

TEACHING SCIENCE WITH INTENTION AND CONNECTION: AN INTERVIEW WITH CLARAH MENEZES

POH TAN

Simon Fraser University



EDUARDO GLUCK

Universidade do Vale do Rio dos Sinos (Unisinos)

Introduction

Science education is a large field of research and to this date, there are numerous articles and publications about how science is taught in the classroom. Understanding teacher practices within a science classroom gives a glimpse on how science is interpreted and learned by her students and in addition, how the teacher interprets and teaches science to her classroom. “The meaning of the *nature* of science education is to enhance scientific literacy...towards responsible citizenry based on enhancing scientific and technological literacy” (Holbrook & Rannikmae, 2007). Within the context of this interview, we will focus our discussion on scientific literacy. Briefly, the field has used both science literacy and scientific literacy to describe the outcomes of science education. Although these two terms have been used synonymously, they present different attributes that define a scientifically literate person. As Roberts and Bybee (2014) discussed in the seminal chapter in the *Handbook of Research on Science Education*, science literacy is described as scientific knowledge built from pre-existing techniques and methods and scientific literacy lists attributes of a person who “reflects critically on information and appreciates and understands the impact of science on everyday life” (p. 547). These two descriptions are labelled as Vision I and Vision II, respectively. For a more in-depth discussion about science and scientific literacy, refer to the *Handbook of Research on Science Education* and for a review, refer to Science Education: Defining the Scientifically Literate Person (Tan, 2016). Each Vision can be viewed as extremes of a scientific literacy spectrum and the dynamic relationship between Vision I and II are often practiced in the classroom, with more educators focusing their practice within Vision I. “In the [teaching] world of practice, the choice facing science educators is Vision I versus a combination of Visions I and II” (Aikenhead, 2007, p. 64).

As we progress through the 21st century, the idea of scientific citizenship is evolving to include a global perspective. Bybee (2018) acknowledges and insists that scientific citizenship must now include a move towards global scientific citizenship where perspectives from **other disciplines are considered** to realize the “interrelatedness of individuals, environments and communities” (p. 61, emphasis added). Through these conversations, and further discussion of

working through different definitions of scientific literacy (Roberts, 2007, Bybee & Roberts, 2014, Tan, 2016), Vision III (Tan, 2018) extends on the meaning of scientific literacy, specifically weaving Indigenous Hawaiian epistemology on the importance of relationality, emotion and connection (Kealiikanakaoleohaililani & Giardina, 2016, Meyer, 2008) with scientific knowledge. We call this different approach, the Three-Visions-Framework (TVF). Vision III challenges current paradigms for teaching science from both the objective and subjective perspective and more importantly, to give an awareness towards a different type of relationship between nature/culture, human/non-human, and subject/object.

Poh first met Clarah on a collaborative research trip to Unisinos University in Porto Alegre, Brazil with Dr. Maria Eduarda Giering's research group. Clarah teaches Grades 4-5 at Arnaldo Grin elementary in Novo Hamburgo. The school is located at the periphery of a community that struggles with drug and substance abuse, violence, racism, and poverty. Her students had varied levels of literacy and numeracy and 9% of her students had hearing, vision, or speaking challenges. For many of Clarah's students, it was their first time being in a science classroom. During my research trip, I spoke to Clarah about her challenges, struggles and successes about teaching science. She talked about her struggles of identifying the most effective ways to create science lessons that were relevant to her students and often spent endless hours searching the internet for the "perfect" science activities to engage her students. Clarah wanted to "show [her] students how science can be applied to their lives and that it can have a significant contribution to change the way they make choices for themselves" (personal communication, 2018). I have so much gratitude and appreciation for Clarah's enthusiasm, dedication, and motivation towards using science for giving hope to her students. In the next few months after my visit, we continued our conversation and we discussed the importance of relationality when teaching science. We quickly determined that Clarah's science curriculum were focused mainly within Vision I. Through TVF, Clarah began to weave the understanding of relationality through her lessons and instead of staying within the confines of Vision I, she began to asked questions about her teaching practices within the framework.

In this interview, Clarah shares her experiences, responses, struggles, and reflections into applying TVF to understand and develop her lesson plans for her class and how relationality shapes how we learn and how we *connect and relate to* what we learned.

The Interview

Authors: Clarah, first thank you for sharing your time to share your experiences and what you've learned about your practice in the classroom with the framework. I'd like to start with an introduction question. Tell us about yourself and your educational background. How many years have you been a teacher, and what teaching means to you?

Clarah (Clarissa Paz de Menezes): I am an elementary school teacher and I specialize in teaching children with special needs. My aspirations to be a teacher began when I was in the eighth grade. Throughout my teaching career I have always focused my work and practice with children of different abilities and, today, I am a teacher working with students and schools to

create a more inclusively classroom and create more inclusion focused curriculum. One of the most important aspects of being an effective teacher and maintaining motivation through sometimes difficult times come from having healthy professional relationships with colleagues and teachers. I believe that relationships are key for the construction of quality learning relationships. From my own experience, I realize that my classroom practices were more satisfying when I developed a deep relationship with my peers and students. I think this link positively influences the teaching of all subjects in the classroom, because, in this way, the teacher is able to understand the demands of teaching and learning where the teacher teaches. The relationships of exchange and affection between the child and the reference adult, whether parents, guardians, the teacher or other school professionals, strengthens the learning process. When teachers engage with the school environment and foster a collaborative culture amongst coworkers and students, they are capable of understanding the school's climate and needs and hence improve their teaching techniques. From my own experience, I realize that my best learning relationships were when there was an emotional bond with teachers and/or colleagues. I think that this link influences the learning relationships of every subject, especially in Early Childhood Education, when children have a heteronomous relationship with adults. The relationships of exchange and affection between the child and the reference adult, whether parents, guardians, the teacher or other school professionals, strengthen the learning process.

Authors: *Tell us a about the school you currently teach at. What are the teachers and students like? Specifically, what does a typical science lesson look like in your class. How do you currently teach science?*

Clarah: I teach at an elementary school with grades from 1st to 9th year, that is, all elementary school grades in Brazil. Unfortunately, the school is located within an area where social economy is low and thus, parent participation is low as well. Due to current social economic status of this city, teachers like me are solely responsible for teaching, curriculum development, resource creation, maintenance of the school's facilities and in some cases, adopting a parenting role to the students. As a teacher, and along with my colleagues, I feel that, although we are tasked with responsibilities that go beyond teaching in the classroom, we believe that we are able to influence and improve education in the classroom, reduce school drop-out rates and violent incidences and work towards creating a positive school space for the community.

For myself, when you visited our school in 2018 and after talking to her about her research and work on scientific literacy, I realized that I am able to teach science in a different way. Let me first tell you about how science classes are currently being taught at my school. Science classes are very structured, and most teachers uses a teaching method to solely meet the mandated and technical objectives of the ministry's curriculum. Unfortunately, science lessons do not go beyond textbook learning and assignments provided by the government. In some classes, students have the opportunity to participate in hands-on experiments, however this is not always the case. Prior to working with you, I often taught science this way because this is the way that my colleagues taught and how I was trained to teach science. For example, I often tried

to look for different and more exciting activities on Pinterest or Google in hopes of creating a little more engagement with my students. In other words, I followed what others did without specific and well-thought out intentions for why I was teaching a certain scientific topic. In addition, from the school's mandate, we were often asked to focus more on Math and language. In other words, I was teaching science from a place of knowledge transmission.

Authors: *We've been working together for over a year now with the three Visions framework. Can you tell us a little bit about how you've used the framework to teach science differently and how you've used it to understand your teaching practice?*

Clarah: When I first learned about your work, it was difficult for me to adapt because it was a new way of teaching science. It meant that I had to do something different from my colleagues, to go against traditional ways of teaching science and more importantly, to go beyond the prescribed curriculum and the assigned textbook. The framework showed me that science education goes far beyond what is in science textbooks alone. Working collaboratively with you and the framework from your research, led me to a better understanding of the processes and stages of science teaching. More importantly, I understood the importance of having a clear intention for the different subjects I was teaching in class. As I worked through the framework, I realized that I was teaching mostly from Vision I, which I felt, made my classes meaningless. We, as teachers, often stay within the constraints of textbook activities and it's rarely that we engage with Vision II. Activities and engaging projects with the students are conducted often when it is convenient with the teacher or rarely conducted due to lack of materials and access to resources. What I am saying is that my practice went from teaching science as a segregated and isolated piece of knowledge to seeing a bigger picture where every piece of knowledge is intentional and contributes to the bigger picture.

Working with you and the framework helped me create intentional hands-on science activities and gave me the courage and will to go beyond the textbook. I am so impressed with my students because, compared to previous years they became more interested in the learning process and began to participate more in class. The biggest difference was with my deaf students, who showed the most significant progress in their grasps of scientific knowledge. It was evident in the moment that the deaf student, realizing the interest of his colleagues in communicating, started his literacy process, as well as showing that he acquired new specific knowledge in other subjects, especially science and history. The students who found learning extremely difficult, began to make daily developments and increased their desire to learn more on their own. I feel that working through this framework has not only developed my practice for teaching science but also in the other subjects that I teach.

Authors: *That is fascinating. Can you give me a couple of examples and elaborate further?*

Clarah: The framework helped me to reflect on how I was teaching science and how my students were learning from classroom curriculum that was created with intentionality. I changed my approach to teaching science and from this change, it gave my students more autonomy and

ownership of what, how and WHY they were learning a certain topic. I want to briefly tell you about two specific times in my classroom where I observed my students applying scientific knowledge from an emotional origin, from Vision III. The first time we explored bacteria and viruses in the classroom, we learned about the anatomy and how they make us sick. I was surprised that after learning about the relationship between humans and bacteria, the students volunteered to help clean the school bathrooms. Due to the lack of easy access to cleaning materials and the high cost of purchasing them from the store, the students, independently took an initiative and used the computers at school to research on making their own disinfectants and soaps. They decided that they wanted to share their knowledge with others in the school and with a little guidance from me, they presented to their classmates about the relationship between us and germs. I was deeply impressed with their concern for their friends. In another example where I focus my science lessons in Vision III, was when I was introducing technology in the classroom. My aim was to show them different types of technology and how technology can impact our daily lives. Part of this lesson was for the students to identify a complementary technology with their interest. For this particular lesson, I emphasized on the importance of using technology to help another person who may need extra help. We talked about the importance of empathy as well. As a result, a group of students created an application that makes possible to learn sign language from games created by them to improve communication between deaf students and able listeners. This was the first time in my teaching experience that my students moved from applying scientific knowledge to meet class objectives to something that's more meaningful for their peers. In both examples, I focused my activities and lesson plan within Vision III and then building the knowledge and application that supports the outcome of Vision III. In this way, knowledge from Vision I and application from Vision II is developed and built, with guidance from me, by the students. In this way, scientific knowledge and application is more meaningful and specific.

***Authors:** As a result of how you've changed your approach to teaching science, what difference have you noticed in the classroom? Did you see any changes or impact on your students' learning and understanding about the topic of science?*

Clarah: Now that I design my scientific lesson plan by using the framework, I observe that my students have more autonomy and ownership over what they are learning. This gives them a sense of their abilities within and outside of the classroom and more importantly, they realized that they are part of this world and they allow themselves to dream and to wish to seek for a different future from the family. The framework provides a clear intent between knowledge, application and relationality to the world and through this introduces possibilities for students to make a difference. Vision III, for example, gives them a framework that allows them to think, learn and act beyond the classroom and in my opinion validates their role within their community.

I want to remind you that my students come from families who are poor, illiterate and marginalized and thus my students' views and perspective of their role within the community,

the world is limited and often school and learning is the last thing they want to participate in. I've seen firsthand, after working with the framework that some of my students find meaning in what they are learning about. They see value and meaning because they are learning and experiencing more than just the textbook or what I am lecturing about. Working through Vision III provides that meaning. I can see that my students feel that they can make a difference despite of their socioeconomic status.

***Authors:** Many educators like yourself will be reading this interview and may identify with some of the struggles that you've presented. To those educators, what would you like to say them?*

Clarah: My experiences and reflections through the application of the framework, I found answers to many of my initial questions. In the past year of working with the framework and you, new questions arose, pointing to the need to continue seeking greater theoretical and practical deepening, constantly transforming my teaching practice. I realized the importance of the contribution of Visions I, II and III as a teacher, I viewed the students' learning process differently by paying attention to students individually and as a collective.

The application of the framework in the school provided a space for the reconstruction of learning for both students and teachers, in which it became possible to adapt practice in order to meet the collective and individual needs of children. The framework helped me to teach students how to have an investigative look, in order to discover their needs and to assist them in the construction of their learning, overcoming learning difficulties and more importantly, have the students realize the importance of connecting to what they are learning about.

The three visions framework helped me build a new perspective and a new pedagogical practice and approach and having a clear intent for what I want for my students. Moving forward, there is no doubt that I will still have questions and explorations about my teaching practice, students and my classroom, and working through the framework has given me more direction on how I can navigate my questions the next time I teach science in my classroom.

***Authors:** Thank you so much for sharing your experiences and reflections with us about how TVF has helped you shaped your teaching practices. I hope the readers are able to take away one or two messages from our interview. Thank you again.*



Clarah's Grade 4-5 science class during Dr. Tan's research visit to Arnaldo Grin Elementary in Novo Hamburgo, Brazil. Clarah is standing on the far left, Dr. Maria Eduarda Giering to the right and Dr. Poh Tan on the far right of the picture.



Dr. Poh Tan with two of Clarah's students who gave a tour of their school.



Two students are showing Dr. Poh Tan and her translator (on the left) where they collected their samples and what they observed in the petri dishes. Clarah explains how the activity gave the students more awareness about pathogens that are visible to the naked eye.



The students were working as a team to understand the roles and effects of pathogens found in their classroom and around their school, and how their immune system played a role in defending their body. Students took turns collecting samples from around the school. Collection materials (e.g. swabs, disposable lab coats, masks, petri dishes and bacterial medium) were a combination of donated, borrowed and teacher purchased.

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