Securing Our Future by Creating a New Generation of Water Professionals

Dr Cherie Westbrook

Scientia

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Canada, like most other countries worldwide, is facing serious issues related to water security. To better address these challenges, **Dr Cherie Westbrook** at the University of Saskatchewan, and her collaborators from various Canadian universities, developed NSERC CREATE for Water Security. This add-on academic program provides graduate and postgraduate students with skills and learning opportunities that prepare them to tackle current and future water security issues.

Increasing Water Scarcity

Climatic and environmental changes are having a major impact on the quantity and quality of water available on our planet. Such water scarcity can have serious repercussions on all areas of society, ultimately threatening the sustenance of humans, animals and ecosystems on Earth.

Canada is among the many countries currently facing water security issues, due to serious shortages in its river basins, increasingly frequent floods and droughts that are worsened by climate change, a growing urban population, and several other factors. Integrative research agendas and collaborations focusing on both science and governance-related aspects of water security could play a key role in tackling and overcoming these challenges.

Identifying solutions to water security problems requires a vast skill set and a solid knowledge of complex systems. As water security issues are expected to rise further over the next few decades, due to the rapidly changing climate, universities should ensure that they are training new generations of experts who have the skills necessary to tackle these challenges.

A good water professional should be able to shift between theory-based science and practice, in order to conduct research, but also apply interdisciplinary scientific findings in her field work. Currently, however, most graduate training programs in Canada are based on a traditional academic model that focuses on a single discipline, without linking scientific knowledge with its practical applications.

New academic programs and training models could thus ensure that young people are better prepared to face current and future water security-related challenges, both in Canada and worldwide. With this in mind, researchers at the University of Saskatchewan and other Canadian institutes, led by Dr Westbrook, have designed NSERC CREATE for Water Security, a career-oriented academic program that prepares graduate students and postdoctoral fellows to effectively tackle water security-related challenges.

NSERC CREATE for Water Security

The Collaborative Research and Training Experience Program (CREATE) was introduced by the Natural Sciences and Engineering Research Council of Canada (NSERC) in 2008, with the mission of funding initiatives aimed at tackling important scientific challenges in Canada. The CREATE program offers financial support to projects that introduce collaborative and integrative approaches to address key scientific issues, as well as initiatives that facilitate the professional development of new generations of scientists.

In 2015, Dr Westbrook and her colleagues were awarded one of these grants for the development of the NSERC CREATE for Water Security program. While their project is led by the University of Saskatchewan, it also involves scientists at the Universities of Waterloo, Calgary, McMaster and Manitoba.

'What sparked our interest in applying for the CREATE program is the increasing recognition that water security is a very response-based field,' says Dr Westbrook. 'There is high demand for water security professionals across all sectors – technical experts, innovators, leaders and influential researchers. To get these jobs, graduates need more than just the skills and knowledge they acquired at university.'

Dr Westbrook and her colleagues observed that PhD graduates in Canada often found entering workplaces outside of academia difficult, due to their lack of professional skills and established networks. In addition, many graduating students struggle to effectively convey the value of skills acquired in their studies to potential employers.

'We noted an underdevelopment of professional skills needed for researchers to work inside academia too, owing to the wider skill set needed by professors to be successful in all aspects of their jobs,' says Dr Westbrook. 'We identified a gap and found that a shift in the existing education model was needed to meet the current shift in demands.'

A Career-oriented Training Model

To fill the gap between traditional training approaches employed by most universities in Canada and the skills necessary to become a proficient water professional, Dr Westbrook and her colleagues created a new academic model. This model is designed to provide students with an interdisciplinary knowledge and the tools needed to apply this knowledge in professional settings.

NSERC CREATE for Water Security is a comprehensive research and training program for both graduate students and postdoctoral fellows with a key focus on their professional development. It is designed to teach prospective water professionals how to solve complex, multi-faceted and dynamic problems, such as those that currently threaten water security worldwide.

'The complexity of the water security problems facing Canada (and the world), requires future researchers and practitioners be trained using a new model, one that is collaborative and integrative across multiple disciplines, and develops the necessary personal and professional skills,' explains Dr Westbrook.

The program introduced by Dr Westbrook and her colleagues is based on a scholar-practitioner model that trains students to integrate science, engineering and policy analysis, applying concepts from all these disciplines to tackle the challenges associated with managing complex and uncertain water systems.

Program Structure

All students in the NSERC CREATE for Water Security program must complete two mandatory modules, which are designed to broaden their understanding of different disciplines involved in the field of water security. These modules also teach students how to combine these different concepts and apply them to real-world problems. They can also participate in five additional program opportunities, including short courses, off-campus activities, workshops, career development sessions, and research opportunities.

'The program provides trainees with a common platform and customisable career path mentoring to facilitate their transition to a research or practitioner career of their choosing,' explains Dr Westbrook. 'Mandatory in the program is a course called "professional practice in water security", where students are introduced to the request for proposals competitive bid process as a demonstration of how academic

skills can be translated to professional practice.'

In addition to mandatory modules, students who take part in the program can attend supplementary short-format courses focusing on specific topics or areas related to water security. They are also offered the opportunity to expand their skills further in laboratory settings or by completing internships outside of their university.

'The students have the opportunity to engage with the consulting industry, municipal and federal governments, and Indigenous peoples to learn different perspectives of integrative science and problem solving,' says Dr Westbrook. 'For the customisable component of the program, some students were very creative in choosing the opportunities important to them. Three students, for example, attended the Science Outside the Lab workshop, which provides a deep-dive, immersive introduction to science, policy, and societal impacts. One of these students met their current employer there.'

Students participating in the program are also asked to complete interdisciplinary research as part of their final thesis. This might entail the integration of research methods from different fields, as well as focusing on a particular topic on the boundary between two or more disciplines.

Key Milestones

So far, 61 graduate students and four postdoctoral fellows have taken part in the program. The feedback received from these students was overwhelmingly positive, as most felt that it helped them acquire an interdisciplinary understanding of problems, showing them how they can apply skills acquired academically in a variety of professional settings.

'There is still a very strong culture of focusing graduate training on preparing students for academia in the field,' says Dr Westbrook. 'To see so many students engage in CREATE for Water Security indicates the beginnings of a cultural shift. The project also enhanced Canadian research momentum in the field of water security.'

Dr Westbrook and her colleagues observed that internships and lab exchanges were widely appreciated by those participating in the program, as they provided hands-on learning opportunities that are not offered by traditional academic courses. 'They have made many connections with professionals and other researchers,' adds Dr Westbrook. 'Several also secured jobs after graduation with the company they did internships with.'

Paving the Way Towards Change

The grants offered as part of the NSERC CREATE initiative cannot be renewed, therefore in March 2021 the program developed by Dr Westbrook and her colleagues will come to an end. Given its great success, the researchers plan to integrate some of its elements into other courses offered at their universities, while also encouraging other institutions to follow a similar training model. For instance, Dr Westbrook and faculty in her department plan to make a modified version of one of the program's core courses available to all graduate students at the University of Saskatchewan.

'As a result of our efforts, individual researchers, including myself, now better see the value of having graduate students engage in professional development workshops, and even lab exchanges and internships,' says Dr Westbrook. 'I think supervisors will continue encouraging their graduate students to explore various opportunities and hopefully provide funding to them to build professional skills.'

Interestingly, faculty members involved in this project observed that memberships to student-led professional development societies, such as the Global Water Futures Young Professionals, have recently increased. This rise in interest could ultimately encourage faculty members to provide similar opportunities as part of regular courses offered at their universities.

Dr Westbrook and her colleagues are now writing a journal article summarising their experiences with the use of a scholar-practitioner model throughout their six-year project. In the future, their training model could serve as an example for other universities in Canada and worldwide, inspiring a cultural shift in academia within the field of water security.

Meet the researcher

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Dr Cherie Westbrook is a Professor of Ecohydrology at the University of Saskatchewan. She holds a BSc in Environmental Science from the University of Toronto, an MSc in Environmental Biology and Ecology from the University of Alberta and a PhD in Ecohydrology from Colorado State University. Dr Westbrook has been engaged in research investigating areas of wetland science and conservation for over two decades. Most of her studies are aimed at understanding how mountain wetland systems are responding to environmental changes. Her work is typically carried out directly in the field. Dr Westbrook has published over 40 peer-reviewed papers related to wetland science, and has also prepared several technical reports for both government agencies and non-profit organisations. Her research has been featured by several renowned publications, including *New Scientist*, *Canadian Geographic*, and *Atlantic.* Dr Westbrook has served as an advisor for numerous government projects and was a key speaker at a number of important conferences on water security. She is also a founding member of the University of Saskatchewan's Global Institute for Water Security.

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