Towards a Post-Modern Science Education Curriculum-Discourse: Repetition of a Dream Catcher

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Addressing the current crisis for renewal in the discourse of school science education may require moving from recollection of past modernistic approaches to curriculum change towards new, post-modern possibilities. Kierkegaard describes this movement as ***repetition***, a type of dynamic conversation between groups where the sharing of knowledge and experience becomes an on-going questioning that may reveal possibilities for change in a curriculum-discourse. This paper provides an example of this repetition through a presentation that weaves a personal account of instructing a group of beginning teachers, all of aboriginal ancestry, with the metaphors of a journey and the preparation of an aboriginal dream catcher. The conversations that arise from this weaving suggest change in the curriculum-discourse of science education is a journey of being made possible as participants in this curriculum-discourse share, discuss, and examine differing cultural viewpoints.

Aborder la crise actuelle du renouvellement du discours de didactique des sciences peut impliquer de passer du rappel des approches modernistes passées quant au changement curriculaire aux possibilités post-modernes. Kierkegaard décrit ce mouvement comme ***répétition***, un type de conversation dynamique entre des groupes où le partage des connaissances et de l'expérience devient un questionnement continue qui peut révéler des possibilités de changement au niveau d'un discours curriculaire. Cet article constitue un exemple de cette répétition par une présentation qui relie une expérience personnelle d'instruction d'un groupe d'enseignants débutants, tous d'origine aborigène, les métaphores d'un parcours et la préparation d'un *piège à rêves* aborigène. Les conversations qui ressortent de cette mise en parallèle suggèrent que le changement dans le discours curriculaire des sciences de l'éducation constitue une entreprise de l'être rendue possible par le fait que les participants partagent, discutent et examinent des points de vue culturels différents.

Introduction

"First, you take an offering to the tree."

"An offering?"

"Yes, because for everything you take you must give something back."

The journey from home to a northern community takes just over one hour when you drive, longer when the snow blows across the highway. Each Thursday I drove to this community to teach an introductory course in science teaching methodology to students pursing a teaching career through a Native Teacher Education Programme (NTEP). I was nervous about this new assignment for two reasons. First, I was new to the area and unfamiliar with the roads and demands of travelling. Second, although I had taught undergraduate university courses in science education teaching methods before, I had yet to teach a class of students all from an aboriginal inheritance. When offered the chance to teach a course in the NTEP programme, my colleagues enthusiastically told me to take it, assuring me that it would be an experience I would never forget.

The first week at NTEP went well and I was welcomed by administration and students. The students were shy at first, but soon entered into the spirit of the opening science education activities I had planned. That day I was struck by the familiar: the activities and the students' responses were similar to others I had taught at universities. Sure, the drive to and from the northern community was beautiful, but hardly enough to be called an experience I would never forget. As I loaded the car the following week for my second trip north, I wondered what my colleagues had meant. I had just closed the lid to the trunk of the car when a snowflake fell on my nose. "Oh, great!" I thought, "I hope the weather isn't changing." It was, but the heavy snowfall during this trip was only the beginning of the changes I was to experience on my journey there and home again.

Modernity and Change in Science Education

"What do you mean by an offering?"

"We call it the Law of Circular Interaction. This is the law of our people. We believe that since all animal life forms depend on gifts from the Creator, the sun, the wind, the water, and food, everyone should practice a policy of taking only what you need and being thankful."

"When you gathered these branches, what did you leave for an offering?"

"I leave a gift of tobacco. That's one of the most common gifts. The important thing is to realise that you are each giving a gift. The tree has given you one of its branches, so you must also give the tree a gift. It is more than saying thank-you to the tree and the Creator of all things, however. It is what you must do, a way of remembering that for everything that is taken out of nature, something must be put back."

The weather that morning became steadily worse. At the half way point in my journey north snow and wind conspired to make visibility very limited and soon I could hardly see more than a few metres ahead. As I continued my journey at less than half my original speed, the swirling snow formed a deep, white mist that blocked all other ways of seeing. Still driving cautiously, I began to recollect another time in my life when I had encountered such a mist.

I used to sponsor an annual overnight camping trip in the mountains for senior high school students. During one particular trip we decided to hike down to a small lake nestled in a mountain range. We reached the lake easily enough, but during the climb back a thick white mist, very much like the blowing snow on my drive north, rolled in and somehow I became separated from the main group. Still, I had come to feel familiar with the surroundings and landmarks after so many hikes in the area that I felt confident I could find my way out, even in the mist. I forgot a key rule of mountaineering and foolishly continued to climb. Eventually the mist lifted revealing that somehow I had climbed onto a small ledge completely opposite from where I should be. Even worse, below was a sheer drop of perhaps 500 metres directly into the lake. In terror I realised I was trapped with no apparent way out! I clung to the ledge, wondering what to do.

As I travelled slowly north in the swirling snowstorm that morning, my reflection of my entrapment on the mountain ledge began to change from recollection to repetition. Kierkegaard (1843/1983) distinguishes between recollection and repetition by arguing that both are movements, except in opposite directions: "For what is recollected has been, is repeated backward, whereas genuine repetition is recollected forward" (p. 131). Recollection, Kierkegaard suggests, embraces the hope that springs from efforts to preserve what has been or from the rush to embrace the newest fad. Kierkegaard compares this recollection to an old garment that no longer fits but still is beautiful. We can, he argues, never really go back to wearing our old garments again and yet he warns us to be wary of offers of new garments.

Neither, suggests Kierkegaard, may encourage the "actuality and the earnestness of existence" (p. 133) found in repetition.

Caputo (1987) suggests that when Kierkegaard uses the word repetition he never means "the re-production of the same" (p. 3) but instead refers to a way of being, a "creative production which pushes ahead, which produces *as* it repeats, which produces *what* it repeats, which makes a life for itself amidst the difficulties of the flux" (p. 3). Repetition is thus an attempt at "keeping the difficulty of life alive and with keeping its distance from the easy assurances of metaphysics and the consolations of philosophy" (p. 3) either as the old garments we once wore or the latest fad. Repetition is rather a continuous change that flows from a radical hermeneutic of being. This hermeneutic is a type of dynamic conversation, an on-going research project that seeks to open questioning rather than prematurely close research through quick and seemingly easy answers (Carson, 1986).

Recollection moved to repetition as I considered how my experience on the ledge while hiking reflected our modern situation. Dramatic scientific discoveries and technological innovations during the past two centuries reinforced the modern belief in progress as "men and women could see wealth increasing on all sides, while science and technology seemed to make all things possible for humanity" (Johnson, 1991, p. 360). The primacy of scientific knowing to human progress and freedom led to the logical extension of scientific methods in attempts to understand and shape human sociological organisation, psychology, even pedagogy; indeed, during the last and present century every aspect of life was seen as potentially benefiting from a scientific and technological approach.

Yet the modern promise to liberate humankind from ignorance and irrationality through science and technology has become increasingly suspect in the light of recent world events (Rosenau, 1992). In the twilight of the 20th century we find planetary environmental degradation, world wars, world-wide poverty and hunger, and questionable technological innovations, such as nuclear weapons, have undermined modern confidence in the inevitability of human rationality or social progress (Mercer, 1990). A certain hesitancy characterises our approach to the future; it is as if humankind has climbed the mountain of progress confident in science and scientific approaches despite the growing mist, but now we find ourselves on a dangerous precipice, the night is approaching quickly and there seems to be no clear direction out of our situation.

Education has, since the 1950s, joined this climb through the development of scientific, technical-rational approaches to curriculum change

(Aoki, 1985). This approach has emphasised the generation of global meta-theories of educational progress that defines all types of curriculum change as a problem best solved by the application of scientific principles. Despite the growing mists of doubt about the actual value of technical-rational meta-theories, educational discourse still clings to the promises of modernity, investing hope that through scientific methods the correct formula to ensure curriculum change will eventually appear (Blades, 1994; Cuban, 1990).

Heidegger (1954/1977) suggests, however, this hope may forever be misplaced. In his essay, "The Question Concerning Technology," Heidegger proposes that scientific-technological approaches are more than a means, or way of acting, but reflect the definition of who we are and how we think; that is, our very being. Heidegger claims this defining is active and dynamic, an enframing (*Gestell*) that limits possibilities for seeing in any other ways than technological. Heidegger prophesied that unless we soon find new ways of seeing and thinking all humankind is deeply and fundamentally in danger.

Heidegger's insight has serious implications for science teacher education. Many science educators today agree that science education must change if children are to learn to address the issues they face now and must deal with in the future as members of a democratic society (Aikenhead, 1983; Duschl, 1990; Hurd, 1989; Klopfer & Champagne, 1990; Science Council of Canada, 1984; Suzuki, 1989; Yager, 1992). Developed in the cauldron of post-World War II politics and exported world-wide, British and American science education curricula have served faithfully for decades in the colonisation of modernity until eventually this curriculum-discourse had a life of its own, disconnected from changes within science and the voices of children, their teachers, and teacher-educators (Kass & Blades, 1992). Suzuki (1989) notes that the consequence of this effect is that while the "most important issues that the next generation will have to contend with will result from science and technology" for many children today "the way science is taught in school turns them off, and too many have stopped taking any science courses midway through high school" (p. 190).

Those who teach children science may be one possible location for changing science education curricula. In their dual responsibly to critically assess, interpret, and develop curricula in science education as well as ensure through their teaching that children develop an authentic view of science as a human and social activity, teachers are in the position to develop with their students relevant science curricula (Bernie, 1991). Teachers of the next generation of science teachers, such as professors at universities, can encourage beginning teachers to develop authentic views of science and

critical views of their role teaching children science; science teacher educators and their students are thus in the task of changing the curriculum-discourse of science education together.

If Heidegger's assessment of our modern situation is correct, this joint task of change may be frustrated by a recollection of vision in science education that is enframed by modernity (Blades, 1990, 1992). Change in science education curriculum-discourse may require a repetition that moves beyond the entrapment of modernism; a movement to a postmodern science education curriculum-discourse. I will not attempt to define the term postmodern; as Huyssen (1990) reminds us, "the term *postmodernism* itself should guard us against such an approach" (p. 236). Instead, I will use this word and retain a hyphen to symbolise *post-modernism* as an attempt at "breaking away" (p. 236) from modernity with/in a particular discourse. Such an approach in science teacher education may be disquieting and unfamiliar: philosophers observe that in post-modernity we are asked to abandon the idea of a rational and autonomous human subject, the metaphysical privilege of scientific theoretical thinking, belief in value of any meta-theory, and any notion that a single right practice exists (Lyotard, 1979/1984; Madison, 1988; Vattimo, 1985/1988). Clearly, a post-modern approach will not enable us to propose a general theory of science teacher education! Instead, the move towards post-modernism begins with an "archaeology of modernity" (Huyssen, p. 260) that involves, through constant questioning, the deconstruction of the discourses we participate in and form, so that new discourses can constantly appear: a type of repetition.

The First Repetition: Developing Authentic Views of Science

> *"Does it matter what kind of tree you use?"*
>
> *"Yes. We use the red willow."*
>
> *"Why?"*
>
> *"This tree is sacred to us. It is used in making the hoops for the hoop dance. We call it the Tree of Life. It is the first tree Mother Earth calls in spring. So, the hoop means spring time to us and reminds us that Mother Earth is caring for us."*

I finally made it safely to the northern community, just on time. For this second visit I intended to demonstrate to my students through hands-on activities how the human activity we call science proceeds naturally when

children discover scientific ideas on their own. To do this I contrast the icon of the scientist in a lab coat and single-person demonstrations of science principles with total class discovery of these principles. First, I dressed formally in a lab coat and briefly lectured to the NTEP group of beginning teachers the effects of acids and bases on the indicators phenolphthalein and bromthymol blue. The students duly took notes (although not asked to) and were very, very quiet as I demonstrated the scientific principles behind chemical indicators. I knew that most, if not all, of my students were experiencing the traditional curriculum-discourse of science, embodied in a male wearing a lab coat.

Removing the lab coat I then directed my students to the back of the room. On a table were several table glasses full of the juice from a red cabbage and a large assortment of household products and foods, such as dish detergent, vinegar, mustard, oranges, and hand soap. Students were instructed to discover how these substances respond when you add a little cabbage juice to each. Soon laughter and noise filled the classroom. I did not have to form the class into groups or tell them to get paper towels for the inevitable messes that resulted. Nor did the students need instruction on taking notes: Everyone seemed to know what to do. Soon the changing colours of the cabbage juice formed a pattern and we gathered together to discuss what was discovered. Apart from the realisation that cabbage juice makes an exceptional, biodegradable indicator, students volunteered how much more fun it was to discover how this indicator works on their own. Several shared how the activity helped them understand more clearly what an indicator was and everyone agreed allowing children to discover a science principle was a more effective instructional approach than simply lecturing. I reminded these beginning teachers that I had seen children as young as those in Grade 3 do this very same activity with little mess and excellent self-organisation. We ended this first half of the class with a discussion on the work of scientists. I reminded my students that the act of discovery is what scientists do; science, according to Canadian Nobel Laureate J. Polanyi, is like "a child learning to walk ... it's an impulse to adventure into the world and embrace it" (1988, p. 1). I suggested to my students that it is precisely this sense of adventure that is often missing in school science. Our discussion turned to ways to bring a sense of discovery back into classrooms and how to help children feel the thrill of their own discoveries by allowing them to be scientists. NTEP students that day began to capture a vision for what science is and what science education might be, moving their recollection in science from my initial demonstration of indicators towards a repetition as they critiqued traditional ways of teaching children science.

The Second Repetition: Dream Catchers

We decided to take a short break. As we filed out, some students continued discussing the class. These students shared that they had been afraid to teach children science but now were beginning to see that teaching science could be fun. Their joy in scientific discovery was delightful and I anticipated the session after the break, an example of lessons on magnets and magnetic fields, would prove to be just as successful.

As I filled my coffee cup, my thinking drifted back to the drive north and my musings on change in science education. I admit I felt very self-satisfied. After all, had not I just helped introduce in this last lesson a critique in science education discourse by illustrating through an activity that science is something humans *do*, something more than lectures or reading assignments? Even though a participant in a science education curriculum-discourse rooted in modernity, I believed at that moment I was contributing to change in the discourse through the teacher education programme at NTEP.

In my self-assurance and arrogance I had forgotten Aoki's advice that in order to transcend the technical-rational instrumentalism of modernity in a curriculum orientation one must enter into a dialectic process (Aoki, 1988). This process is impossible, however, when communication is in one direction. I came to the students in the NTEP programme with the same approach and attitude I came to with my students enrolled at a university: I believed the lessons I had designed would encourage students to develop a view of science and science education different enough to precipitate a change in the curriculum-discourse of science education. In other words, my lessons were imperialistic in that the vision I sought to establish with my students was *my* vision, elevating my particular perspective to the level of meta-theory. In this movement I had slipped comfortably and easily into the defining activity of modernity: Repetition became recollection as I sought to dominate the curriculum-discourse and force it to change. Although I was to realise this more fully on my journey home that day, the seeds of this realisation were planted when I decided to join my students in the lounge before resuming our class.

I sat beside a student who had just fashioned a long branch into a hoop. Completely fascinated, I watched as my student tightly tied a long piece of sinew in eight places on the hoop, forming an octagon within the hoop. She continued to tie the sinew midway along each side of the shape, forming an increasingly smaller network that bore an uncanny resemblance to a spider's web. I asked her if she intended the pattern she was weaving to resemble a spider's web. She smiled and said simply, "Yes."

"Why a spider's web?" I wondered.

"We call the spider 'Grandmother Spider.' Spiders are patient and teach us that if we watch and wait, then we will be strong indeed. The parts of the Spider have meaning, too." Still weaving, she continued, "Four of its legs refer to the four sacred directions, or the four Grandfathers. The other four legs refer to body, soul, mind, and wholeness. The body of the spider teaches us about male and female balance."

It was at this point I became intrigued by the depth of the symbolism in the design she was making. "Could someone use something other than sinew, say string, for the weaving?" I asked.

My student smiled. "You could ..." she confirmed, "but sinew is special. It reminds us that an animal gave its life, and this giving of life is not to be taken lightly." As she finished the hoop my student reached into a bag and brought out a small jewel. She deftly attached the jewel to the centre of the hoop.

"That would represent dew on the web, right?" I ventured.

"At one level, yes. The stones placed at the centre have meaning. This one, for example, is white and represents love. I'm giving this dream catcher to my niece who was just born."

As I walked with this student back to our classroom to begin the second half of the lessons for that day I thought about dream catchers. Could a physical object determine the direction of dreams? Are physical and spiritual dimensions in life brought together and influenced by objects, such as dream catchers, made in faith, deep and long-experienced symbolism, and love?

Certainly the whole approach to making dream catchers serves as a powerful reminder of the deep and profound ways humankind is connected to our planet. Imagine if our culture was founded on beliefs in the value of studying the rhythms of ecosystems, was dedicated to replacing that which is taken from the Earth, or considered products from trees and animals as gifts instead of viewing living and nonliving forms as resources to be exploited in the name of progress. What if we were to bring to question and exploration the thought embedded in dream catchers that there exists a spiritual nature to people and this nature does not exist separate from the universe but, in some mystical way, is part of it. In my thinking I was not suggesting that everyone should adopt a particular aboriginal perspective to the cosmos. Such a notion

presents a generic view of aboriginal groups and melts cultural differences that exist between various aboriginal groups. Further, such a movement would create a meta-theory that defines how people should see the world, thus falling into the entrapment of modernity. No, my thinking simply presents questions to explore, musings for consideration, an invitation to repetition by considering in a discourse those voices still able to see the world in different ways.

The Third Repetition: Magnetic Fields and the Spirits of Ancestors

The second part of the lesson taught beginning teachers how to lead children in discovery learning using magnets as an example. I arranged the beginning teachers into ten stations. Each station had some equipment and a card with brief instructions prompting an exploration of a particular aspect of magnetic phenomenon. I always enjoy watching adults intending to teach children as a career rediscover the properties of magnets; soon the class was full of discussion, laughter, and excitement. After everyone completed all ten stations we discussed how children might prepare booklets about magnets from these activities and possible ways of incorporating science discovery into other subject areas, such as Language Arts.

The lesson concluded with my favourite activity. I asked the students to gather around a table as I spread a large sheet of paper over a large bar magnet. With the students watching, I gently sprinkled iron filings over the paper. The filings attract to the poles of the magnet, forming a beautiful pattern of the magnetic field generated by the magnet. I reminded students that our planet is also a giant magnet, with similar magnetic fields, called the Van Allen Belts, that extend around the Earth into space. "Dangerous particles given off by the Sun," I continued, "are trapped by this magnetic field and then sucked into the strongest areas."

"That would be the poles, right?" A student ventured.

"Exactly!" I replied. "When the particles enter the upper levels of the atmosphere, they interact with the atmosphere to form what we call the Northern Lights. "So," I continued, "when you see the Northern Lights you are seeing not only a beautiful phenomenon, but also the atmosphere of the Earth in action protecting us from radiation from the Sun."

I normally find students usually quite excited and interested in this science concept, but my NTEP students responded to this last point with complete silence. I looked around and asked if anything was wrong.

One student finally shared with me that ever since he could remember he has been taught that the Northern Lights are the spirits of ancestors coming to visit.

"The ancestors are elders," one student explained, "they are telling us how they feel." Soon student shared more stories and beliefs about the Northern Lights, such as the belief that these lights are ancestral spirits dancing before the Great Spirit. As we sat and discussed different views of the same phenomenon, I realised how science provides one way to understand the cosmos, but perhaps not always the only way. Our class ended on a promise to allow more class time in the future for discussions on Aboriginal ways of seeing the world and how these views compare and contrast to typical scientific views.

The class was not over, however. Several students remained to discuss further the Northern Lights. Many told me that when they were children their parents told them these lights were the spirits of ancestors checking at night to see who had been misbehaving. To these students, the Northern Lights always filled them with dread. The scientific explanation that the Northern Lights can be seen as an elaborate and beautiful protection system seemed to these students a refreshing change of perspective.

Conclusion

"So," I asked, "how do dream catchers work?"

"Dream catchers," my student told me, "are a gift of love. They are given to someone you care for in the hopes that their dreams will be fulfilled. You see," she explained, "we believe dreams come from our ancestors." I nodded, beginning to understand as she continued, "these dreams may be good or bad. When a dream catcher hangs near the window the good dreams are allowed to pass through while those that are bad are caught in the webbing."

"What happens to the bad dreams?"

"The sun rises and purifies the dream catcher, evaporating the bad dreams away."

"Just like the dew on a spider's web?" I asked.

My student smiled. "Exactly," she said.

As I stepped into my car for the return trip home, I thought that my colleagues were correct, after all; teaching in the NTEP programme was an experience I will never forget. Well aware that in my role as a science teacher-educator I was also an ambassador of science, my hope was that the introduction of conversations of critique with beginning teachers might introduce change in the science education curriculum-discourse. Through my involvement with students at NTEP, this missionary approach to my teaching moved from recollection to repetition as my students shared with me voices that still reflect ancient wisdom forged through experience while I shared with them in turn other ways to see the activity and ideas of science.

On the drive back home that day my thoughts returned to my experience hiking with the students and to what it felt like to be trapped on a treacherous precipice. I know I yelled for help, because after a few moments a student heard me and began to give me directions out of my predicament. I had to trust her advice since mist obscured the path she told me to take. At one point the student told me to take a short step. She assured me that even though I could not exactly see where I was going from her position she could see the way clearly. I had to trust this voice in the mist; soon I safely rejoined the main group.

This recollection of how I trusted the voices of others in the mist became repetition on my drive home. What began as a teaching assignment became a journey of possibilities for teacher and students through a conversation of science and distinctly nonscientific ways of seeing. We had begun, it seemed to me that day, to prepare through conversation our own dream catcher that moved the recollections of two different cultures towards a repetition that may encourage a post-modern science education curriculum-discourse. I had travelled in a circle that day, but returned changed in ways I can not clearly explain. In that change recollection became repetition and with it the conviction that change in the present science education curriculum-discourse is possible still.

She held up the now completed dream catcher.

"It's beautiful," I volunteered. "I hope your new niece will now have only good dreams."

My student looked thoughtfully at me. "Thanks," she replied, "she will."

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