

# ARE NOVA SCOTIA TEACHERS PREPARED TO TEACH CLIMATE CHANGE?

A preliminary look at the knowledge and needs of pre-service teachers, as well as opportunities for improvement

This draft summary is one of the products of a 2013 study funded by Nova Scotia Environment's Climate Change Adaptation Fund. The main component of the research was a survey of Nova Scotia teachers' climate change knowledge and attitudes, their thoughts on (and where applicable, their approaches to) climate change education, and their requests for resources and other support to help them integrate climate change into their teaching.

## CLIMATE CHANGE KNOWLEDGE

Studies in other jurisdictions have revealed low levels of climate change knowledge amongst pre- and in-service teachers<sup>1</sup>. In Nova Scotia, our survey of 188 in-service teachers reveals that while most have a reasonable base of climate change knowledge, misconceptions and knowledge gaps are also common.

Preliminary results from our survey of pre-service teachers demonstrate that these issues extend to Nova Scotia teacher candidates as well<sup>2</sup>. For example, climate change misconceptions held by many pre-service teachers closely mirror those held by Nova Scotia in-service teachers (see table below). These preliminary findings are not surprising: Nova Scotia pre-service teachers surveyed self-evaluate their level of climate change knowledge as average (79% of survey respondents reported that their level of climate change knowledge was between 4 and 7 on a 10 point scale; in-service teachers made similar evaluation: 71% chose between 4-7/10).

## COMMON MISCONCEPTIONS HELD BY NS TEACHERS<sup>3</sup>

Thinning of the ozone layer contributes significantly to the greenhouse effect

Radioactive waste from nuclear power plants contributes to climate change

The greenhouse effect is entirely human-caused

Pollution of waterways contributes to climate change

Littering contributes to climate change

Melting of sea-ice causes sea-level rise

Methane is produced primarily by burning fossil fuels

More sunlight reaching the Earth contributes significantly to present day climate change

Climate change causes earthquakes

Climate change causes skin cancer

Climate change causes acid rain

Half or less of climate scientists endorse anthropogenic climate change

## SCIENCE BACKGROUND

Misconceptions and knowledge gaps are not surprising, given that both elementary and secondary-stream pre-service teachers were surveyed, and many of the respondents likely have little (or possibly no, in the case of some non-science secondary teacher candidates) science background. A background in science appears to have improved survey performance amongst in-service teachers (science majors scored an average of 8.3/10 vs. 7.5/10 for non-majors); similarly, secondary in-service teachers performed slightly better than elementary teachers (7.35/10 vs. 7.95/10).

**ELEMENTARY:** Pre-service elementary teachers are required to have completed a minimum of six science credits prior to applying to any of the B.Ed. programs in Nova Scotia.

**SECONDARY:** All pre-service secondary teachers are required to have completed a minimum of 30 credits in their first teachable and 18 in their second teachable, with no required science courses for those with non-science teachables.



## SCIENCE PREPARATION AS PART OF B.ED.

Nova Scotia pre-service teachers undergo different degrees of preparation to teach science, depending on where they complete their B.Ed. The numbers of required science courses, availability of electives, and access to specialized faculty members are some of the ways that B.Ed. programs differ in Nova Scotia.

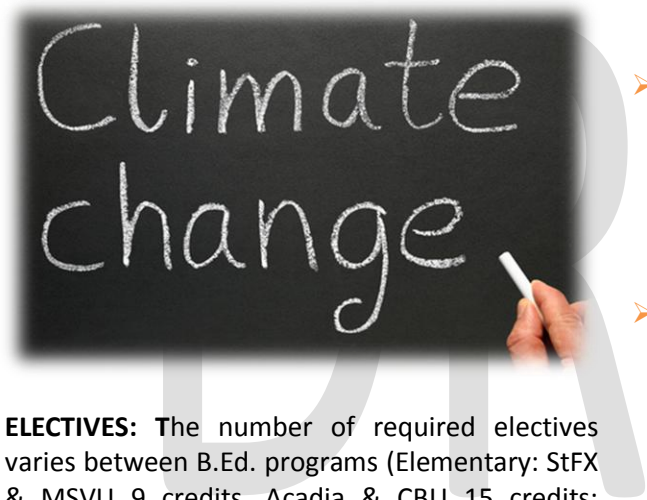
1. See, e.g., Hayhoe, D., Bullock, S., & Hayhoe, S. (2011). A kaleidoscope of understanding: Comparing real with random data, using binary choice items, to study preservice elementary teachers' knowledge of climate change. *Weather Climate and Society*, 3(4), 254-260 and Wise, S. B. (2010). Climate change in the classroom: Patterns, motivations, and barriers to instruction among Colorado science teachers. *Journal of Geoscience Education*, 58(5), 297-309.

2. Only 49 pre-service teachers (from CBU, StFX, and MSVU) responded to the questionnaire as of March 14, 2013. A more in-depth analysis of the data will be conducted once final results are in (after March 31, 2013) -- this draft summary will be updated after this time.

3. This list of misconceptions was generated based on the data from the 36 pre-service teachers who completed the questionnaire and 188 in-service teachers. As the pre-service data is preliminary, this table may require updating as additional data becomes available.

**ELEMENTARY:** Science course requirements differ between the B.Ed. programs offered at NS universities. There is only one three-credit science requirement for CBU, Acadia, and StFX students. Two three-credit science courses are required for MSVU (two-part science curriculum & methods course). As a result, pre-service teachers completing their B.Ed. at MSVU appear to have greater preparation for science instruction<sup>3</sup>.

**SECONDARY:** Acadia requires that B.Ed. students complete two three-credit methods courses in their first teachable and one in their second. CBU, MSVU, and StFX require two three-credit methods courses in each teachable. Pre-service teachers who are required to take more science courses may be more confident and better prepared to teach science<sup>3</sup>.



**ELECTIVES:** The number of required electives varies between B.Ed. programs (Elementary: StFX & MSVU 9 credits, Acadia & CBU 15 credits; Secondary: MSVU 6 credits, StFX & CBU 12 credits, & Acadia 18 credits). So does the number and selection of available electives. Some of the electives that would be appropriate places to include a focus on climate change are MSVU's EDUC 5404: Critical Media Literacy and StFX's EDUC 419: Curriculum and Instruction in Middle School Science<sup>4</sup>. Acadia appears to have the most relevant electives, with a selection that includes EDUC 41A3: Energy, Power, Transport Technology, EDUC 41E3: Science, Technology & Society, EDUC 42A3: Media & the Environment, and EDUC 4453: Advanced Curriculum & Instruction in Elementary Science.

**FACULTY:** Acadia's School of Education includes a faculty member with climate change education as one of his principle research interests. CBU has two faculty with a sustainability education focus, within its small dept., and is currently in the process of launching a new focus area for their B.Ed: Education for Sustainability. Differences in faculty research and departmental specialization create uneven opportunities for student exposure to climate change; however, faculty at all schools showed interest in facilitating this project, and are therefore likely to be receptive to efforts to increase pre-service teacher climate preparation.

## WHAT IS BEING DONE ELSEWHERE?

There is evidence that including curricular modules on climate change as part of science methods courses may help improve pre-service teachers' readiness for teaching about climate change:

- Hestness et al. (2011)<sup>5</sup> designed a curricular module on global climate change and incorporated it into a required elementary science methods course. Pre-service teachers who participated reported improved understanding of climate change, a greater appreciation of the benefits of climate change education, and reported feeling more prepared to teach about climate change.
- Lambert et al. (2012)<sup>6</sup> also provide evidence of benefits of integrating climate change into elementary science methods courses. The authors assessed pre-service teachers' climate change knowledge pre- and post-intervention, and found improvements in their performance, as well as other benefits, including more interest and confidence in learning about climate change.
- Matkins & Bell (2007)<sup>7</sup> developed and tested an elementary science methods curriculum that combined learning about climate change and global warming with explicit study of the nature of science. The researchers found that understanding of both climate change and the nature of science improved for pre-service teachers who participated in their intervention.

## WHY INTEGRATE CLIMATE CHANGE INTO TEACHER PREPARATION IN NS?

- Has the potential to improve understanding of the processes and nature of science
- Helps ensure that teachers' understanding of climate change more closely aligns with that of the scientific community (this is especially important as pre-service teachers reported that newspapers and TV were their most common sources of information on climate change)
- Prepares teachers for dealing with other complex, interdisciplinary, and potentially controversial topics in their classrooms
- Has the potential to improve teachers' confidence in their ability to teach science, as well as increase their appreciation of the importance and value of teaching about climate change

3. There is some evidence, however, that increasing the number of science courses required by pre-service teachers may not translate to significant knowledge gains. See, e.g., Wenner, G. (1995). Science knowledge and efficacy beliefs among preservice elementary teachers: A follow-up study. *Journal of Science Education and Technology*, 4(4), 307-315.

4. Interestingly, elementary pre-service teachers are required to take 468: Teaching Mathematics in Middle Schools, but not 419: Curriculum and Instruction in Middle School Science.

5. Hestness, E., McGinnis, J.R., Riedinger, K., & Marbach-Ad, G. (2011). A study of teacher candidates' experiences investigating global climate change within an elementary science methods course. *Journal of Science Teacher Education*, 22, 351-369.

6. Lambert, J.L., Lindgren, J., & Bleicher, R. (2012). Assessing elementary science methods students' understanding about global climate change. *International Journal of Science Education*, 34(8), 1167-1187.

7. Matkins, J.J., & Bell, R.L. (2007). Awakening the scientist inside: Global climate change and the nature of science in an elementary methods course. *Journal of Science Teacher Education*, 18, 137-163.