

New rules of engagement

Following training as a research scientist and then a teacher, **Dr Chantal Pouliot** turned her attention to improving the way in which people engage with science education. Her work promises to improve how science is taught by involving those whose voices would normally be excluded



Could you outline your professional background and primary research interests?

After my first degree in biology, I worked as a research professional in entomology. Following this, I attained a certificate to teach at college level and became a biology teacher. This gave me the opportunity to teach a variety of different programmes including sciences, humanities, nursing and dietetics. I completed my PhD while working as a teacher and obtained a professorship a few months before my thesis defence.

My primary research interests concern the ways in which science education can help to develop citizens who are active and competent with regards to the development of science and technology.

What does your science education research programme entail and what challenges are you hoping to address within this field?

The teaching of socioscientific issues (SSIs) has not yet emerged as the natural place to focus attention when it comes to the sociopolitical management of such issues. I think that science education should incorporate a critical view of the dominant discourse concerning the roles and capacities of citizens in particular. We have to stop seeing citizens as ignorant and disengaged people.

Can you give some examples of your research projects and describe how they were conducted?

I wanted to investigate how science students and pre-service teachers make sense of their relationships with scientific experts and interpret the roles and capacities of

social actors. To do this I used a variety of methodological tools including individual interviews, focus groups and questionnaires.

My PhD student, Audrey Groleau, conducted a study in which she used a game, PlayDecide (www.playdecide.eu) to discuss how pre-service teachers manage the controversial issues surrounding the developing field of nanotechnologies. She discovered that her participants held diverse views about the roles scientists and citizens should play. For example, some think scientists should both inform citizens and make decisions relating to this field. Other participants believe that citizens are able to make those decisions and should do so, or at least participate in the decision-making process in collaboration with scientists, engineers and politicians. Groleau's approach to this issue was very instructive and innovative.

What have you discovered about the perspectives of pre-service teachers in regard to the development and management of present and future socioscientific challenges?

It is now commonplace in science education for teachers working in class with SSIs to focus on fostering scientific literacy so that young people can familiarise themselves with science in action; develop their evaluative capacity; make decisions concerning controversial sociotechnical issues; and take part in discussions based upon relevant sociotechnical controversies.

My studies show that science students and pre-service teachers are able to talk coherently about technoscientific issues – the constitution of research collectives, for example, as well as the dissemination and use of results. They have also presented some interesting ways to manage controversies via different kinds of public engagement. One point is clear: for many, public participation in the management of scientific controversies constitutes a way of limiting the risks of political and technoscientific misadventures such as corruption and biased representation of important issues.

What have been the project's proudest achievements to date?

It's important to illustrate that pre-service teachers understand

the management of SSIs and demonstrate that they have interesting ideas, which can be built upon to help them teach science. Instead of focusing on what they don't know (the 'deficit model'), I use the French notion of 'relationship to knowledge' (in French, *rapport au savoir*) to propose a positive interpretation of their reflections on a topic.

Where will you focus your professional efforts over the next few years?

I plan to investigate more SSIs and utilise novel methodologies to understand pre-service teachers' points of view. I will work with teachers from all levels of education on pedagogical activities related to SSIs. I am also working with preschool and primary teachers to identify new ways for children to explore science and art simultaneously.



Power to the people

A unique project from **Laval University** seeks to establish the viewpoints of prospective teachers concerning their attitudes to scientific experts in part of a broader research programme into the way socioscientific issues are handled in society

TO MANY, THE world of science can seem somewhat inaccessible – either due to the complexity of the subject matter it deals with or the apparently elitist nature of the systems that underpin it. This situation is entirely understandable, and yet science lies at the heart of so many issues that affect people on a daily basis. While scientists are in a position to make informed decisions regarding complex matters, it is suggested, in many fields of research, that citizens should have some role in technoscientific affairs which affect them personally.

Perhaps science education holds the key to greater participation by the public; after all, more confident citizens would be in a better position to contribute to decision-making processes regarding science policy. Dr Chantal Pouliot from Laval University, Canada, sees an increased focus on socioscientific issues (SSIs) in education as a crucial step towards improved management of such issues. “The concepts of participation and deliberation have been given strong symbolic weight in science education,” she explains, but is sure to stress the word ‘symbolic’. “In point of fact, although such methods are highly valued in everyday political discourse, they are not always taken seriously in government action.” The truth is the democratisation of SSIs that could potentially arise from an increased focus on their teaching

is a long way off. What is needed is a set of new tools with which to approach these matters in science classes.

CITIZEN ENGAGEMENT

Since completing her PhD in 2007, Pouliot has been developing a research programme aimed at contributing to science education and citizenship, with a view to enrich the way SSIs are managed. Her research has focused particularly on air pollution, cellular phones, biotechnology and nanotechnology – all controversial issues that have sparked much interest and debate in the public sphere, and have a tangible effect on the entire population.

An innovative aspect of Pouliot’s work is her use of theoretical tools from other research fields such as public understanding of science, science and technology studies, and political philosophy. Studies previously conducted in these areas to ascertain the public’s capacity when it comes to scientific dialogue have frequently demonstrated ample engagement abilities. Skillsets assumed to be the preserve of experienced researchers have proven to be perfectly comprehensible to regular people; these include defining what constitutes a problem, establishing research protocols, producing legitimate knowledge and critically comparing uncertainties and risks accompanying SSIs.

A demonstration of these principles in action, and of people power driving the advancement of science, comes from Pouliot’s home province of Québec. In 2012, a Québec City resident, Véronique Lalande, noticed a red dust coating the outside of her windows while at home on maternity leave. She had samples of the dust analysed and found that it contained high concentrations of carcinogenic nickel, prompting her to push for increased awareness of the issue and measures to combat these pollutants. Some of her wishes were eventually granted, but along the way she met many obstacles from political representatives not used to accepting the input of non-experts. It is these obstacles that Pouliot’s work aims to break down.

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INTELLIGENCE

PORTRAIT OF FUTURE TEACHERS ENROLLED IN THE ONLY PRE-UNIVERSITY PROGRAM IN EDUCATION IN QUÉBEC'S RELATIONSHIPS TO SCIENTIFIC EXPERTS

OBJECTIVES

To understand the way students and prospective science teachers picture the management of socioscientific issues and conceive of the roles, capacities and legitimacy of the social actors concerned. The project is also interested in their relationships to scientific experts. Research conducted here draws on the analyses and findings of science studies, public understanding of science and political philosophy.

KEY COLLABORATORS

Researchers: **Steve Alsop**; **Larry Bencze**; **Lyn Carter**; **Ralph Levinson**; **Isabel Martins**; **Matthew Weinstein**; **Richard Gagnon**; **Vincent Richard**; **Thérèse Laferrière**

Teachers: **Jean-François Maltais** (biology); **Dominique Thibault**; **Christine Veilleux** (social sciences); **Dominique Bouffard**; **Guy Blouin**; **Marika Panci** (building mechanics); **Martin Dumas**; **Jérôme Fachon** (civil engineering); **Catherine Rhéaume**; **Stéphane Gaumont-Guay** (physics), Cégep Limoilou

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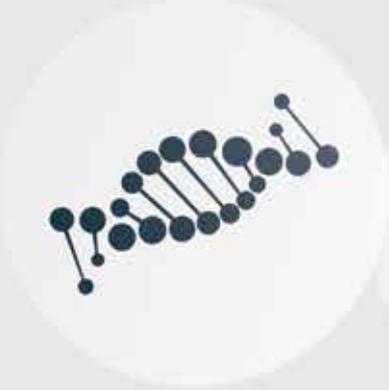
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CHANTAL POULIOT studied biology (BSc, 1997), literature (MA, 2001), science teaching (CEC, 2001) and science education (PhD, 2007). She worked as a research professional (1997-2002) and teacher of biology from 2000-07. Pouliot published work in *Science Education*, *Research in Science Education*, and the *International Journal of Environmental and Science Education*. She wrote a chapter in *Activist Science & Technology Education* (Springer, Eds L Bencze and S Alsop, 2014) and is an editorial board member of *Cultural Studies in Science Education*.



DIFFERENT MODELS FOR DIFFERENT APPROACHES

When it comes to examining citizen-scientist interactions, three models (described by Michel Callon, a French researcher in the field of science studies) are generally utilised, each of which takes a different approach to the relative roles of each group in the socioscientific decision-making process. The deficit model is so-called because it assumes that citizens have a deficit of knowledge when it comes to comprehending matters relating to science. As such, this approach gives a highly asymmetric distribution of the right to voice opinions, favouring the scientific community, who are seen as the social actors in the best positions to influence major SSIs. This is by far the most widespread model used when managing such issues.

The public debate model seeks equality in terms of representation of the two groups' viewpoints. Citizens and scientists are allowed to interact in public discussions, wherein citizens can form subgroups to voice their opinions and hopefully influence those of the scientists. While the flow of communication has now become bidirectional – a development from the unidirectional deficit model – the ultimate input still comes exclusively from the scientific community.

The third major approach is the coproduction of the knowledge model, which is characterised by the full incorporation of citizens ideas and knowledge into the discussion, and also a substantial input into final political outcomes. This model relies on at least some members of the public to be equipped with the expertise and cognitive abilities to bring something new to the discourse, as well as providing a fresh perspective on the pertinent issues being discussed. Pouliot believes the incorporation of political notions and considerations into the classroom could lead to a decisive change in the way SSIs are dealt with and a shift away from the deficit model. The tools that she uses in her research represent the first steps towards such change.

PROSPECTIVE TEACHER PERSPECTIVES

Given the perceived importance of education to encourage debate and involvement in scientific issues, it is surprising that no prior research has been done to establish the viewpoints of the teachers on the different actors concerned by SSIs. When discussing controversial issues in a classroom, the way a teacher approaches the subject is bound to have an effect on their

students. As such, they are crucial social actors whose actions can have far-reaching effects.

It is this way of thinking that has led Pouliot to her main body of work, a unique study into the opinions of pre-university students who are also prospective primary and secondary school teachers. This information was gathered by distributing Views on Science-Technology-Society (VOSTS) open questionnaires to many groups of pre-service teachers to garner their views on the roles that citizens, scientists, industry and government should play in deciding the outcome of SSIs. The results were intriguing – the students tended to view scientists as the best people to be making decisions, and in this respect, conformed almost universally to the deficit model. However, there were some key points which suggest a need for a shift in the systems currently in place – primarily the idea held by many that there should be transparency from scientists when decisions are being made regarding SSIs. There was also a lot of emphasis placed on the role that education should have – many participants suggested that the scientists' role should include educating the public about SSIs that were liable to affect them personally. Overall, the view these pre-service teachers had of the public was as 'concerned watchdogs'.

Pouliot's vision is for an education system which actively encourages involvement in SSIs, and to achieve this she has extended her work to include various other assessment methods. Aside from these studies, she also works directly with teachers to provide them with the tools to promote academic persistence. One aspect of this work is her 'Teaching values at the college level' project, in which her team has developed eight novel activities that can be incorporated into existing science courses, with a broad goal of giving meaning to college students' education. At a time when curriculum reform is being widely discussed, Pouliot's focus on the promotion of values and interaction suggest an intriguing new direction for the science education system.

