“Trees Don’t Sing! ... Eagle Feather Has no Power!”—Be Wary of the Potential Numbing Effects of School Science

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INTRODUCTION

Let’s start in the middle. (Aamodt & Bazzul, 2019)

Three family conversations prompted the writing and the title of this essay. Each of the conversations happened at different times with each of my three children when they were 8, 11, and 13 year old, respectively. Although having little firsthand experience of my children’s science classes or their experiences at school in general, I could not help wondering about how much their formal education has played a part in the responses they gave me that have somewhat alarmed me not just as a parent, but also as a science educator. Let me first share the three conversations.

Conversation 1

A mid-summer afternoon, 2018, wind was gusting at about 30 mph, swinging branches and crowns of trees, a typical day in the prairie part of Saskatchewan; mother and her 8-year-old son were walking side by side in the neighborhood. We haven’t done this for a while for some reason, so we were both excited to be with one another combing the sidewalk and chatting now and then. After

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one round around the block, we came under a quaking aspen, one of the many stimulating trees in our neighborhood, and paused...

Mother: *"Jun! Listen—the quaking aspen is singing . . . very loud!"*

Jun looked up: *"What do you mean?"*

Mother: *"Remember, we used to stop under each tree and listen to them sing?"*

Jun, with a bewildered look: *"No, trees don't sing!"*

Mother's heart sank and wasn't sure what had happened to her son.

My thoughts went far back to when Jun was about 3 years old and before he started any formal schooling. We did the neighborhood walk quite regularly—almost daily. At that time Jun and I carried our conversations in mandarin Chinese—the language I have spoken/sung to him since he was born—well, actually while he was still in the womb. We referred to all the trees as “大树公公 Da Shu Gong Gong”—a Chinese phrase meaning “Big Tree Grand One.” That time we rarely walked side by side but more often Jun was either ahead of or behind me—examining something new or exciting, such as a leaf or small branch, a feather, a puddle. . . . On one of those windy days in late spring Jun was way ahead of me running with his rainbow-colored pinwheel raised above his head to see how fast it could spin. Then suddenly he slowed down and backed up in front of our neighbor Rick's sidewalk and stopped there while looking up around and about. Curious about what happened I quickened my steps and caught up with him, asking in Chinese:

"Tell me, Jun, tell me, what did you find?"

With the pinwheel in front of his chest, his mouth in an exaggerated “O” shape, Jun quietly said to me: *"Listen! Da Shu Gong Gong is singing!"*

"Oh—what is Da Shu Gong Gong singing about?"

"Happy song!" Jun said with a big, radiating smile.

I listened more intently under the tree. With the coming and going of each gust of wind, I heard the somewhat lower pitched yet cheerful rustling sounds crescendo and decrescendo above and around me. I recognized the tree from my naturalist training years and knew right away from its greenish powdery bark, its distinctive heart shaped leaves, and their fluttering movement that it is a quaking aspen! We both were mesmerized by the chorus of this tree mixing from time to time with that of the nearby Dutch Elm trees, as well as the quieter songs of the spruce tree. My naturalist training taught me that quaking aspen is the largest living organism, growing in clones that reproduce primarily by sending up sprouts from their roots. One clone of this aspen tree in Minnesota was estimated to be 8,000 years old! So the Chinese phrase “Big Tree Grand One” indeed makes sense! We both closed our eyes, stood there under the quaking aspen, and listened! I was grateful that Jun invited me to listen, and was thrilled to see the trees through his little being! From then on

we made it a habit to pause under each tree during our walk and listen to them sing—especially when the wind was stirred up! Now five years later Jun was telling me that “Trees don’t sing!”.

Conversation 2

May, 2018. Returning home at the end of a day after attending the Canadian Society of Studies in Education (CSSE) conference session on indigenous medicinal plants and healing practices with a Cree Elder, I could not contain my excitement. Hovering over the kitchen table, mother and 13-year-old daughter Li started a chat:

Li: “*Where were you mom?*” (usually she could read my face—which was now spilling over with apparent exhilaration!)

Mother: “*I just attended a most interesting session with a Cree Elder named George. He showed us some of his ancient tools for healing.*”

Without a pause, mother kept rambling: “*One of the things he used in healing practice was a fan of eagle feathers. It is almost one hundred years old—the Elder told us! The feathers looked plain and rather torn in many parts, but he said it has healing power while the other kind—the modern one with glittering decorations—doesn’t. He even passed the eagle feather fan around and let us hold it!*”

Li’s face grew in impatience and disbelief as she snapped: “*Mom, what are you talking about?! Eagle feather has no power!!*”

My heart crinkled upon hearing this certain conviction from my 13-year-old daughter.

Mother: “*How come eagle feather can’t have power?!*”

Li: “*Are you kidding, Mom?!*”

Mother, trying to stay calm: “*Well, tell me how come an eagle feather can’t have power. The elder uses his eagle feather fan as part of his healing practice for people. How can you be so sure that it has no power?*”

Li: “*A feather is not even alive. You can’t believe whatever the elder tells you.*”

Mother: “*You have a point that we should not believe whatever others say. But what if in that context the eagle feather has healing power? You don’t know for sure it has no power!*”

I do not remember much of the rest of our conversation other than that Li eventually rolled her eyes and walked away to her room. Whatever explanation or invitation I tried to offer her was only met with deaf ears and a closed mind. She seemed to have a hard time putting side by side the possibility that an eagle feather can be dead as determined by the Western science criteria, but can also carry healing power in another context, such as in this Cree Elder’s healing practice, and that one view does not have to exclude the other to be valid.

Conversation 3

End of school year in June 2019. Getting ready for bed, mother and 11-year-old daughter Ann were at the bathroom—brushing teeth together. Out of nowhere, the following exchange just happened:

Ann: *"You know ... mom ... I am very good at science ... but I hated it!"*

Mother: *"What do you mean?"* apparently alarmed and concerned, not just as a mom, but also as a science educator.

Ann: *"Well, I got all As because I am good at doing what she (the teacher) asks us to do, but science is just ... ughhh."*

Mother: *"Oh ... I am sorry to hear that. How come you sound so disgusted by school science!?"*

Ann: *"I don't know ... all we do is ... read the textbook, the handouts, answer questions on the worksheets! Then repeat!!!"*

Mother: *"That is NOT science! That is reading comprehension!!!"*

By the end of Grade 6, Ann already determined that she does not like school science. The hopeful side is that at least she was aware enough to know that she was disgusted by school science. All my three children went to the same elementary school and had mostly the same teachers. In no way I am here to suggest their teachers are to blame, but I could not help wondering about how science education is carried out in their elementary school. As a science teacher educator, I am aware of the challenges of science education at the elementary school level, such as minimized time given to science teaching and learning due to more emphasis on literacy and numeracy in most schools. Teachers in elementary school in general have taken a limited number of science courses and tend to by and large shy away from teaching through the sciences. As Ann informed me in the above conversation, it is not uncommon for science to be approached as a reading exercise, which can be mostly content driven instead of process driven. Very little hands-on/experiential inquiry based learning takes place to truly develop students' scientific literacy and competency. There is no way for me to verify, but I wonder if the responses from Jun and Li in Conversations 1 & 2 have something to do with what they have been taught at school. It would be very concerning if my children have learned through school science education to have to choose either this or that when it comes to seeing, understanding, and experiencing our world. It would be as concerning as if they were taught to choose the Chinese or Nepalese or Canadian side of their identity while they are all three, because they were born to a Chinese mother, a Nepalese Father, and are growing up in Canada.

While Ann was aware of how she felt about school science, Jun and Li were not even conscious that school science may have impacted them in ways that might limit their future experiences of what is possible. At such tender ages of 8 and 13, with only a few years of formal schooling behind them, they both have already become crusted and closed to other possibilities of experiencing

the world—and the worlds still in the making. I wonder how “educative” my children’s science learning experiences have been at school. Dewey (1938) proposed a set of criteria for signifying “educative experience” (pp. 33–50), one of which is the principle of continuity of experience. It covers the “formation of attitudes, attitudes that are emotional and intellectual; it covers our basic sensitivities and ways of meeting and responding to all the conditions which we meet in living.” One exemplification of the principle of continuity of experience is growth, or growing as developing, not only physically but intellectually and morally (p. 36). School science might have contributed to my children’s attitudes toward science or other possibilities of experiencing the world that are not “conducive to continued growth,” but instead can be detrimental.

What’s also alarming is how similar my three children’s experiences of school science were to mine from decades ago when I was schooled out of the openness to or even tolerance of any other possibilities aside from scientific ways of knowing and truth defined by so-called science teachers. My formal introduction to science started in middle school (grade 6) chemistry and physics classes in the People’s Republic of China during the late 1980s. China, then under Deng Xiaoping’s leadership, was going through a nationwide economic reform and opening up to the outside world. As stated in the 863 Program or State High-Tech Research & Development Program, China aimed to stimulate the development of advanced technologies in a wide range of fields for the purpose of rendering China independent of financial obligations to foreign technologies. We secondary school students were mostly Youth League members (团员) and were regarded as the heirs of the Chinese Communist Party. Studying the sciences and technology became our obligation in order to better serve society and to serve China. The influence of school science on my worldviews and beliefs on truth and what is possible is subtle, gradual, yet profound—just like the metaphor of a frog sitting in a pot of cold water being heated up slowly to boiling point. The frog never jumped out, and would eventually be boiled to death. These learned ways of seeing and legitimizing have to some extent alienated me from my mother, who has very little formal schooling and never took any science class but has much experiential knowledge through her active living and experiential knowing. For instance she truly sees plants as persons with feelings and believes that our ways of working with them can influence their (the plant’s) feelings, and consequently how well they grow. I must have rolled my eyes in my teenage years when mom tried to teach me how to treat plants right so as to not upset them. Here is a conversation I had with my mom after I harvested some 韭菜 (jiuca, *Allium tuberosum*) from our backyard garden.

Mom: (after taking a look at the handful of jiucan in my left hand) “*How did you cut them?*”

Xia: “*I only cut those that looked good—tall and broad-leaved. Aren’t these great?!*”

Mom: “*Yeah! But you mustn’t cut them like that anymore!*”

Xia: “*Why?*”

Mom, paused for a few seconds as if trying to find the right words to communicate her concern, “*The way you cut the jiucai would upset the ones you didn’t cut! They would be so upset that they would not grow well. You should have cut them roll by roll—leaving none behind.*”

Xia: “*Jiucai has feelings?! How funny you believe that they would be upset!*”

As an adolescent I could be very insensitive to my mom and often laughed at her unusual remarks from time to time—attributing her off-key beliefs to her lack of schooling and lack of science education. Now 30 some years later as I recalled this conversation about harvesting jiucai, I was reminded of the experimental study with sweet grass by Robin Kimmerer and her graduate student Laurie (Kimmerer, 2013, p. 156). In their research over two years to compare the effects of two different ways of harvesting on the growth of sweet grass, they challenged a dominant view held by mainstream academic ecologists that “to protect a dwindling species was to leave it alone and keep people away” (p. 163). Their research verified the theory known to Kimmerer’s ancestors that “If we use a plant respectfully it will stay with us and flourish. If we ignore it, it will go away.” Kimmerer (2013) reminded us that “we are all the product of our worldviews—even scientists who claim pure objectivity” (p. 163). I have to admit that my learning in the school sciences have greatly contributed to the alienation I developed toward my mother’s worldviews and ways of knowing/doing/being. The following poem highlights some of my own experiences as a student of science in middle school and high school in mainland China.

As a Student of Science

Science is for the smart students,
But who are not talented enough
To go into the creative arts!

Science track will surely lead you
To some sort of professional job,
So that you don’t have to repeat
The back-breaking lifestyle of your parents
Who were frozen in value (if any)
As farmers and factory workers.

Science is the new life force,
Science and technology is the
Primary productive power,
Sought after by every sector of society!
Indoctrinated by such slogans as
Scientification/modernization of agriculture,

Scientification/modernization of industry,
 Scientification/modernization of defense,
 Modernization of science and technology!

I repeated these pledges
 Day after day, year after year:
 "Love the motherland,
 "Love the people,"
 "Love the Communist Party,
 "Serve the people!"
 These energizing words
 Echoed throughout my impressionable years.

Science is about the absolute truth,
 It is amoral, apolitical, acultural.
 Science has been put on a pedestal,
 Believing itself entitled to be enthroned!
 All should yield in the advance of science;
 No one shall, nor can be in his way!

A very sad and confusing thing is that my years of formal schooling have gradually steered me away from my mother and her ways of knowing, being, and relating. I learned from my school subjects (especially the so-called natural sciences, such as physics, chemistry, and biology) that anything that does not align with the established sciences is primitive, backward, and even superstition, and should be despised and abolished. The alienation from my mother and her worldviews and ways of knowing grew with my accumulated years of formal schooling. I remember the feeling of shame for having a mother like mine.

Also, in school science, we learned about the glorification of many scientists who in serving their country with the mission to advance China's science and technology development sacrificed their lives and families. Many more scientists lived incognito until years after retirement from their research career in the nuclear science and military/defense technologies. For instance, from 1961 to 1989 a Chinese scientist named 于敏 (Yu Min) concealed his identity so as to devote himself to the research on hydrogen bombs, leading to the success of China's hydrogen bomb development! According to the Baidu website, many more scientists dedicated their lives to science and technology research work classified as state top secret (implicating national security). Most of the time even their families did not know where they were working and what they were working on. Behind the success of the China's first atomic bomb many more scientists lived/worked incognito. I remember having mixed feelings and reactions in high school as we watched the documentaries of these scientists held as national heroes. On the one hand I admired their selflessness and dedication to their work, on the other I wondered about how any scientist with good consciousness would willingly contribute to the creation of deadly weapons of mass destruction.

After six solid years of being a student of science in junior and senior high school in mainland China, somehow I did not want to choose science as the field of study for my post-secondary education as most of my peers did. I was drawn to the creative arts instead, even though I did not feel I had the “talents” for them. However, like many children from working-class families, I was confronted by the dilemma of “what job prospects can the arts bring you?” as questioned by my parents, and reminded by my high school teachers. So, there I was—accepted into the English Department at the West China University of Medical Sciences and Technology, which was a compromise with the daunting forces trying to leave a mark in my adolescent and young adult life. I studied English for Medical Science and Technology—really not sure what job prospect or career this degree would lead me to. As the first person in my family and in my neighborhood to go to university I had no idea that an English degree from a university of medical sciences and technology would not lead me to become a medical doctor. Most of us (in an 18-student cohort) were very disappointed to learn this harsh reality! Two students actually switched to the medical school after one year of waiting. I also contemplated switching to medicine—although I did not have the financial or social means.

A lab incident at the medical school in the winter of 1995 totally turned me away from the idea of pursuing a career in medicine. My cohort of 16 students pursuing an English major were divided into groups of four to learn and carry out the tracheotomy procedure. For this lab, our instructor brought four lab rabbits in a cage. We learned that after undergoing these medical procedures, the rabbits would eventually die and be disposed of, which did not sound necessary or right to my group of four young women. We tried our best to comply by getting the anesthesia drug ready and injecting it through the vein on the rabbit’s ear. As we waited for our rabbit to be anesthetized, there was a commotion in the lab when a couple of students were trying to catch a rabbit from the cage. Some yelled in excitement: “she is pregnant... looks like she is about to labor... any moment!!” Well, the lab instructor could have turned this into a teaching/learning moment—guiding us through the birthing process of the rabbit, comparing that with the human experience. The four members in my group all spoke up—requesting our instructor to spare this rabbit from the tracheotomy procedure as she had young ones coming and needed to nurse and take care of them. We even offered to share our rabbit with the other group so that they can learn the procedure as well without harming this pregnant one. What a relief when our request was tentatively approved by the instructor: “Well, we will see. Let’s leave her alone for now.” So we went on with our lab work, while the mother rabbit gave birth to four babies. However, by the end of the lab session, we learned that another group of students got hold of the mother and carried out the procedure on her anyway, obviously with the instructor’s silent approval. I felt disgusted, powerless, and indignant as I painfully recalled the well-rehearsed slogan of my minor years that “In the pursuit of science, life will be sacrificed!” Throughout history

(distant and recent) and globally so many lives have perished in the name of scientific research and progress.

Upon graduation from the West China University of Medical Sciences and Technology, I continued to Graduate School at the University of Minnesota (St. Paul/ Minneapolis) in the United States. As a graduate student there from 1997 to 2007 I had the good fortune to take classes from a variety of colleges. There was no restriction as to what I could take as long as they were graduate courses. At the turn of this century I sat in one class on humanist geography, and learned that one way to understand aesthetics is its opposite, which is anesthesia (Tuan, 1993). According to Tuan, the aesthetic is "not merely one aspect of culture but its central core—both its driving force and its ultimate goal." He wisely noted that "the pervasive role of the aesthetic is suggested by its root meaning of feeling—not just any kind of feeling, but shaped feeling and sensitive perception... and the opposite of aesthetic is anesthetic, which is a lack of feeling—the condition of living death" (p. 1). Is this what we want to school the next generation of learners into—"living death?"

The good news is that the lack of aesthetics in my science learning experiences was compensated by the required courses in English literature as I majored in English. My five years of immersion in British and American literature kept me human/humane and well aware of the recursive "bad faith and cruelty" and "savage inequalities" (Kozol in Greene, 1993, p. 211) operating in all societies (Baldwin, 1963, p. 17). Literature also provides ample examples of heroes and heroines who are "not bound by the expedencies of any given administration, any given policy, any given morality, and who exercise their birth right to examine everything and come to their own views of the world and make their own decisions" (Baldwin, 1963, pp. 18–19). In a way, immersion in literature helped to prevent me from becoming the "living death." I kept searching for and remained open to the next adventures in life. After all, as Kenko (1967) wisely said, the most precious thing in life is its uncertainty.

The following significant life experience (Ji, 2011) got me questioning what I have been learning (and not learning) from my formal science classes and opened a new path for me in the field of environmental education.

Encountering Living Water: A Turning Point in My Science Learning Journey

Serendipity is the one word I can think of to express how I remember the experience in the summer of 1995. It was my third year of university, at the end of the spring semester, the week after all the final exams. I was relaxed and enjoying my mid-day nap when I felt shaken side to side and stirred up by a familiar voice:

"Amy, Amy, wake up, wake up!"

"What?!!"

I opened my eyes, unhappy about the fact that Helen (my best friend) disrupted my nice and well-deserved nap. We all had English names then given our major in English.

Amy: *"What's the matter that you had to wake me up from my nap!?"*

I was still rubbing my eyes—trying to stay awake. We were the only two left in the dorm room of five women. The rest of them had all left for their homes in other provinces for the summer holidays.

Helen: *"You said you want to stay here to work this summer, right!? Now is our chance! Come, they are interviewing students for summer jobs, interpreter job! It's said to be very well paid! Come on!"*

Amy: *"Really?! When do we start?"*

Helen: *"Don't know. We will find out."*

I rolled out of bed, ran to the public washing area, hand washed my face with cold tap water, skipped back to the dorm, combed my hair, and checked my clothes—which weren't obviously wrinkled from lying in bed. Off we went—Helen and I along with three other students who were one year ahead of us, toward the Foreign Faculty's Residence of the West China University of Medical Sciences and Technology.

This is how I got my first summer job—to work as a Chinese-English interpreter for the Keepers of the Waters project in the city of Chengdu, China. That is where and when I met Betsy Damon, an eco-feminist, performance artist, and environmental and civil rights activist, and Jill Jacoby—a water resource scientist and environmental educator, both from the United States. Keepers of the Waters is a community-based water activism initiative, which was founded and directed by Betsy Damon in 1991. It brings scientists and artists together to stimulate community action on water quality issues. As Damon (2016) shared in her lecture titled "I Am Water," she intended to "create a language of consciousness," with which she has certainly reached a deeper dimension/consciousness of me as I worked as a language interpreter initially and later as a volunteer for the Keepers of the Waters projects in Chengdu and Lhasa. A couple of the photographic images of water drops (see Fig. 2.1) she shared with us totally challenged my established and unquestioned scientific view on water, which is made of three atoms—two hydrogen and one oxygen, and is believed to be the same everywhere (Fig. 2.1).

Betsy shared Schwenk's research, which has discovered that "If water is of good quality or tested from a natural source it will express rosette and vortical patterns. If water is of poor quality or contaminated by pollutants it will lack expression." This view and understanding of water did not register with me until I drew and painted the living water drop image again and again alongside Betsy Damon, trying each time to make my drawing of the water drop more alive and expressive!

Fig. 2.1 Photo & caption credit to Theodore Schwenk, used with permission

Fig. 2.2 Artwork and photo credit to Xia Ji

Writing this chapter I tried again to draw a picture of the living water drop image (see Fig. 2.2) as this practice has had a profound impact on my perception and consciousness. Drawing and painting is a process that forced me to attend to my attention as the energy of my attention often resulted in different things I observed and what I could replicate or interpret as a result (Fig. 2.2).

For both summers in 1995 and 1996, I worked and volunteered as an interpreter and assistant to Betsy Damon, and was immersed in public performances and installation arts created by a diverse group of artists to raise awareness of source water protection, particularly the Fu and Nan Rivers and Lhasa Rivers. Details of these two summer community-based art events were recently included in the Asia Art Archive (AAA-Hong Kong, 2017). Through these experiences I learned that “the arts can serve to liberate human perception, challenge human creativity, and stir the human soul” (Jacoby & Ji, 2010, p. 135). I was reminded of Eisner’s understanding that “artists invent fresh

ways to show us aspects of the world we had not noticed; they release us from the stupor of the familiar” (Jacoby & Ji, 2010, p. 135). I also came to the realization that “In the face of our collective daunting global environmental and health challenges, we do not just need science and engineering, but also other forms of knowledge and ways of knowing. As the ‘creative force’ in our society artists can serve as awakening, educating, and provoking agents as they themselves learn about the various social and environmental challenges of our time” (Jacoby & Ji, 2010, p. 143).

So far in the above sections I have shared some of my observations and concerns regarding potential numbing effects of school science on students through the conversations I had with my three school-age children and my own experiences as a student of science. I have also shared my experience with the living water garden and the Keepers of the Waters projects as a major awakening stage in my life and work. Next, I would like to turn to my experience as a teacher of science/science educator.

As a Teacher of Science/ a Science Educator

It is beyond the scope of this essay to provide a detailed remedy to the potential numbing effects of school science as shown above in the experiences of my children and my own experience. However, I want to share a few commitments and strategies that I have tried over the last ten years of teaching in the area of science and environmental education. Science education as status quo in public schools is not acceptable and cannot meet the complex demands and challenges of our time or the future. Darling-Hammond (2015) called for “new learning for a rapidly changing world.” She reminded us of the reality we face today, that “2/3 of today’s young people will enter jobs that don’t yet exist, using technologies that have not yet been invented to solve complex problems we have not solved—such as climate change, water quality and security, food insecurity, [and] poverty.” Six decades earlier Baldwin prophetically wrote the following text.

... we are living through a very dangerous time... we are in a revolutionary situation, no matter how unpopular that word has become in this country. The society in which we live is desperately menaced . . . from within. To any citizen of this country who figures himself as responsible—and particularly those of us who deal with the minds and hearts of young people—must be prepared to go for broke. (p. 17)

Baldwin pointed out that “the whole process of education occurs within a social framework and is designed to perpetuate the aims of society.... The paradox of education is that as one begins to become conscious one begins to examine the society in which he is being educated;... at the point when you begin to develop a conscience, you must find yourself at war with your society” (p. 19). If a country does not “find a way to use that energy of the

young generation, it will be destroyed by that energy” (p. 20). We educators are left with no choice but to take up the challenge of our time. If we do not, we are part of the problem.

In my own practice as a science and environmental educator working alongside pre-service teachers mostly in their early 20s, I have certainly come to recognize the gravity of our responsibilities. In my practice as a science teacher educator I consciously invite my students to engage with me in *currere*. *Currere* is a concept and method suggested by Pinar (1975, 2004, 2012), which is an infinitive form of curriculum and encourages educators and learners to engage in an autobiographical examination of themselves and their lived experiences. As Pinar states, “The method of *currere* reconceptualized curriculum from course objectives to complicated conversation with oneself (as a ‘private’ intellectual), an ongoing project of self-understanding in which one becomes mobilized for engaged pedagogical action—as a private—and—public intellectual—with others in the social reconstruction of the public sphere” (Pinar, 1978, p. 318). *Currere* encourages participants to “confront difficulty in order to loosen its grip” (Pinar, 2004). One exercise I always introduce to my students is an autobiographic writing/drawing/rumination about their lived experiences as a student of science. Aside from treating science as a process of sustained disciplined inquiry I have also been exploring the following strategies to truly open up possibilities for both my students and myself.

Science Education as a Healing and Restorative Experience

If we truly believe in the interconnectedness of all as featured by the David Suzuki Foundation’s Declaration of Interdependence (<https://davidsuzuki.org/about/declaration-of-interdependence/>), we must feel deeply the pain and suffering of the millions for our scientific progress and for our pursuit of comfort, profit, pleasure, power, and dominance! The amount of damage, suffering, and trauma that have been inflicted upon so-called “others,” including our fellow human beings, has been accumulating historically, and is ongoing. Therefore, we need to deepen our consciousness of the need for healing, healing of ourselves, and healing of all. Greene beautifully advocated for a “curriculum required to help provoke persons to reach past themselves and to become” (Greene, 1993, p. 220). Science curriculum and pedagogy should and can champion a commitment to a healing and restorative experience for all, starting with whomever we have in a class community, and from “the world that touches us” (Remen, 2005).

What I learned from medical school—“Do no harm”—a pledge we made on day one of attending the West China University of Medical Sciences and Technology, is a minimum ethical standard and commitment we must uphold as educators. I have also tried contemplative practices with my students in the science and environmental education classes, including journaling, music and song writing, visualization, deep listening, insight meditation, loving kindness,

walking meditation, and circle of trust. These practices have been healing and restorative for me and for many of my students. As the ongoing COVID-19 pandemic and the revitalized anti-racism and global climate justice movements remind us, we have much collective trauma to confront and an increasing need for collective healing. Our classroom spaces have to not just pose no harm to anyone, but also need to be healing and restorative places for all who inhabit these spaces. If not, what else should they be?

Teaching Science as Humanities and as Narrative Knowing

Greene described “women’s ways of knowing” as something that is “concrete, transactional, narrative in form.” With this in recognition, approaches to science can be affected—“engagements *with* the objects of study rather than analytic work *on* them” (Greene, 1993, p. 219). Following Greene’s conception of curriculum as something emerging out of “an interplay among conceptions of knowledge, conceptions of the human being, and conceptions of the social order” (p. 216), we can really make science learning into diverse human experiences of various combinations of possibilities! The aforementioned currere method is one of the ways to approach science education as humanities and narrative learning. Storying and story-telling of our lived experiences as students and teachers of science can shed some light, so does engagement with the history of science and stories of scientists of diverse cultures and backgrounds. Storying can be “an endeavor that is oriented towards liberation and transformation” (Goodson & Gill, 2014, cited in Bazzul & Siry, 2019, p. 6); one in which we re-visit/re-evaluate the past as we work to attend to the present (Ji, 2014), and construct the future (Bazzul & Siry, 2019, p. 6). Science educators/scholars/researchers from dominant groups should “stop trying to know the Other or give voice to the Other, and listen, instead to the plural voices of those Othered, as constructors and agents of knowledge” (Scott, 1991, as cited in Fine, 1994, p. 75). Teaching science as humanities and as narrative knowing/learning is an area I have immense interest in exploring further to see how to actualize this possibility for science education.

Restoring the Centrality of the Arts/Aesthetics in (Science) Education

Educational philosopher and social activist Maxine Greene called for the “centrality of the arts” (1993, p. 214) to education at all levels decades ago, yet the aesthetic core of education has been often negated to the margin or completely forgotten in public education, as shown in recent drastic school measures to respond to the COVID-19 pandemic situation by only offering literacy and numeracy instruction. What is desperately needed in formal education is what Greene termed as “wide-awakeness” or “being attentive to the beauty and cruelty of life,” to “aesthetic encounters” and “living in the world esthetically” (2001, 2005). Maxine Greene seeks to define aesthetic education for

us in a number of ways. For example, she wrote that aesthetic education is defined as “an intentional undertaking designed to nurture appreciative, reflective, cultural, participatory engagements with the arts by enabling learners to notice what is there to be noticed, and to lend works of art their lives in such a way that they can achieve them as variously meaningful” (Greene, 2001, p. 6).

Engagement with the creative arts and artists can bring out more diversity, which includes diverse participants and perspectives, diverse worldview and experiences, diverse forms of knowing and knowledge, diverse way of defining and solving problems, and diverse possibilities and ways to realizing what is possible. I was fortunate to experience these transformative learning opportunities decades ago as an undergraduate university student, which is documented in the Asia Art Archive project (AAA-Hong Kong, 2017). I look forward to collaborating more with eco-social justice-minded and community-based artists in this area of work. I have tremendous hope for the possibilities in centering the arts and collaborating with artists in our work as (science) educators.

CONCLUSION

This essay was drafted in the mist of the COVID-19 pandemic. At this point I am still not sure how I feel about the very term “Anthropocene” considering the tiny novel coronavirus COVID-19 (less than 0.5 micron in size) and not even classified as life (in the strict sense of Western science) has been wreaking havoc across the globe and bringing humanity to our knees in such a short period of time. Could we then say that we are now into a corona virulence after a fleeting kiss with Anthropocene? Maybe the need to focus on Anthropocene is not that urgent or even relevant—considering what we know and what we do not know. This chapter is written from the orientation championed by Bazzul and Siry (2019) that “science education needs to be for the wellbeing of communities and justice for our shared planet... and for the creation of environmentally and socially just futures” (p. 3). Collectively we need to find “openings for transformation” (p. 5). In the face of the pandemic and climate crisis we might as well focus more on the opportunities they can bring—such as collective awakening to what is essential to life/livelihood, collective healing from past and present intergenerational traumas, and greater public demand and alliance for justice. The Chinese characters for “crisis”—危机 (weiji)—illustrate, 危 (wei) means danger, and 机 (ji) means chance/opportunity. Maybe what is required is “a profound reversal in our perspective of ourselves and the universe around us” (Berry, 1999, p. 159). The few strategies I suggested above can hopefully contribute to restoring science education onto a more life-affirming and life-sustaining path that would enable all to not only survive, but also to thrive. After I engage more with what I have proposed above as a teacher of science/a science educator I hope to share my experiences and findings. I have the conviction that the aesthetics which the creative arts are best at can provide possible antidote to the “living death” plague, and can counter the forces which have been

- Ji, X. (2011). Environmental education as the mountain: Exploring Chinese-ness of environmental education. *Australian Journal of Environmental Education*, 27(1), 109–121.
- Ji, X. (2014). The heart of education and well-being is spiritual: Autoethnographic inquiry as an educational practice for sustainable well-being. In F. Deer, T. Falkenberg, B. McMillan, & L. Sims (Eds.), *Sustainable well-being: Concepts, issues, and educational practices* (pp. 121–137). ESWB Press. https://www.eswb-press.org/uploads/1/2/8/9/12899389/sustainable_well-being_2014.pdf.
- Keepers of the Waters. (n.d.). *Living water garden*. <https://www.keepersofthewaters.org/projects/living-water-garden>.
- Kenko, Y. (1967). *Essays in idleness: The Tsurezuregusa of Kenko* (D. Keene, Trans.). Columbia University Press (Original work published ca. 1330–1332).
- Kimmerer, R. W. (2013). *Braiding sweetgrass: Indigenous wisdom, scientific knowledge, and the teachings of plants*. Milkweed Editions.
- Pinar, W. F. (1975, April). *The method of currere*. Paper presented at the Annual Meeting of the American Research Association. Washington, DC. <https://files.eric.ed.gov/fulltext/ED104766.pdf>.
- Pinar, W. F. (1978). Currere: A case study. In G. Willis (Ed.), *Qualitative evaluation: Concepts and cases in curriculum criticism* (pp. 316–342). McCutchan.
- Pinar, W. F. (2004). *What is curriculum theory*. Routledge.
- Pinar, W. F. (2012, 2019). *What is curriculum theory?* Routledge.
- Remen, R. N. (2005, August 11). *Dr. Rachael Naomi Remen: The difference between curing and healing*. On Being with Krista Tippett. <https://onbeing.org/programs/rachel-naomi-remen-the-difference-between-fixing-and-healing-nov2018/>.
- Schwenk, T. (2013). *Images of living water vs. dead water*. <https://truespring.files.wordpress.com/2013/01/drophotography.jpg> <https://stroemungsinstitut.de/institut/>.
- Tuan, Y. (1993). *Passing strange and wonderful: Aesthetics, nature, and culture*. Island Press.

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