"Roll Up Your Sleeves and Get At It!" Climate Change Education in Teacher Education

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Abstract

We present findings from research on a nine-week elective course, Climate Change Pedagogy, *taught for the first time in the Bachelor of Education program at Lakehead University in winter 2014. After reviewing literature on what is needed for effective teaching about climate change and some of the neoliberal barriers to such teaching, we draw on interview and questionnaire data to describe successful aspects of the course and barriers we encountered in teaching about climate change. Participants said openness and a welcoming environment were important and they appreciated the relevance of course content and pedagogy to their future teaching in various grades and subjects. Barriers to teaching about climate change include teacher candidates' lack of knowledge about climate change and concerns about the "political" nature of climate change education. Many participants said that the course should be longer and mandatory for all teacher candidates.*

Résumé

Nous présentons les conclusions d'une recherche effectuée dans le cadre d'un cours à option de neuf semaines, Climate Change Pedagogy, *donné pour la première fois dans le Baccalauréat en éducation à l'Université Lakehead, à la session d'hiver 2014. Après avoir examiné la littérature sur les éléments requis pour enseigner avec succès en matière de changement climatique et sur certains des obstacles néolibéraux à cet enseignement, nous tirons parti de données provenant d'entretiens et de questionnaires pour décrire les aspects réussis du cours et les écueils à l'enseignement portant sur les changements climatiques. Les participants ont dit que l'ouverture et qu'un environnement accueillant étaient importants et qu'ils ont reconnu les mérites de la pertinence du contenu du cours et de la pédagogie pour la suite de leur carrière en enseignement à divers niveaux et dans différentes matières. On compte parmi les obstacles à l'enseignement en matière de changement climatique le manque de connaissances et les préoccupations des enseignants candidats à propos de la nature dite politique de l'éducation en matière de changement climatique. De nombreux participants ont révélé que le cours devrait durer plus longtemps et figurer parmi les cours obligatoires pour tous les candidats dans le programme en enseignement.*

Keywords: climate change education, teacher education, environmental education

Introduction

UN Secretary General Ban Ki-moon declared climate change the "defining challenge of our era" (UN News, 2007, para 1) and the IPCC (2014) predicted dire consequences if we continue with business-as-usual, yet climate change education in teacher education is still in its infancy (UNESCO, 2013). According to our searches, *Climate Change Pedagogy* at Lakehead University is the only dedicated climate change education course in teacher education in Canada. We describe what worked well for teacher candidates in the first offering of the course in 2014 and discuss barriers to teaching about climate change based on data gathered from student participants and our own observations.

Natalie taught the course, an 18-hour elective open to primary/junior (grades K-6), junior/intermediate (grades 4-10), and intermediate/senior teacher candidates (grades 7-12), over 9 weeks. Her overall goal was to enhance teacher candidate knowledge of climate change and ways to teach effectively about it through engaging them in activities that they might use in their own classrooms, hoping to increase their confidence and likelihood of doing so in the future. Natalie's background is in leadership development, community-building, and environmental education, and her master's thesis explored university responses to the climate crisis (Gerum, 2014). This was the first university course Natalie taught. Paul, a middle-aged tenured associate professor, gathered the data. Martha, a PhD student working in Indigenous education, helped with data analysis and writing.

Background

There is much general literature on climate change and how to communicate effectively about it (e.g., Moser & Dilling, 2007). Specific literature on teaching about climate change often describes approaches or activities within K-12 schools. We draw on both this and the less extensive literature on climate change education in teacher education to situate our work.

Climate change education in initial teacher education is important because, despite the dire threat climate change poses to all life on Earth (McKibben, 2010), teacher candidates are likely to lack knowledge necessary to teach about it (e.g., Arslan, Cigdemoglu, & Moseley, 2012). Even high school science specialists assigned curriculum that includes climate change hold many of the misconceptions about climate science held by K-12 students (Boon, 2013), perhaps because they themselves did not learn much about climate change in their own schooling (Porter, Weaver, & Raptis, 2012). This knowledge gap may mean they avoid teaching about climate change (Blum, Nazir, Breiting, Goh, & Pedretti, 2013). The interdisciplinary nature of climate change may mean multiple knowledge gaps for most teachers since new scientific, political, economic, sociological, ethical, and other knowledge is rapidly emerging.

Improving teacher candidate knowledge is necessary if their future students are to be empowered to take action on climate change (Schreiner, Henriksen, & Hansen, 2005). Much literature aims to help science teachers teach climate change as a scientific issue of social importance through an inquiry approach. Scholars believe that this will help prepare students for democratic participation as they learn to make decisions and change environmental behaviours (e.g., Albe & Gombert, 2012; Hestness, McGinnis, Riedinger, & Marbach-Ad, 2011). Some aim for student engagement in *personal* change such as recycling and bicycling and even in nominally political acts such as voting (e.g., Filho, Pace, & Manolas, 2010; Herman, 2015) while others suggest a more transformative agenda, for example suggesting that knowing the causes of climate change is the first step in being able to "assist students in feeling empowered to reduce individually, and corporately, the impact of these causes" (Skamp, Boyes, & Stanisstreet, 2013, p. 193). Hestness et al. (2011) argue for the importance of helping elementary science teacher candidates "consider the globally-significant ethical dimensions" (p. 367) of climate change. Vongalis-Macrow (2010) suggests that teaching should raise awareness of the impact of climate change on humanity and its dangers rather than explaining the science precisely. In her Australian study, teacher candidates were critical of government and felt industry should be more heavily regulated, despite their uncertain grasp on climate science. Across disciplines, these teacher candidates believed it was their collective responsibility to teach about climate change.

Many studies emphasize that climate change should be taught across disciplines (e.g., Bangay & Blum, 2010; Chambers, 2011; Kulnieks, Longboat, & Young, 2013) to address the complexity of the issue and to provide opportunities to recognize social and scientific aspects (e.g., Council of Ministers of Education, 2012; Hayden et al., 2011). Teaching that is experiential, engaging, fosters critical thinking and helps students imagine different futures and develop the capacity to act—which will be necessary for all citizens to deal with climate change—is also emphasized (Bangay & Blum, 2010; Filho et al., 2010; UNESCO, 2013).

It may be hard to enact such a transformative classroom agenda in the current neoliberal context of an immense "drive to consume" that is "'infinitely' greater than the drive to sustain" (Wals & Corcoran, 2012, p. 24). Indeed, neoliberal ideology may be the biggest impediment to tackling climate change (Klein, 2014) and it has created conditions for schooling that make teaching about climate change difficult. For example, individualism, competition, and consumerist agendas make education about necessary collective action challenging (Levinson, 2012). Further, the very structure of school systems, particularly their compartmentalization of knowledge, presents a barrier to empowering climate education (Schreiner et al., 2005) and tensions remain "between a centralized curriculum and the need to promote locally-based and locally-appropriate knowledge" (Bangay & Blum, 2010, p. 15).

In Ontario, Canada, where the current research was conducted, curriculum outside of the sciences has little emphasis on climate change (OME, 2011) and

initial teacher education programs in Ontario are not required to teach about climate change education by the regulating authority, The Ontario College of Teachers. In Alberta, a Canadian province heavily invested in the oil and gas sector, even science teachers who held high environmental ideals often found themselves glossing over climate change curriculum expectations due to pressures exerted by the school system, such as preparing students for standardized tests and having to cover much curriculum (Chambers, 2011). Interpreting Chambers' and others' work, Bissell (2014) wrote that Alberta teachers feel the tension between climate change and capitalism's "grand narrative of progress" based on fossil fuels (p. 23). They may unconsciously avoid teaching about climate change solutions since doing so threatens those in power and may be controversial amongst parents. In school systems that prioritize efficiency, standardization, and preparing students for job readiness and in political climates of privatization and distrust in governments (Elmore, 2013), teaching that may call the entire corporate capitalist system into question (Jensen, 2006; Klein, 2014) will be a challenge even for knowledgeable and committed teachers. Initial teacher education must help teacher candidates prepare for this challenging work.

While most Canadians do believe humans are causing climate change and are concerned about it (McDiarmid, 2014), feeling helpless and overwhelmed may cause people to avoid thinking deeply about it (Norgaard, 2011). This may mean teachers underestimate the urgency of the problem. Teachers who do teach about climate change face a potentially challenging emotional context (Kelsey & O'Brien, 2011). Some fear overwhelming students with depressing information (Hung, 2014; National Centre for Science Education, 2012), although an emotional response may be necessary for change. Upsetting imagery from what seems like large, faraway problems is less likely to engage people in action than are "everyday emotions and concerns" with local relevance (O'Neill & Nicholson-Cole, 2009, p. 355); localized, participatory learning is advocated (Bangay & Blum, 2010; Kulnieks et al., 2013; UNESCO, 2013).

The current study contributes to the growing literature on climate change education by reporting on an 18-hour elective course that helped teacher candidates from many subject areas and all divisions learn more about climate change and various ways to teach about it. By sharing both barriers and what has worked in our context, we hope that more of us will be able to plan and deliver more effective climate change education for aspiring teachers.

Methods

We used a case study methodology, appropriate for answering our research question given our focus on a single site. Though limited in their generalizability, case studies are appropriate for exploratory studies (Merriam, 1998). Data were gathered via interviews, questionnaires, and anonymous feedback in week three and six of the course.

Paul introduced the research near the beginning of the first class and distributed a description of the research, consent forms, and the semi-structured interview questions for all interviews. He invited people to contact him if they were interested in participating and returned in the second and third class to repeat the invitation; several people were immediately keen to participate and more volunteered after Paul assured the class that participants did not need to be knowledgeable about climate change. Natalie left the class when teacher candidates were invited to ask questions about the research process and she did not know who was a participant in the study until after final grades were submitted.

The questionnaires, administered by Paul in the first and last class, were used by Natalie to inform her teaching. They were anonymous and teacher candidates could indicate at the bottom whether these could also be used as data in the research. Opportunities to provide Natalie with anonymous feedback on the course at the end of the third and sixth classes were also administered by Paul. He returned the questionnaires and feedback to Natalie with the indications of participation removed so that Natalie did not know how many students were participating until after grades had been submitted. Paul had no connection to any of the students outside of the research.

Twenty-one semi-structured interviews were conducted by Paul. He is deeply concerned about climate change and is working actively to raise awareness in the community. He took a sharing and conversational stance for fairness, also knowing that it would mean good data. There was no pretense of neutrality (Oakley, 1981).

Six teacher candidates were interviewed near the beginning, middle, and end of the course; a seventh was interviewed twice and an eighth once. Six were male and two female, from a class of 16 males and five females—a very unusual ratio at a faculty of education where more teacher candidates are female than male. Interviews, conducted in Paul's office, lasted about 30 minutes each.

Questions in the first interview asked why people took the course, what they hoped to learn, whether they were concerned about anything in taking the course, what they thought after the first class, what they know about climate change and where their knowledge came from, and how thinking about climate change makes them feel. Questions in the second interview asked how the course was going, what had been enjoyable or challenging, what the strengths and weaknesses of the course were, whether participants had particular emotions connected to the course, and about classroom dynamics. Questions in the third interview asked what people learned in the course that was unexpected, what the most powerful learning experience was, how their view of teaching about climate change shifted through the course, how likely it is that they will teach about climate change and how comfortable they will feel, what makes them nervous about this teaching, what they are most uncertain about in teaching about climate change, what advice they would give teachers who are thinking about teaching about climate change, and what could be done to improve *Climate*

Change Pedagogy the next time it is taught. The interviews were transcribed and coded in the qualitative software program Atlas.ti.

Quantitative data were collected via questionnaires on the first and last days of the course, with questions similar to those in the first and third interviews. Qualitative anonymous feedback was collected after week three and week six; students could write what was going well about the class and what they would like to see changed. These data allowed us to contextualize the interviews to see whether the interview participants (n = 8) were representative of the whole class (n = 21) (Tashakkori & Teddlie, 2003). Between 16 and 18 teacher candidates gave permission to use the two questionnaires and anonymous feedback as data in the study.

Paul and Natalie also spoke frequently about how the course was going. They discussed instructor goals for different assignments, teaching challenges, successes, and pedagogy. These conversations were digitally recorded and transcribed.

The elective nature of the course, the volunteer nature of participation in the study, and the small sample size raise the possibility that the participants were more committed to climate change education than average teacher candidates and that our findings do not accurately represent all teacher candidates. There was, however, a diversity of background knowledge and beliefs about climate change amongst interview participants and quite varied reasons for taking the course; students had seen only the course title at the time of registering. For example, some took it by mistake—thinking it was about something else—and some because it was what fit their schedule. This variety gives us confidence that our findings will be useful in designing similar courses for teacher candidates with varying knowledge about climate change and varying levels of motivation for teaching about it.

Findings and Discussion

We focus here on two things participants said made the course effective: (a) openness and the welcoming environment; and (b) the relevance of the learning to teacher candidates' future teaching. We discuss challenges alongside successes. We highlight the need to acknowledge and address teacher candidates' fears about the politics of teaching about climate change. To provide context, we begin with some broad findings about participants' knowledge of climate change, motivation for taking the course, and concerns related to teaching about climate change.

Most participants felt they had some knowledge of climate change while a few said they had quite a lot of knowledge. Asked on the first questionnaire to indicate what they thought the worst-case prediction for the consequences of climate change was, participants indicated:

- "minor disruption including intermittent extreme weather events" (n = 3)
- "major disruption including drought leading to millions of climate refugees" (n = 10)
- "major warming leaving only the polar regions inhabitable by humans" (n = 3)
- "runaway warming leading to oceans boiling and all life becoming extinct" (n = 2).

The latter is a worst-case scenario discussed by leading climate scientist Hansen (2009); the former is, of course, already happening. This is one indication that student knowledge varied widely on entering the course and a similar diversity was apparent amongst the eight interview participants. One of them had extensive knowledge from listening to the American radio program, *Democracy Now* and another from reading, a few had learned something in high school or university, and some learned mostly about climate change from social media. Most believed that humans were causing climate change, but some were not sure. Only a few could describe the basic science behind anthropogenic warming.

Participants described various reasons for taking the course including wanting to learn more about "the facts" in light of the "controversy" surrounding the topic, feeling that environmental topics should be taught more in schools, and interest based on the subjects they were becoming qualified to teach. Others took it simply because it fit in their timetable or by accident. When asked what made them most nervous about teaching climate change, questionnaire answers included the concern that their future classes would end up having "heated debates" about it, its political nature, lack of knowledge, presenting information without bias, and the reaction of their students to "worst-case scenarios." Participants hoped to learn about teaching methods, about climate change itself, about teaching critical thinking, and about inspiring and engaging students.

Natalie believes that many students carried an underlying fear or nervousness – fear of "politics" (seen as conflict with students, parents, colleagues, or administrators), fear of losing their jobs, or fear of creating controversy. This may feel especially pressing at a time in Ontario when entering the teaching profession is a difficult prospect due to a huge oversupply of qualified teachers. It will be discussed later as will Natalie's thoughts on her own fears teaching the class. We turn now to what participants liked about the class.

Openness and the Welcoming Environment

The "open" nature of the course, that it could be taken by any teacher candidate at any level and subject specialization, was valued. Multiple perspectives were integrated in terms of grade levels, learning goals, and subject focus. Although a few students would have preferred more hard science or a secondary school focus, many saw the subject and age level diversity as a strength:

> Powerful…. Everyone was from different backgrounds and they brought a new spin to their approach to teaching and I think that was one of the best things in that class…. You learn from those and you're inspired to learn on your own too.

Natalie designed the course so that students could learn from each other. She included interactive simulations, many small group discussions, and a group "myth-busting" project where small groups debunked a popular climate change myth by teaching the class in a way that peers could use to teach their future students.

As noted earlier, the teacher candidates' foundational knowledge on climate change varied greatly. One person suggested this might reflect the reality of K-12 classroom teaching and said it could mean that some activities were "a little redundant for a couple of students." He said that while he did not learn content from all of the activities, it was very helpful to see how people with less knowledge responded. While it may have been impossible to meet the specialized needs of everyone, participants said they found that ideas were applicable across grades and subjects. For example, following a simulation game in the gym where the basic science of greenhouse warming was embodied, an intermediate/senior teacher candidate said: "Everyone likes to get on their feet, whether it's grade 3's or grade 12's." The efficacy of teaching climate change experientially resonates with the literature (e.g., Bangay & Blum, 2010).

A music teacher who took the course out of interest and to increase general knowledge said:

> You exist outside of your subject as well as being a person delivering the subject. So there are things that you bring to the classroom that are outside your subject area that I think should be important to the students, as well as the teacher.

An open course with varied subject matter and pedagogy worked well for this participant. It did not matter that the teachable subject of music might not be the first place you would think of including climate change content.

Natalie's approach as the course instructor was noted frequently by students who described her as "open and enthusiastic" and able to facilitate discussions where multiple perspectives were shared. Many participants described an environment where people spoke passionately, but where respect was maintained. One said, "The teacher's always doing a good job. If she senses there's some tension, she can break in and say something just to… keep the discussion on track." Another said that when people participate, "they do it because they genuinely have got something that they want to say." Most appreciated discussions as an important part of their learning. Natalie, in her reflections with Paul, agreed that discussions were useful, but noted that they rarely engaged the whole class. Many times the class was broken into small groups for activities and discussions in order to encourage greater participation. Although students appreciated the opportunity for open discussion and learning from multiple perspectives, concerns were voiced that in large group

discussions Natalie did not clearly state when a student was wrong. Instead of just acknowledging their contribution, one participant suggested challenging them: "Make them support their theory or their opinion a little bit more."

Facilitating class discussions to maintain openness and invite rather than discourage participation can be difficult. It may be most powerful when the instructor can draw on peers' knowledge to correct factual errors (Bateman, 1990), but it is worth considering the advantages and disadvantages of direct correction if this is not possible. In our environment of media inundation and the decline of traditional news sources, many people seem not to know what to believe about climate change. One participant said this is because there is "an opinion on all sides." Correcting misperceptions and teaching how to evaluate sources would therefore be very useful (Porter et al., 2012; Vongalis-Macrow, 2010).

This may also be fertile territory to explore openly with a class; everyone may be entitled to an opinion, but the role of the climate denial industry in disseminating misleading information to delay action on climate change has been substantial (Hogan & Littlemore, 2009). Discussing this explicitly and deciding together on ground rules for how the instructor might tackle "incorrect" information could add a valuable dimension to the course. Teacher authority could also be productively discussed. In the midst of a crisis that will not be solved by relying on authority (Filho et al., 2010; Hedges, 2015), interrogating classroom power structures and their connection to obedience and passivity would be useful, although perhaps difficult in an 18-hour course!

The open nature of the course was also reflected in assignments. The final assignment for the course allowed students to demonstrate their learning in a way they chose themselves. Some students created songbooks by rewriting popular song lyrics. Others made blogs or websites to help teachers connect with climate change information, or created climate change *Jeopardy* games for use with students. Some chose research papers on specific areas of climate change. While there was some initial apprehension about the openness of assignments, many came to appreciate the opportunity to build on their own strengths, backgrounds, and to expand their base of resources in a personalized way. The goal was for students to create something useful for themselves as beginning climate change educators.

Overall, Natalie's approach seemed to engage teacher candidates from different disciplinary backgrounds who will teach different grades, and helped them learn from each other despite very different levels of knowledge about climate change. Part of this may have been Natalie's work to create a welcoming emotional environment. Natalie admitted to the class that she was sometimes nervous, that she did not know everything, and that as a young female instructor, she might be given less authority than an older male. One participant praised this and we expect that it helped create space for participation.

By the participants' accounts, the class provided an environment where people could learn and change. Several spoke about the anticipation of coming

to class to see what unique approach or activity would engage them that week. Not needing to memorize information for an exam was also welcome: "You can just come in, put your feet up (not literally) and then just soak it in." This participant noted a "group kind of feeling" that existed only in *Climate Change Pedagogy* and his *Indigenous Education* class.

We are not surprised that these two classes might have been unique in prioritizing group cohesion. Neoliberalism may make teaching climate change as well as Indigenous education difficult, but the friction may go even deeper. As Saul (2014) wrote, we have trouble taking sustainability seriously "because our underlying ideas of progress and individual rights eliminate it. Continuity is not a Western democratic idea. But it is an indigenous idea" (p. 172). Western schooling is implicated in colonization (Battiste, 2005) and environmental destruction (Orr, 1991); to attempt to address either from within the structure means doing some things differently, such as resisting individualism, as the growing literature on decolonizing and Indigenizing environmental education attests (e.g., Scully, 2012).

Natalie worked intentionally to create community in the class, something that may be present in broader educational rhetoric but infrequently embodied. A participant said:

> It's just such a good atmosphere to be in and you're not afraid to say something. And if you say something wrong, you're not afraid to be wrong because you know that the right answer is going to be coming up and you're learning from those mistakes you've made.

On the questionnaire administered on the last day of class, all participants noted that the classroom environment was positive. This may have contributed to most people reporting "substantial" shifts in their orientations to teaching about climate change, although this is speculative and we do not have data from the questionnaires about what precisely those shifts entailed. Interview participants provide a window into this, however, and described shifts such as being able to simplify complex concepts for students, having ideas of where to start in teaching about climate change, having thought about how to respond to controversy in the classroom, having moved to a more activity-based approach, having understood that there are many human-relationship aspects to climate change, and knowing how to integrate climate change into different subjects.

One participant said that Natalie's role modeling helped create a classroom environment that welcomed risk-taking. For example, by playing her guitar and singing to the class as a way to teach about climate change, the participant said Natalie's unspoken message was, "Listen, I'm willing to put myself [out] here. I hope you can do the same for me." The same person suspected that not all students seemed receptive to this indirect approach to teaching through modeling and demonstrating possibilities. The data, however, suggest that many students *did* value Natalie's purposeful creation of a welcoming learning environment

and saw it as important to the course. Natalie described one of her roles as a teacher educator as "nurturing care"—by caring about the environment and caring about students.

Participants noted many other tangible ways Natalie created a welcoming environment. In the first class, everyone was asked to select two artifacts out of many that Natalie provided, one to represent what they were looking forward to in learning about climate change and one a fear. Participants noted that this activity encouraged philosophy and metaphor and, in allowing them to express themselves, created a climate where people immediately had the opportunity to connect with one another. On the last day, people brought in their own artifacts to represent what they would take away from the course, again providing the opportunity for both self-reflection and mutual learning and connection. Several students praised the sense of closure that was established through this artifact sharing circle and other last-day activities including the sharing of food. These were valued for creating a welcoming learning environment and also for their potential use in their own future teaching settings.

As welcoming as participants reported the course to be, gender imbalance provided some challenges. Some interview participants reported that in large group discussions the male students spoke more than the female students. Natalie noted this too. One female participant described feeling uncomfortable in the male-dominated discussions. She tried to choose her seating to stay away from all-male groups, noting that, "when guys get together, they're a lot meaner than when there's a good mix." A male student also commented on gendered group dynamics, saying that, "Natalie did a great job of keeping it neutral," but that he had sometimes felt reluctant to contribute for fear of being "shot down" by some vocal students. Active strategies to monitor classroom dynamics, such as asking for anonymous feedback throughout the course, may be helpful even in a more gender-balanced class. Attention to gender in environmental education has been noted as something that is needed (Gough, 2013); research on gender dynamics in courses such as this one would be helpful.

Relevance to Future Teaching

Teacher candidates pointed to the applicability or relevance of both content and pedagogy as one of the greatest strengths of the class. One example that was commonly cited was an activity devoted to the Alberta Tar Sands, a very contentious project in Canada (Nikiforuk, 2010). Natalie brought in a cooler containing water then mixed in molasses and corn meal. She asked the students to separate the components with a plastic cup. They could not. Two participants used the word "ridiculous"—in a positive way—to describe the experience, which gave them a tangible, and also emotional, sense of the amount of energy and water used in the process of removing bitumen from Alberta's Tar Sands. Some weeks after the activity, one participant mentioned that this demonstration was "still sticking with me because [of] the way she approached it."

After the simulation, Natalie facilitated a "Tar Sands Trivia" activity. One participant said:

> I actually shared the trivia thing with my mom, who shared it with her boss, who shared it with the office. And now my mom's office is more informed about the Tar Sands and the destruction that's happening in Alberta.

She described such take-away knowledge as the most impactful aspect of the course for her. The "Tar Sands Trivia" activity was unusual in Natalie's class in that it was a direct transmission of information via a question-and-answer PowerPoint, albeit in the form of a game.

Several other activities were noted as high-impact and particularly relevant: the previously mentioned simulation in the gym—embodied learning that helped people visualize the role of greenhouse gases; Natalie's songs with re-written lyrics to convey messages about climate change and possible responses by society; and an activity where students had "Thumb Wars" in pairs and learned that to win they needed to cooperate by pinning *either* player's thumb, a sharp shift away from their initial assumption that they needed to compete with one another. The "Thumb Wars" activity exemplified Natalie's focus on community and tied well into the bigger picture that neoliberalism and greed are driving forces in creating and maintaining climate change and that cooperation is needed to address it (Klein, 2014). Students emphasized how much they valued the variety of experiential, interactive approaches Natalie used, both for their own exploration of climate change and to equip them as future teachers of the topic.

Helping students plan for the grade levels and school subjects they were preparing to teach also helped keep things relevant. In a well-received activity late in the course students were asked to write down some of the key ideas in the Ontario curriculum that they would be required to convey in their grade and subject areas. Natalie had prepared some "big ideas of climate change cards" inspired by MacGregor's (n. d.) *Curriculum for the Bioregion*, such as "water impacts and water security," "food impacts and food security," "social justice," "consumption and consumerism," and "Indigenous perspectives." She then grouped students based on their subject areas or grade levels and asked them to draw three climate change "big ideas" and three subject area ideas from a hat. Groups were then responsible for explaining how they would connect the climate ideas to the subject ideas through classroom lessons and activities. Helping students see cross-curricular connections resonates with the recommendation to teach climate change across subjects (Bangay & Blum, 2010; Chambers, 2011; Kulnieks et al., 2013).

One person remarked that this exercise allowed students to see not only how to connect climate change knowledge to the curriculum, but more broadly how to connect *any* of their own knowledge to the curriculum. Natalie was initially surprised at the impact this activity had, but upon reflection she saw

it as a contributor to their confidence in teaching climate change within the institutional constraints they will have to negotiate as future teachers. Connecting to Ontario curriculum also appeared to show them that they can quite easily integrate "political" content into a conservative education system.

Politics and Climate Change Education

An activity that was directly designed to increase teacher candidates' confidence in dealing with controversy was "Political Red Rover." The class was divided in two and each half generated five scenarios that made them nervous about teaching climate change. Teams took turns calling someone over and sharing one of the scenarios. The person then returned to the home team and had 30 seconds to discuss what to do before reporting back. The first team then had 30 seconds to compliment, question, or add to the response.

Natalie was very impressed by how students performed in this activity and described a great discussion following one scenario that turned on whether or not a teacher could take a student to a local climate protest. Natalie said to Paul:

> So it started to take some of the fear out. They still think they're going to get fired in certain situations for doing the most innocuous of things, and that I think is a larger [problem of teacher] culture. I think they think they're going to get fired for all kinds of stuff. I'm trying to show them Ministry documents where it's okay: "Right here it says you have a responsibility to do this! You're not going to get fired."

Ontario teachers belong to very strong unions, so on the face of it these teacher candidates' fears may seem hard to understand. But a "Comfort Zone" activity, where Natalie read scenarios and teacher candidates had to move their bodies to indicate where they were on a continuum from "comfortable" to "fearful" may help to explain. What terrified them most was the idea of "talking to a colleague, another teacher, about something they taught that you disagree with." Natalie said that in the debrief some teacher candidates told stories of how the teachers supervising their first practicum had called them out and made them look bad in front of classes:

> These horror stories of them being cut down and made to feel so small, … that kind of power dynamic makes me sick, because not only are we asking them in doing *Climate Change Pedagogy* to take some risks in terms of where society is around bringing this issue into the classroom, now we're asking them to go into spaces where they don't feel safe anyways because of the professional conduct of their [supervisors, later potentially] peers, and risk being called out and being belittled in front of students.

While, of course, this is not the experience of all teacher candidates out on practicum, it is a reminder that schools are hierarchical places and that a few stories may be all that are needed for we teachers to police ourselves.

Somehow, too, it seems that people have come to believe that teachers should be neutral. A number of participants stated explicitly that they did not want to be "biased." One, however, held a view much closer to that of the three of us. He said: "Well, not to get too philosophical, but I mean any position that you hold, holds bias. You can't be bias-free. It's impossible, in my view." We agree with Kincheloe (2008) that teachers cannot be neutral, but they must be fair. Who could be neutral on climate change?

"Neutral," in the context of schooling generally means supporting corporate capitalism (Giroux, 2007). For example, returning to the Tar Sands, a participant said:

> I remember when I did my first placement at Conform School [not its real name], Grade 7 and 8, and I looked at the geography textbook. You know, "The Tar Sands are this." You dig it out of the ground and then you do this and it goes through a pipeline. And there are environmental concerns, but there's also rejuvenation projects—so basically it's a clean slate; it all balances out. Oh my God. And for a lot of teachers, I'm sure maybe their major is not geography, they don't know. They don't care. They just teach that. Who cares? And the problem just perpetuates itself.

We side with educational philosopher Warnock (1988) who wrote that students benefit from seeing teachers who weigh evidence carefully and come to a principled position that they are willing to share with students. In the example presented above, a class exploration of the way the Tar Sands is portrayed in the textbook could be the vehicle for learning about connections between the Tar Sands, bias, climate change, and capitalism.

Also related to bias, some participants said they were afraid of getting something wrong in their teaching. Natalie noticed that she too sometimes worried about what she was teaching because she is "not an expert" on climate change science. She speculated that at base, for her, her fear really was about speaking up politically, even though there are some Ontario curriculum expectations on climate change and she was hired specifically to teach about it! It reminds us that we are, after all, embedded in a dominant political discourse that pits jobs against the environment and we are living, at the time of writing, under a government that withdrew Canada from the Kyoto Protocol, trashed environmental legislation, fired and muzzled scientists (Chung, 2014), and shamelessly promotes the Alberta Tar Sands. Our national opposition parties protest to some extent, but largely accept the same premises and have wholly inadequate plans to deal with climate change.

Natalie credits Paul's support through their frequent discussions for helping her teach the course as a critical educator. The three of us believe that we all need support in such work, especially as structures to protect political spaces are being dismantled and universities increasingly rely on much more vulnerable contract faculty. We expect that wherever one is teaching, collegial support may significantly influence what risks one is willing to take.

Conclusion: Make Climate Change Education Mandatory

As an overall reflection on activities that most highly engaged the class, Natalie noted that students were drawn into "good, active experiential education," "things that they could use in the classroom," and "things that proved to them that they were capable." On the questionnaire administered on the last day, most students indicated that they were very likely to teach about climate change, but they were split between feeling "comfortable" and "very comfortable" in doing so. They listed concerns ranging from their own level of knowledge in a rapidly changing field (see, for example, Blum et al., 2013) to the emotional dynamic of teaching a depressing subject (see Hung, 2014) and possible resistance from students, parents, administration, or colleagues. While clearly some were still hesitant, after just nine classes, we are pleased with this beginning.

Asked in the final interview what recommendations they had to make the course better, *all* participants suggested it should be longer or mandatory. One questioned why the course was only an elective while mathematics education was mandatory. Another said that a yearlong course would do the topic more justice. A third said that, "If you're teaching the next generation… in the real world, climate change should be a mandatory course from Grade 1 up." One suggested covering climate change science in the first semester and teaching strategies in the second; another said simply, "I implore you to continue offering the course." Another argued for integrating climate change pedagogy into all of the teacher education courses, and finally, one said: "Definitely try to push for a mandatory or push for a double semester. I don't know how hard that's going to be."

In the neoliberalized university, one might expect teaching about climate change to be challenging (Gerum, 2014). Still, there are positive signs, at least at our university. Just around the time that *Climate Change Pedagogy* was first added as a "special topics" elective, all teacher education programs in Ontario were mandated to shift from one-year to two-year programs. Recognizing that our university was already known for its environmental education focus at both the undergraduate and graduate levels, our faculty colleagues were receptive to including a mandatory 36-hour course in *Environmental Education* that includes climate change content in our new 2-year program. The first offering of this course will be in 2016.

This experience reminds us that we can miss opportunities if we give up before we even start or if we wait until we know "enough." On this matter, we give the last words to two students. The first remained skeptical that humans are causing climate change right through the middle of the course, but by the end of nine weeks, he had made a radical shift. Asked what advice he would give another teacher about teaching climate change, he said:

> Definitely take risks and maybe do something out of your comfort zone; and try to engage the students…. I think climate change is one of those things that you can engage students with.

Asked the same question, the second said:

> They should do it. That's my advice. That's all I have to say to that. Man, do it. Don't compromise.... That would be my advice to a fellow colleague. Get in there, roll up your sleeves, and get at it.

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