EDCI 403 - Assignment 2:
Grade 3 Students as Researchers
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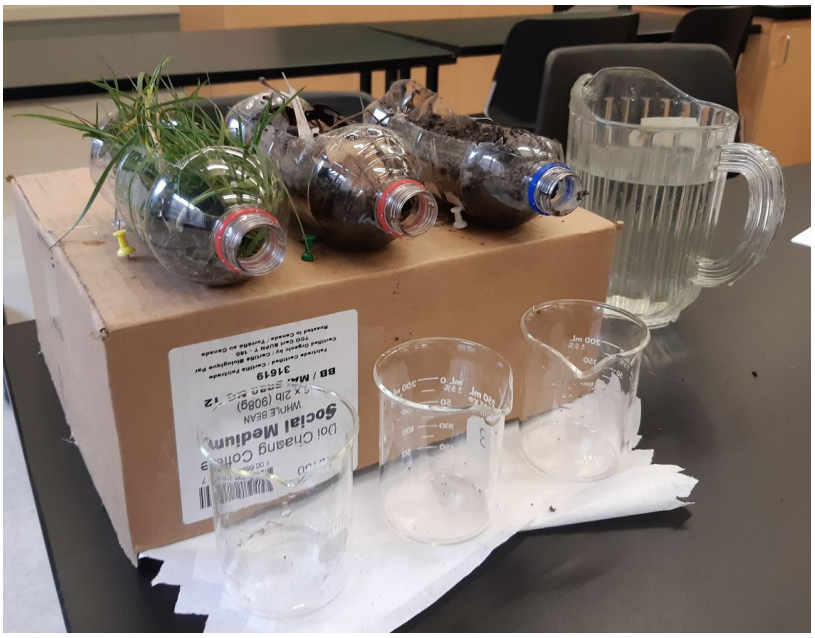
I. Introduction

The purpose of this experiment is to present a visual of water erosion to the students. The students will have an opportunity to bring in scientific thinking by making predictions and observations surrounding the ways in which rain water affects land in three different scenarios. One of the goals of this activity is to get students thinking about the real-life situations the experiment applies to, e.g. why might mudslides happen? What happens when it rains in an area where plants/trees have been cut down?
In order to carry out the demonstration, you will need the following materials:

- 3 x plastic bottles (half cut off lengthwise)
- Shoebox
- Tall thumb tacks (to keep bottles in place on the box - use them to keep the bottles from rolling, do not poke holes in the bottles)
- 3 x 250 ml beakers
- Pitcher/jug
- Water
- Grass/plants with roots in soil
- Dead leaves
- Soil

Cut each bottle almost in half lengthwise (ensure that water will not spill over the sides.) Fill the first bottle with soil in a way that it lies flat if the bottle is lying on its side. Fill the second bottle with a lesser amount of soil and place a good amount of dead leaves on the top. Lastly, fill the third bottle with the grass and roots in soil (no need to add extra soil.) Set up the three bottles by lying them on their sides on a shoebox with their spouts sticking out over the edge slightly.



General set-up for experiment, note the tacks in place, the similar sized bottles and beakers and moderate elevation of the bottles.

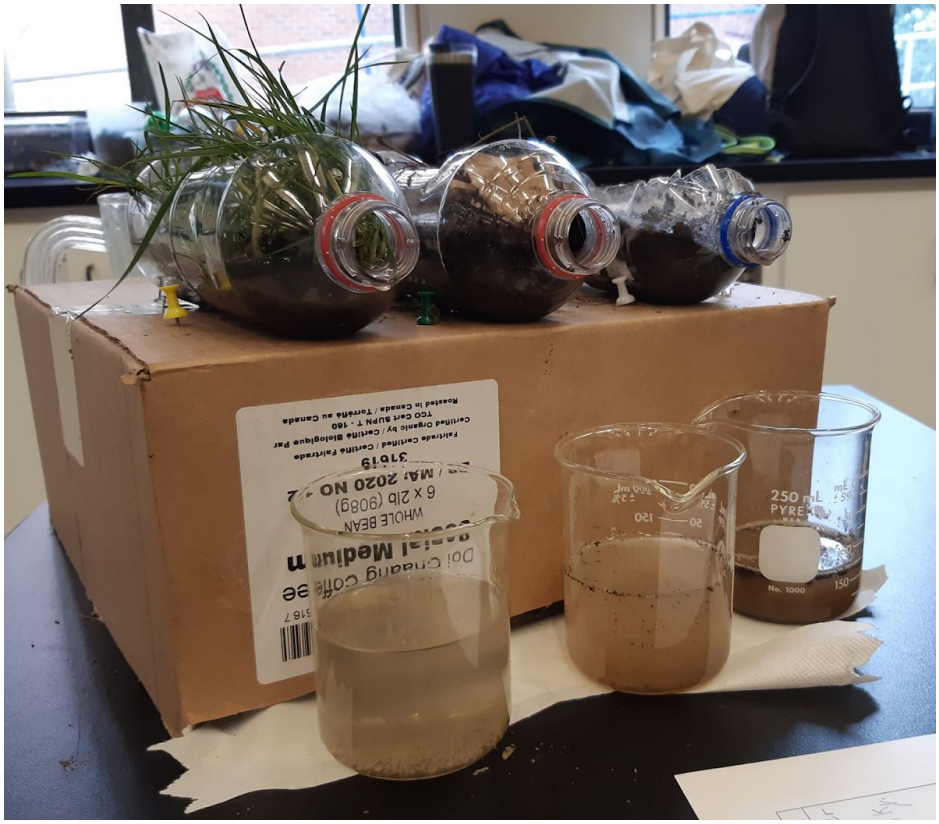
Place as many thumb tacks as necessary on either side of each bottle to keep them from rolling. Set up the three beakers on the table, next to the shoebox, positioned so that they are sitting under the spout of each bottle. These beakers will catch the drained water after water is poured into each bottle. The main part of the demonstration is predicting and observing what the water looks like in each beaker after flowing through the various types of land. Students should be presented with a graphic organizer (shown below) where they can write or draw predictions and observations as the demonstration proceeds.

Birds eye view of different landscape groups: soil, dead leaves and rooted plants.

The demonstration should be carried out as follows:

- Prompt the students to predict what might happen when rain water pours into each of the bottles. What will each of the beakers (containing the drained water from each bottle) look like for each?
- Ask a student to act as a rain cloud and make it “rain” by pouring water from a jug into the first bottle and observe what drains into the beaker.
- Write down observations and do the same for each bottle.

The soil bottle should have the cloudiest water and the plant bottle should have the clearest water. This will prompt discussions as to why this is and where this is seen in nature. Three key words students should leave understanding in connection to erosion in the environment are *run-off, filter* and *particles*.



Typical results for this experiment, the runoff getting lighter as the plant life increases.

II. Transcription

Session 2 (Teacher: Lauren):

Lauren introduces herself and presents the graphic organizers to the students.

Lauren: "Do you know what Erosion is?"

Students answer "yes" and explain they have done a unit on erosion

Lauren: "What kind of things might cause erosion?"

Students spend time thinking and coming up with answers

Lauren validates their answers and goes on to explain that rain can cause erosion. Water erodes! She gives examples, such as potholes in our roads, etc.

Lauren goes on to explain experiment:

- "What we have here are 'simulations' … or visuals"
- "The soil here is like a completely cleared mountain or space"
- She also explains the dead leaves on soil and the grass with roots in soil - making sure to point out that there are roots in the soil

Lauren: "What do you think will happen to the water when it 'rains' in each?"

Some discussion - most answers include 'mud.'

Lauren prompts the students to write down predictions for the soil bottle.

Lauren: "What are some of the words you used to predict?"

Students discuss. Answers include: mud, soil, gross, etc.

Lauren gives choice to the students on whether to do *all* predictions at once or go one by one through each bottle and carry out the observations after each prediction.

The students choose to go through each bottle one by one and observe right after they predict, with their reason being so that they can "learn as they go"
Lauren gives students the chance to pour the water and prompts one of them to do so.
A student pours water into the soil bottle
Lauren: "What did you notice that happened to the water in the beaker?"
Students discuss their observations.
Lauren: "Can you *see through* the water in the beaker?"
Lauren then places a pencil behind the beaker and asks if the students can see the pencil through the water from the other side.
Lauren: "The water is completely *opaque.*"
Lauren prompts them to write down their observations and says "give me a nod when you're ready to move on"
Lauren: "Did you write down any key words?"
The students respond with words like float, etc.
Lauren: "Excellent! Two new key words we learned."
Lauren goes on to talk about the dead leaves and prompts the students to make predictions.
Lauren discusses with students about what they wrote and asks if there's anything they want to say before going ahead.
The other student pours the water this time.
Lauren prompts another discussion by asking what they are observing. She prompts them further by asking about the colour and opacity.
Lauren gives them time to write down their observations.
Lauren prompts a discussion about predictions for the grass bottle.
One student thinks it's going to be the same colour as the dead leaves.
This time the water from the grass bottle was darker than the water from the bottle with the dead leaves.
Lauren (and Denee) point out to the students that this went differently than expected, and differently from the last demonstration.
Lauren prompts a discussion as to why this may have happened. She posits that maybe the roots already had too much water in them from the last demonstration. The students agreed.
There was less time to talk about real life situations where we would see these types of erosion, but Lauren did discuss it with the students, mentioning mudslides, and what might happen when we don't have plants or trees in an area.

III. **Discussion** (likely 2 pages)

- Talk about things learned between the 2-3 sessions

Overall we were really excited by the opportunity to gauge the level of participation in this activity with real-life students. It was incredibly valuable to note the tangible benefits and pitfalls of our elected experiment as demonstrated by our participating grade 3s. In our first group we were working with students with high written proficiency, so our allotted time didn't seem to be out of sync with their abilities. As we proceeded to session 2, it became evident that we would integrate more time for written and oral prediction making and allow for processing time in line with their own metacognition. Essentially, prompting and giving ample time to write predictions and observations is needed in order to make students see a connection between their own work and the real life demonstration in front of them.

An excellent reminder to both of us around student attention occurred during our experiment when we were confronted with the distraction of "more fun" experiments going on elsewhere. We think this is important to note given that students deserve to have some sort of internal investment in your

learning outcome, so as teacher it is your responsibility to test new ideas and tactics often to find the most engaging learning object for your lesson. When students had more autonomy over manipulating the variables of the experiment, their excitement around engaging in the demonstration clearly increased. In the future, we would definitely want to add more hands-on steps to the experiment to make it more tactile for the students, getting their bodies activated and engaged. In the future we would have them carry out far more steps in the procedure, including set-up, to increase their own investment in the experiment's outcome.

Though predictions and observations are a necessary skill in science, we would have de-emphasized the graphic organizer early on to allow more hands-on time, and then provide a longer period of time for a less stressful written period afterwards. We also would have made more engaging graphic organizers that included visuals of projected outcomes to guide student thinking and avoid making it too unfamiliar to their previous knowledge around the subject. If they are presented with a demonstration too far above their zone of proximal development, it decreases confidence in their own abilities to carry the experiment out, and what was far more important in this lesson for this age group was making real world connections to erosion rather than simply the scientific method. This is why at times it felt a touch too teacher-centered, and so next time we would try and centre the discussion more around their own wonderings.

Further, we found the room to be extremely loud which stilted discussion in many cases, particularly with less domineering students. When the room was overwhelmingly loud it disrupted the natural flow of conversation and inquiring questions posed by the students, so we weren't able to follow their natural curiosities as well. As teachers we could have elicited more information from our students by first focusing on their emotional safety around volunteering answers in unfamiliar settings and subject areas. Ideally, we would have and spend more time getting to know the personalities of the students and to ensure students felt they could answer in ways that weren't contrived or without focusing on appeasing our own notions of what they should say. We believe a longer standing relationship of academic trust will always benefit richer discussions in classrooms going forward. For the most part it was clear where their areas of understanding and confusion were based on the convergent questions we chose to pose to them.

Teacher wait time is very important to student confidence in their own responses. We observed that it is necessary to give students time to think and with ample time they will come up with more answers. Teachers should make it clear early on with their students that contemplative silence is a valuable part of the learning process and digesting new information, and so teachers should strive to resist the urge to fill these 'learning' silences with their own preconceived notions. Wait time for verbal answers was strong during our experiments as we intentionally went in with the goal of giving them conversational space to speak their predictions. Going forward, we would slow down our trajectory for the written component. Written communication is a newer skill to grade 3 students than their verbal proficiency, a developmental benchmark we overlooked in our preparation for our experiment. We weren't used to the pace they needed with their newer communication skill and in the future we should either; (a) place more emphasis on the conversation, or (b) give more time to the written/visual aids. This would better support the First People Principle of Learning that learning takes time.

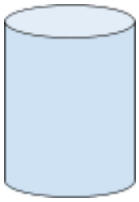
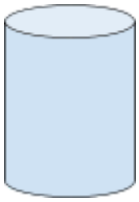
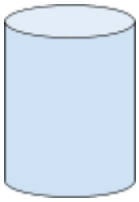
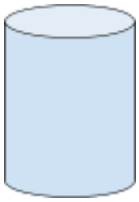
Student frustration manifested in the form of some boredom and anxiety as there was a great deal of emphasis on the written portion of our experiment. For instance, in the case of one less dominant student, I could tell she was more anxious with the quality of her work because she did not write as fast as her partner. This is a concrete example of how our emphasis on the written portion was inappropriately

matched to their cognitive age, and how students in this case would be better supported with more hands on participation. It was her in particular that made us think we needed more generous and relaxed expectations around the timeliness and the look of their written predictions, and instead have a stronger focus on tangible scientific processes. Though the cross-curricular attempt at including written fluency was well meaning, it heightened anxieties around their own scientific abilities, which were actually at a higher level of understanding than they gave themselves credit for due to their more limited written (as opposed to oral) vocabulary. All that to say, we found that our students persevered very well, humouring our scientific process well and attending to the detail required of our graphic organizer.

Our questioning strategy was largely convergent heavy, focusing on our specific learning outcomes. This limited the student-directed inquiry involved in our experiment; however, to our credit our purpose of teaching environmental runoff was clearly understood by our students by the end. This was made evident during our closing discussions with the students when we discussed mudslides, clear-cutting and water quality for wildlife. We were proud of our questions in that they were clearly grounded in our environmental purpose and pulled students in to the demonstrable effects of landscapes and run-off. At times they could be more open to interpretation when asking around bigger ideas, for instance asking broadly, “what does erosion look like?” As we got further along in the experiment, questions became more specific around particular key-learning points. These specific questions included what they saw in the beakers after the rain fall and if they could see an object (ie. pencil) through the debris to test their understanding of the results.

Graphic Organizer:

(Record predictions and observations by drawing in the beaker and/or writing it out)

	Predictions	**Observations**
Plain Soil		
Dead leaves and soil		
Grass with roots in soil