Smarter Science: A visit from Jennifer Parker, Rick Pardo and Mike Newnham

Introduction

Scientific-inquiry has been a part of school science for more than half a century [Schwab 1960, Suchman1966, Romey 1967] for good reason. Just as we know art is best learned by actively doing art, and hockey is best learned by playing the game, few would dispute that the processes of science are best learned by doing scientific-inquiry. What has been argued about for the last fifty years is interpretation of the term scientific-inquiry, as well as how it should best be approached in schools (inquiry, inquiry-based science, guided inquiry, open inquiry, open-ended inquiry and discovery learning; Chiappetta and Koballa 2010). Recently, efforts have been made in Ontario, through the revised science curricula, to guide interpretations and approaches to scientific-inquiry, specifically through the skills continua charts (The Ontario Curriculum for Science and Technology; Grades 1-8 p.15-16) . However, since many teachers have little experience with performing scientific-inquiry themselves, especially at the initiating and planning stages, they find the skills continua difficult to interpret. What these teachers are seeking is scaffolding; a framework that they can follow to take them through scientific-inquiry step by step; a guide that they can use in their classrooms to help them develop appropriate scientific-inquiry opportunities for their students.

Over the last five years, Mike Newnham, Jennifer Parker, Rick Pardo and a team of teachers at Thames Valley District School Board have been working with a framework that they developed for scientific-inquiry, called Smarter Science. This framework can be utilized effectively by teachers in classrooms from kindergarten to grade twelve. During the past five years some of us have been lucky enough to attend presentations at STAO conferences or workshops at Thames Valley from Smarter Science practitioners. Last fall at the 2009 STAO conference, Smarter Science was officially launched and materials have been made freely available through the Smarter Science library at the official website: http://www.smarterscience.ca . Since then many school boards across the province have adopted the Smarter Science framework. At the University of Western Ontario, preservice teachers have been learning to use the Smarter Science framework for scientific-inquiry. In this article we will describe a recent visit from Jennifer Parker, Rick Pardo and Mike Newnham to our junior/intermediate science education class at Western and with their permission we will share a little
of what we learned of their Smarter Science framework. Through the use of an example we will be describing how the
Smarter Science framework can be used by teachers to guide their students through the Initiating and Planning stages
of Scientific Inquiry.

Editor’s Note: It is recommended that this article be read with the Steps to Inquiry right in front of the reader – either
printed out or on a different window. It may be found at: http://www.smarterscience.ca/library. (At the General
Resources area, select “steps to inquiry” posters.)

The Class
When we entered the classroom, we were excited to see materials set out at all of the tables. The materials included
two clear plastic cups with mystery substances inside, a stir stick and two pads of different coloured sticky notes –
yellow and pink. There was also a colourful poster for each of us that outlined the entire Smarter Science framework
(Figure 1: downloadable 12 x18” poster from http://www.smarterscience.ca/library: General Resources). Along one
wall, large posters (adapted from: Goldsworthy and Feasy 1994; Buttemer 2006; Fulwiler 2007) were attached showing
the Steps to Inquiry (Figures 2-5: downloadable 8 x 11” posters from http://www.smarterscience.ca/library: NSTA
handouts 2010).

![Smarter Science Diagram](Figure 1)
To begin the presentation, Rick and Jennifer asked us what we thought was in the cups. We examined them and described their contents. “Well, it looks like we have water in one cup and I don’t know what this white substance is” answered one teacher candidate. Rick responded by asking us to pour the water onto the white powder, to carefully observe what happened, and then to write down one thing we observed on a yellow sticky note. To everyone’s delight pouring the water on the powder had dramatic results! Observations included comments like: “wow, it grew! It was sooo cool!”; “it really expanded!”; “the water’s gone”; “the water’s absorbed”; “it’s really squishy now.” Our sticky notes describing this exciting event were quickly attached to Step 1 of the Steps to Inquiry posters, under I Observe (Figure 2).

Next Jennifer and Rick asked us to think of questions we had about what we had just observed and write them on the same colour sticky notes. Our elected helper posted these notes under I Wonder in Step 1 of the Steps to Inquiry poster (Figure 2). We accumulated a wide range of questions including; “could this be used as a snow replacement?”; “I wonder what would happen if we added more mystery white powder?” “I wonder what the mystery white power is?”; “how does the water make the powder grow?”; “I wonder where we can get this stuff?” “how might I make the powder grow bigger?” Jennifer explained to us that we can sort these questions into three types (Hartlan 2001):

i. Questions that can be answered by research alone: for example, “how does the water make the powder grow?”

ii. Questions that can be answered by investigating with research: for example, “how might I make the powder grow bigger?”

iii. Questions that are speculative and cannot be easily answered by investigation or research alone: for example, “could this be used as a snow replacement?”

It is the second type of question that can lead to Testable Questions; the focus of scientific-inquiry.

In our class with our mystery white powder activity, we had identified several questions of this type. For the next step to inquiry following the Smarter Science framework, Rick asked us to think about aspects of the event that we could change that were related to one of our questions; “what might make the powder grow bigger?” We were getting used to this process and had our sticky notes prepared in no time. Suggestions included: add more water, add more powder, use warm water, and stir more. We were identifying the Variables in our scientific inquiry. We attached one yellow sticky note to each box labeled Variable in step 2(a) on the Steps to Inquiry poster (Figure 3). Rick told us that our next task...
was to decide what we could measure to find out the effect of changing this variable. Our objective was to decide “what might make the powder grow bigger” so we decided to measure “the amount of the powder produced.” We were not sure at this point how we wanted to measure the amount, we thought of “the height of the powder produced” or the volume of the powder produced.” This time instead of writing each of our ideas on a yellow sticky note Rick asked us to write each on a pink sticky note. He let us know that the reason for the different colour sticky notes would become obvious really soon. We were happy to oblige and we posted our pink sticky notes saying; “the volume of the powder produced” and “the height of the powder produced” to the two boxes labeled Measure/Observe in step 2(b) of the Steps to Inquiry poster (Figure 3).

The next stage of the process created a “eureka” moment for some of the class because our work with the sticky notes started to really make sense. Rick asked us to decide on one variable that we would change in our inquiry – we decided on “the amount of water that I add” so Rick moved this yellow sticky note from section 2(a) of the Steps to Inquiry to section 3 (Figure 4) – top of the poster labeled – one thing [variable] I will change is ...... So that we had completed the sentence to read: One thing [variable] I will change is “the amount of water that I add,” on a yellow sticky note. As well, Rick asked us to choose which thing we wanted to measure. We decided that measuring volume was the best way to go so Rick moved the pink sticky from section 2(b) to the top of the poster for section 3 (Figure 4) and placed it in the box entitled: I will measure or observe this result: ...... This sentence was therefore completed to read: I will measure or observe this result: The volume of the white powder produced, on a pink sticky note. Next Rick moved all of the other yellow sticky notes in the boxes labeled “variable” in section 2(a) of the poster, to the boxes labeled “Unchanged Variable” in section 3 (Figure 4) – we had, almost miraculously it seemed, identified all of the variables which we must control in our experiment!
We were now ready to phrase our testable question by moving our two key sticky notes one more time from the bottom of step 3 to the top of step 4 (Figure 5) of our Steps to Inquiry poster, which read: “What is the question I want to explore?” By moving our sticky notes to the appropriate boxes to step 4 of the Steps to Inquiry we had phrased our question. Our question was: “If I change the volume of water that I add, what will happen to the volume of the powder produced?” The variables that we needed to control were the initial volume of the powder, the temperature of the water and the amount of stirring. Not only did Jennifer and Rick go on to complete the twelve Steps to Inquiry with us but they also demonstrated how we could help our students develop literacy and numeracy skills through the Smarter Science framework. Then Mike Newnham took over.

Mike explained the need for a change in science education to suit the requirements of students who will be competing for jobs that require higher-order thinking skills. It is scientific-inquiry that engages students to develop these skills. Mike shared his hopes for bringing scientific-inquiry to all students in Ontario. The Smarter Science framework is designed to help teachers throughout the province achieve this goal. Free access to Smarter Science materials is now possible through the Smarter Science website.

The teacher candidates really appreciated the visit from Jennifer, Rick and Mike. I would like to end this article with some of their comments. It is comments such as these that give us hope for the future!

- I’ve seen in my placements already the success that can come from students performing guided inquiry experiments and the joy of the experience for them and I can’t wait to see how they are when they break the surface of self-directed inquiry. Greg Ryerson: Teacher Candidate
- I think this was a very valuable experience that made me realize that I can give the students the control and that this is feasible to do in the classroom. Francois Mayotte: Teacher Candidate
- During my practicum in April I’m going to be trying out a Science Club - ... to stimulate some interest in Science, develop a positive attitude and develop some inquiry-based thinking. Sherri Young: Teacher Candidate
References


