, paint a very, very narrow band of turquoise to represent all the available fresh water on earth!
- Students string the pasta into a "necklace" with the 3 Ice and Groundwater pieces in the middle to illustrate the percentage of fresh water.