2016 - 2017 AESN / NOII Case Study

School Name: Nanaimo District Secondary School

School District: SD#68 Nanaimo-Ladysmith

Inquiry Team Members: Mary Anne Perkins and DJ Thompson

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Type of inquiry: NOII

Grade levels: Secondary (8 - 12)

Curricular area(s): Mathematics / Numeracy, Science

Focus area(s): Core competencies (for example, critical thinking, communication, problem solving), Formative assessment, Inquiry-based learning, STEM / STEAM

In one sentence, what was your focus for the year?

New K-9 Curriculum: We are developing and implementing inquiry based learning units for the new Science 8 Curriculum.

Scanning: Briefly summarize your scanning process. How did you use the four key questions as part of the scanning process? What did you notice about the experiences of your learners that were most important to your team?

Through in-class observation, many students appear apathetic towards their learning. Closed binders, on their cell phones and off topic side conversations were observable. Through conversations, many students report that classes are boring, have no point and are unclear of "why teachers gave them their mark?" The key question that arose is the frequent "Why do we have to learn this?" and this is what stimulated our inquiry.

Focus: In a few sentences, explain why you selected this area. What changes were you hoping to obtain for your learners?

The focus of our inquiry is based on the new curriculum and its emphasis on inquiry-based learning. The new 'big ideas' in science brings greater local importance and context to learning the content and therefore an area that we hope we can engage students by giving

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them personal relevance for learning about the topic.

Students easily disengage from their learning for various reasons, such as finding the content not relevant to their lives, not interesting, even boring, and too difficult to understand and master. Students are further distracted by their peers and electronic devices. Increasing student engagement has been shown to result in deeper and more meaningful learning and greater achievement and success. This in turn spirals into greater engagement. Students then begin to take ownership of their learning.

Hunch: Describe your hunches about the ways in which practices at the school may have been contributing to the experiences of your learners that were of concern to you.

Traditional science classes have been stand and deliver from chapters in the textbook along with videos and 'hands-on' labs to reinforce learning. In this style of teaching and learning, teachers are the givers of information and students are the receivers. This method fails to engage students in the real purpose of science which is to learn how to think and act like a scientists and how scientists investigate ideas through questioning, investigation and exploration.

New professional learning: What new areas of professional learning did you explore? What resources were most helpful? What specific designs did you use to support the learning of your colleagues?

To support this inquiry, we investigated inquiry based learning techniques, Understanding by Design (backwards planning), and review our understandings around assessment for, of and as learning. This will help us create differentiated learning opportunities to engage students. We will also work with our district to review planning tools to implement the new curriculum. To support the learning of colleagues, co-teaching was implemented, learning resources were shared, release time was used to develop the inquiry process and weekly PLC time was used to share and discuss the process.

Taking action: Describe strategies you and your team decided on and how your actions worked out.

Creating units of inquiry, is more constructivist with students at the centre of the learning and allows the teacher to model the learning process. Together teachers and students search out answers to scientific topics in a more collaborative learning community. This will hopefully engage students more deeply and empower them to become greater owners

of their learning.

As many students were not experienced in using the inquiry-based method of learning, I spent the first two weeks of the guided inquiry unit modelling for the students the process and the skills necessary for inquiry in order to build a culture of inquiry within the classroom. Key factors included approaching the inquiry with enthusiasm and excitement, using the language of inquiry, facilitating the process by discussing, clarifying, supporting and monitoring, modelling questioning behaviours, evaluating the process, and using technology to support the process. The role of guided inquiry in the intervention was through students forming expert groups and then collaborating and teaching others in the class. This was followed by a research question (a Big Idea) and lab activities that supported the learning standards and curricular competencies for the Science 8 curriculum (Alberta Learning, 2004; British Columbia Ministry of Education, 2015). Throughout the process the teacher monitored and guided student learning, allowing student's freedom in the way they acquired knowledge. Group work and collaboration were encouraged.

Checking: Summarize the differences you made. Were they enough? Were you satisfied?

During the first Inquiry unit, student behaviour was a definite concern. Many students were not happy and resisted the process of inquiry. They did not understand what was expected of them and continually asked for notes and worksheets. They wanted to go back to traditional methods of instruction. We feel this was because students were unfamiliar with the inquiry process and not accustomed to being responsible for their own learning and the learning of others within a classroom community of learners.

In hindsight, the students were not well prepared for the inquiry process. The language and skills required to perform inquiry should have been established prior to initiating the inquiry.

Guided inquiry was defined as learning through the Inquiry Model (Donham, 2001) and described in depth in Focus on inquiry: a teacher's guide to implementing inquiry-based learning (Alberta Learning, 2004). The methodology of the Inquiry Model is that students are not passive learners, merely listening and reading but are actively involved in developing their own understanding from their observations and experiences. This includes their skill development, analysis and evaluating evidence, experiencing and discussing, and talking to their peers about their own understanding. The emphasis is on students working together in a supportive collaborative environment rather than working alone in a competitive environment (Alberta Learning, 2004). Use of the Inquiry Model has

demonstrated improvement in student engagement and attitudes toward science and has been shown to contribute positively to students' academic achievement (Bybee & McCrae, 2011; Donham, 2001).

Two different science units were taught to both science classes. Each unit took approximately six weeks. The first unit to be taught was Plate Tectonics and Class A was taught with guided inquiry methods. This involved students collaborating to make expert groups, forming inquiry questions and them working on individual research projects. For this inquiry-based unit several materials were developed; a teacher instructional plan for Plate Tectonics, a student's science 8 Plate Tectonics Road Map, an Expert Groups assignment and formative assessment rubric, and a Research Project (Big Idea) assignment and formative assessment rubric. Class B was taught with traditional methods and used worksheets from various textbooks and instructional material. Throughout this unit, both classes used formative assessments and at the end of the unit students were surveyed with the instrument and a final summative assessment test was performed. The next unit was Microorganisms and this time Class A was taught by traditional methods and Class B was taught with guided inquiry. Again, inquiry-based materials were developed for this unit, formative assessments were used, and at the end of this unit students were surveyed with the instrument and a final summative assessment was performed. At the end of the course, the students in both classes were given a final exam assessment to determine their retention of the content that they learned during each unit, and then answered an open-ended question asking their opinion on how they learned science during the semester.

After students had completed both inquiry and traditional instruction units, the majority of students preferred inquiry-based learning over traditional instruction, and reflected that future science courses should be structured using inquiry-based learning strategies. This was determined from Likert-type surveys that assessed student's cognitive, behavioural and emotional engagement. Open-ended questions that the students completed after the inquiry unit assessed the student's favourite way to learn science, how interested they were in the science unit, how well the students learned the content (self-assessment), and did they feel the instructional method decreased the difficulty in learning the content. They also completed an exit question asking which instructional method they preferred (traditional vs inquiry).

The students preferred inquiry-based learning over traditional and showed greater emotional, cognitive and behavioural engagement. Both classes valued the inquiry process. The exit question showed that over 75% of the students expressed that inquiry-based

instruction made science more interesting, fun, and enjoyable. They also reported they understood more. About half of the students responded that they felt like they learned how to do new things, that science was easier to learn and there was more help from the teacher. These were all very positive responses to inquiry-based instruction.

Reflections/Advice: Finish by sharing what you learned from this inquiry, where you plan to go next, and what advice you would offer other schools with a similar interest.

I was genuinely surprised by the success of inquiry-based instruction, not only on the academic achievements of the students, but in their engagement and desire to learn more. This instruction technique was shared with department members in the second semester of the school year.The unit plans on Plate Tectonics and Microbiology were used by three teachers in the school and the same process was used to develop a unit on Light.

I am currently working with colleagues to expand the inquiry process in the school as it had such positive results. The learning that I took away from this experience was the importance of student voice and the inquiry process. I shall not be relying on textbooks or the standard tradition methods of instruction. There will be more scaffolding of the inquiry process throughout the school year and from grade to grade so students will be more fluent and confident with this instructional method. Next year I plan to develop more Inquiry-based units for the rest of the Science 8 course and the Biology 12 course. If there is an interest I would offer a Professional Development for science teachers on inquiry-based instruction.

Recently, I am coordinating a school-wide inquiry with the Student Spaceflight Experiment's Program (SSEP), NASA, the Smithsonian and vancouver Island University. This will involve Science, Biology, Chemistry. Physics, English and Mathematics teachers mentoring students to design an experiment, one of which will be on the International Space Station in the spring of 2018.

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