

Expanding institutionalized learning spaces in/for science teacher education: the case of a community garden in Ottawa

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Abstract

The purpose of this experience report is to share and reflect on the authors' views and experiences of adopting a place-based pedagogy in a community garden to create a science learning space within an institutionalized teacher education program in Ottawa, Canada. The situations described here are based on loose (autobiographical) recollections of events that occurred over the last five years in science methods courses taught by the first author while taking student teachers on a field trip to a local urban community garden. In addition, we present a sample of selected informal feedback collected from participants in support of our argument that noninstitutionalized outdoor urban spaces can provide valuable opportunities to enrich science student teachers' experience in teacher education programs.

Keywords: science teacher education; community-based learning; place-based pedagogy; community garden.

Resumo

Expandindo ambientes de aprendizado institucionalizados na/para a formação de professores de ciências: o caso de uma horta comunitária em Ottawa

O objetivo do presente relato de experiência é compartilhar e refletir acerca dos pontos de vista e das experiências dos autores sobre a adoção de uma pedagogia baseada no local, em uma horta comunitária, para criar um espaço de aprendizagem de ciências dentro de um programa institucionalizado de formação de professores em Ottawa, Canadá. Os eventos descritos aqui são baseados em lembranças soltas (autobiográficas) de eventos que ocorreram nos últimos cinco anos em cursos de métodos de ciências ministrados pelo autor enquanto levava professores em uma excursão a uma horta comunitária urbana local. Além disso, apresentamos uma amostra selecionada de feedback informal coletado dos participantes, para apoiar nosso argumento de que os espaços urbanos ao ar livre não institucionalizados podem oferecer oportunidades valiosas para enriquecer a experiência de professores estudantes de ciências em programas de formação de professores.

Palavras-chave: formação de professores de ciências; aprendizagem comunitária; pedagogia baseada no lugar; horta comunitária.

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Resumen

Expansión de entornos de aprendizaje institucionalizados de/para la formación de profesores de ciencias: el caso de un jardín comunitario en Ottawa

El objetivo del presente informe de experiencia es compartir y reflexionar sobre los puntos de vista y experiencias de los autores sobre la adopción de una pedagogía basada en el sitio, en un jardín comunitario, para crear un espacio de aprendizaje de ciencias dentro de un programa institucionalizado de formación de profesores de ciencias en Ottawa, Canadá. Los eventos descritos aquí se basan en recuerdos sueltos (autobiográficos) de situaciones que ocurrieron en los últimos cinco años en los cursos de métodos de ciencias realizados por el primer autor mientras llevaba a los profesores a una excursión por un jardín comunitario urbano local. Además, presentamos una muestra seleccionada de comentarios informales recogidos de los participantes, para respaldar nuestro argumento de que los espacios urbanos al aire libre no institucionalizados pueden ofrecer oportunidades valiosas para enriquecer la experiencia de los profesores estudiantes de ciencias en los programas de formación docente.

Palabras clave: formación de profesores de ciencias; aprendizaje basado en la comunidad; pedagogía basada en el lugar; jardín comunitario.

What is science education for?

It is not uncommon for the word *institution* to have a negative connotation in our society. In an institution, each person is supposed to have a role and is constantly under observation (so it feels). So, it often evokes a sense of control and surveillance – two scary terms in a period characterized by heightened concerns for individuals' autonomy and privacy (Orlowski, 2020; Zuboff, 2019).

Notably, schools can be (come) such institutionalized spaces. The building architecture, the grade division, the classroom dimensions, the desk arrangements (not to mention the infamous seating charts), and the particular responsibilities assimilated by teachers and students – respectively as *those-who-know* and *those-who-learn* – tend to facilitate the easy spotting and punishment of anyone who dares to deviate from the expected norms of behaviour. Even the language used in the context of traditional schools reveals the institutionalized nature of the relationships that exist within their walls. For example, *detention* (in French *rétenion*, literally “to hold someone”) and *report cards* (i.e., an official written account of a student's performance as observed and measured by an appointed institutionalized representative).

The existence of a hidden curriculum in schools only reinforces this gloomy reality by seeking to maintain the status quo that benefits those already in power (Gordon, 1982). Likewise, the perpetuation of ineffective (traditional) pedagogical structures of teacher education programs can rob student teachers of the opportunity to transform archaic teaching and learning practices into more innovative and engaging ones. As Deborah Britzman (2003, p. 9) puts it: “the very [conventional] measures for success and failure in learning [to teach] shut out the existential crisis that allows the newly arrived [teachers] their chance in becoming [teachers in their own right]”.

That is, teachers might not be properly equipped to fight the systemically institutionalized (oppressive) configuration of schools (e.g., surveillance, grades, competition, streaming, resource allocation etc.). Consequently, it goes without saying that they must be prepared to understand the inherent struggles (tensions) of schooling. Otherwise, phenomena like the *school-to-prison pipeline* – to mention just one – may continue to exist (Singh, 2021). (This argument is strengthened by anecdotal evidence of *pipeline schools* – i.e., those with a history of gangs, guns, police arrests, police searches etc. – rarely holding practicum placements for student teachers).

In this (nearly helpless) scenario, how can one disrupt this typical cycle of imprisonment in conservative institutionalized settings? How can we attempt to “provoke the students, give them a new slant, challenge the assumptions and comfortable beliefs they brought with them (...) [so that they can properly] enter the fellowship of educated men and women”? (Wilson, 2006, p. 132).

Yet, not *educated* in the common sense:

There is a myth that the purpose of education is to give one the means for upward mobility and success. The plain truth is that the planet does not need

more successful people. But it does need desperately more peacemakers, healers, restorers, story tellers, and lovers of every shape and form. (Orr, 1991).

A potential answer to this problem lies in making science relevant by creating opportunities to discover its meaning in one's life (e.g., Reis, 2009, 2010). In the centennial words of John Dewey (1916, p. 68): "if education is growth, it must progressively realize present possibilities, and thus make individuals better fitted to cope with later requirements." According to Fletcher (2009, p. 2), "Dewey (1916) also claimed that if education was to be effective, its goal was not only to prepare students for life, but also to engage students wholly in life at the present moment".

Yet, not *life* in the usual individualistic (human-only) sense.

One of the most recognizable mantras of education in the Anthropocene is that all living beings are part of the same "web of life" (Capra, 1996). Another way to see this is through the realization that environmental destruction is directly linked to the mistreatment and killing of nonhumans (Sorenson, 2014). The belief in the "myth of human supremacy" (Jensen, 2016) only serves to support the (un)ethical division of the world into *us* and (versus?) *them* (Phelps, 2012). For that reason, we need...

... alternative and timely ways of breaking with current ideals of human, all too human pedagogical practices that rule out and/or ignore the educational significance of the ecological nature of reality itself as well as human beings' inevitable embeddedness in this ecology of humans and nonhumans alike. (Lysgaard; Bengtsson; Laugesen, 2019, p. 17).

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Rather than understanding humanity's place in the world as being superior (greater) than others (Plumwood, 2002), ecologically mindful science educators recognize that humans and other living beings are more similar and interdependent than not (e.g., Reis; Scott, 2018; Roth *et al.*, 2008) – a perspective also endorsed by several Christian theologians (e.g., Conroy, 2021). (There are those who go so far as to construe nonhumans animals as persons [e.g., Szttybel, 2008]). Hence, there is an urgent call to enact a "pedagogy of responsibility" (Martusewics, 2019), which sits in stark opposition to an egotistic view of life.

In summary, there is a negativity around the concept of *institution* produced by the discerning sensation of control and surveillance that comes (almost instinctively) attached to it. Through its their materiality (from building architecture to classroom language) and hidden curricula, schools can be perceived as one such institutionalized place that perpetuates discrimination and inequality. Likewise, teacher education programs seem to exacerbate (or sustain at least) the situation by not adequately preparing teachers for the pressing socio-ecological challenges of today (e.g., Bodzin; Klein; Weaver, 2010; Karrow; Di Giuseppe, 2020). As argued here, a possible solution of this conundrum can be found in the integrality of science with people's immediate experiences and possibilities as members of an ecologically inclusive society.

Schools are an intrinsic – perhaps vital – part of the communities where they are located. More so: they depend on that same community to exist and thrive.

Schools purport to prepare students to become active members of their communities and yet (more often than not) they can lead students to a situation where they end up being isolated from the rest of their community with little to no school-community engagement. If students should learn anything, it is how to *use* knowledge to illuminate and broaden their lived experiences in the real world. In other words, what they learn should benefit their lives *and* the lives of others. It follows then that one way for teachers and their students to participate in authentic, relevant and meaningful science activities is by entrenching them in the community. In fact, “this important educational innovation can help students become more engaged in learning science, help them connect their science learning to other subjects, strengthen their understanding of science, and improve their capabilities for responsible citizenship in their community” (Fazio, 2016). Connection to community teaches students how they may actually apply science education to real-world scenarios that affect them, making it practical, engaging and rooted in reality. Otherwise, (science) education can be dreaded and avoided (specially by girls [e.g., Thébaud; Charles, 2018]) because of the disconnected and theoretical way it is often taught in institutionalized settings (e.g., Metz, 2009).

The premise of community-based learning is well aligned with the notion of place-based education, defined as...

... an approach to curriculum development and instruction that acknowledges and makes use of the places where students live to induct them into the discourses and practices of any and all school subjects. More than anything else, teachers who use this approach share a perspective about teaching and learning that alerts them to the educational potential of phenomena outside the classroom door. For them, community and place become additional “texts” for student learning. (Smith, 2013, p. 213).

Notably, the value of lodging teaching and learning in the community is also recognized by the Ontario College of Teachers (OCT), which is the organization that licenses, governs and regulates Ontario’s public teaching profession. According to the OCT’s *Standards of Practice for the Teaching Profession* – a framework of principles that describes the knowledge, skills and values fundamental to its affiliates – teachers’ ongoing professional learning is not only integral to an effective practice, but is informed by collaboration in a variety of diverse and wide-ranging contexts, including the community.

The purpose of the present report of experience is to share and reflect on the authors’ views and experiences of adopting a place-based pedagogy in a community garden to create a science learning space within an institutionalized teacher education program in Ottawa, Canada. As such, the events described here are based on loose (autobiographical) recollections of circumstances that took place over the last five years in science methods courses taught by the first author while taking student teachers on a fieldtrip to a local inner city community garden. Therefore, they are not accurate narratives of any particular classes or groups of people at any specific point in time. As for the direct quotes from student teachers, they were collected by means of in-class informal assessments of those visits to the garden.

Both the stories recounted and the available student feedback presented here were purposefully selected in support of our line of argumentation that non-institutionalized outdoor urban spaces can offer valuable opportunities to enrich science student teachers' experience in teacher education programs.

Our work is founded on the assumption that the responsibilities of (science) teachers to their students go beyond the delivery of mere textbook content (Gardner; Jones; Ferzli, 2009). As such, we feel compelled to address important and often sensitive socio-ecological matters that occur both in and outside of our schools, like poverty, racism etc. (e.g., Reis, 2019). Although one's experience with these phenomena is irrevocably personal, it is also rooted in the existing interactions and ties with community residents and organizations (Raphael, 2020), including schools. As a result, new and seasoned science teachers must seek ways of improving the health and quality of life of those living at the margins of their own community. Otherwise, what is science education for?

A day or two outside

It is a regular workday. One of the authors (Giuliano) gets off the bus on the downtown university campus after a 45-minute ride from his house in the Ottawa suburbs. For the first time he can remember, he notices a garden right behind the bus stop (Figure 1). It has different plants, which he cannot identify despite having a biology degree (botany seems to have evaded his memory long time ago). Wooden information signs can be seen scattered all around the estimated 80m² plot (or about 860 sq-ft for those less accustomed with the metric system). The writing on the signs is difficult to make out from a distance, but they are just a couple of words long and accompanied by a picture – presumably the names and images of the flowers, vegetables and herbs growing in that inconspicuous space just outside a nearly century-old catholic church building (Byrne, 2007).

Close to the garden one can see a door at the top of a small flight of stairs. It opens to a corridor that leads to another door at the top of another short flight of stairs. This second door is locked, and visitors must get clearance from the office (visible through a glass window on the left wall) before gaining access to the foyer on the other side. A piece of paper affixed to the opposite wall shows the times when coffee and meals are served. Once inside, a kitchen is visible to the right and a pantry is located on the far left corner. The two-story building houses both a soup kitchen and a food bank. It is no coincidence that it is attached to the garden outside (or vice-versa). A light bulb goes off in his teacher's mind.

All the necessary arrangements are made with the organization's staff, including the garden's keepers, through personal visits, emails, and phone calls. Finally, the science student teachers are set to arrive for a first visit early one morning. They come by foot as their regular science classroom (a windowless room with movable furniture with access to a central laboratory area) is only 500 meters away. Indeed, the distance makes for a brief enjoyable walk: people in the group chat and have a chance to finish their coffees.



Figure 1 – Local urban community garden at the university campus [2019].

Upon arrival, a room is waiting for them on the second floor, just above the main entrance. Student teachers are introduced to the reasons why the kitchen, the food bank, the garden and the people there exist. It is about serving those in the community who need a place like that, no matter the reason. “All are welcome,” they say. (It is a sentiment that bluntly contrasts with the \$5 hand crafted lattes sold in the coffee shop next door and the university classes across the street filled with a considerable number of tuition-paying young undergraduates).

In the following week, during the second visit (also part of the activity as a whole), the student teachers spend most of the time outside helping to prepare the garden for the Winter. The church has a small contingent of volunteers who usually need a few days to remove plants that will not survive the season (many start to die when the temperatures drop in the Fall). The university group takes down stakes, turns the soil to increase aeration, and feeds the outdoor compost bin with leaves and other yard waste generated in the process. It only takes about two hours for the science teachers-to-be to finish the entire job.

In addition, as part of a class assignment, student teachers must choose one of the plants they see in the garden, take a picture, and find as much information about it as possible: common and scientific names, commercial value, origin, uses (e.g., for decoration, medicinal or cooking purposes) etc. They are free to ask church volunteers on the ground – after all, those people have been caring for the garden for years. Likewise, they must create a map – in any format they choose: drawing, screenshot from Google Maps etc. – indicating the specific location of the garden within the downtown/campus area. (The mapping activity is designed to help instill a sense of place [Sobel, 1998]). Finally, they are asked to submit a lesson plan showing how they could integrate this activity in their future teaching in intermediate (grades 7 to 10) or high school (grades 11 and 12) Science courses.

As the morning progresses and the group is instructed on how to sort what is still edible from what is going to be discarded, they progressively learn more about the plants in the garden, the workings of the soup kitchen, the food bank and the people who use these services (also called *clients*). Access to the compost area is partially restricted since there is a homeless person sleeping there at night (likely due to the warmth generated by the composting process) and nobody wants to invade his privacy. Surprisingly, some of the garden beds and the pollinator houses have been vandalized recently. (Who would damage a community garden?). There are also anecdotes about how the garden is a therapeutic place for the visitors: one person is said to have chosen to work in the garden one day as a way of coping with the loss of a family member. (Who would damage such a therapeutic place?). Once the work outside is completed, the group returns to the building and collectively tries to find meaning in what they did: What does a place like this have to do with teaching science? Why were they brought here? After a brief conversation, they collect their belongings and make a small monetary donation to the food bank.

As part of a reflective routine adopted in the course – somewhat inspired by the work of Lori Fulton and Brian Campbell (2014) – student teachers write in their science journals about how they perceived the garden. The reactions are mostly positive:

Going to the garden gives students a hands-on kinaesthetic experience in nature. This is something that a classroom cannot provide. (D. E.)

This was very relevant to science. It can teach many lessons about citizenship, stewardship, sustainability, giving back, community, biology, where food comes from, food security, helping those in the community + volunteering. (R. B.)

I was reminded how “real” science is [sic]. It is very easy to get lost in theory in the classroom. (K. K.)

Even if there were no curriculum connections, I would still consider this to be a worthwhile activity for a class: get them out in the world, interacting and connecting with nature, and working with their hands. (J. E.)

There was so much discussed today: citizenship, ecology, health, [and] community self-care. The benefits of this kind of activity are many. (G. L.)

This is a huge application piece that I feel is often lacking in classrooms today. (...) It allowed us to be humbled by this experience. (D. C.)

This experience confirmed that I am not expected to be an expert at [sic] everything and having students learn from others who are very knowledgeable is valuable to [them]. (S. G.)

The student teachers value the sensorial (physical) and social aspects of the experience and recognize that its complexity is something that words and pictures alone cannot rival (McMurtry; Reis, 2019). This is hardly surprising: contrary to a laboratory, where students are told what to wear and where to sit, the garden exerts less control (restrictions) over their bodies, leaving them more at ease to explore the surroundings. Besides, there is a strong sense of being part of a community that opens up opportunities to teach and learn the science curriculum.

Contradictory as it may sound, the visits represent an occasion to see the suffering of a community where some of the residents rely on the food bank and the soup kitchen to feed themselves, where some of the *locals* see no other choice but to use the outside compost area of the church as sleeping quarters. In this way, student teachers begin to feel first-hand how science merges with the ecological, social, political, and economic realities of the city. In the garden, all these elements of modern urban life intersect (e.g., Benton-Short & Short, 2013; Haluza-DeLay, 2013; Milbourne, 2011; Schell *et al.*, 2020). In other words, they learn through immersion in this community garden about the great intersectional dance of existence: how each aspect of society depends upon and affects another.

A few weeks later, at the end of the term, the student teachers are invited to do an official course evaluation. Although it does not help them to reflect on how much effort they had personally put in to making their learning journey a successful one, the results can nevertheless assist instructors in their efforts to create a professional environment that is increasingly conducive to the highly sought-after teaching degree.

In the evaluation form, there is a space for written comments, in case they wish to shed light onto the scores given to various aspects of the course, like clarity of instruction, preparedness of the instructor, relevance of assignments etc. One student makes the following remark:

On the second week [of class] we went to a church community garden. I'm not Christian/Catholic so I felt out of place, but the importance of a soup kitchen for families was eye opening. However, it did not teach me how to teach intermediate science. On week three, we spent the whole class turning over the community garden. Giving back to a good cause is great, but how do I teach electricity to my grade 9's? This is not what I had in mind for my teacher education. (...) I love field trips and I love gardening, but I also love teaching students science. (Comments Report, Fall Semester of 2017).

While this is one assessment out of many, we cannot help but wonder: what went wrong? This student is clearly pragmatic: the garden did not teach her how to address the topic of electricity in class. So, what did it teach her? Why do her classmates seem to appreciate (appropriate) the visit to the garden while she did not? Could this student be placing an overemphasis on *what we know* at the expense of *how we know* it (Collins; Osborne; Ratcliffe; Millar; Duschl, 2001)? Why isn't she making "connections to real-life applications and to [her] lived experiences," as determined in the grade 9 science curriculum (OME, 2022) that she seems so eager to teach?

We do not know the answers to these questions and any attempt to explain them would be mere speculation on our part. Regardless, that gave us a chance to (re)consider that there is always room for improvement in our praxis. Case in point: one strategy adopted in subsequent years has been to present and dissect this commentary in class to make the objectives and expectations of the activity as clearly as possible. Further information (data) is still needed to verify the impact of this approach.

Final considerations: The road ahead

More than a response to one student's unfavorable comment, this article aimed to contribute to this thematic issue of the journal by examining the value of community gardens – and other similar places outside of the classroom by extension (Beames; Higgins; Nicol, 2012) – as invaluable learning spaces within institutionalized teacher education programs. It argued that our attempts to make science more applicable were not without its trials and oppositions, a situation not uncommon to those in the field of education:

Because “urban” often stands in for these negative narratives in public education, many urban public high schools turn their backs on their cities. Schools fortify themselves with locked doors and police officers. They cancel field trips and outdoor experiences and double down on test prep. They elevate and celebrate standards and ways of communicating that are remote from students' experiences outside of school. They forget that their cities are full of educators who may not hold teaching credentials – students' family members, local artists and community gardeners, for instance. They mimic the cultures of wealthy suburban districts or fancy private schools because this is what “good schools” look like. They tell students the only path to success is to leave their families, neighborhoods, and cities behind. (Tolman, 2022, p. 40).

Yet, we are reminded that our community is replete with all forms of life as well as brimming with inequities. Teachers – old and new – simply cannot (and should not) turn a blind eye to it.

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On a brighter side, and as an outcome of the work described here, a team composed of members from the university's Faculty of Education, the soup kitchen/ community garden and a local community-based organization has received a small (but significant) community service learning grant to expand the reach of the garden by making it a learning hub for local schools. That way, younger students have another chance to learn about flora and fauna, composting, food sovereignty, sustainability, gardening techniques, eco-justice etc. Most importantly: they can see first hand how a small plot of land encrusted in the city can be a refuge for the weary and hungry – humans and nonhumans – and become a beam of hope for many (e.g., Purcell; Tyman, 2015; Wakefield *et al.*, 2007; Walter, 2013).

The garden beds have been recovered and the garden redesigned for inclusivity and accessibility purposes. It is an opportunity for those involved to go beyond selfish pursuits and engage in larger issues that exist in the community where they live.

It is our hope that teaching and learning at the community garden will serve for people to hear the call to active citizenship to revert a deplorable reality:

While some are concerned only with financial gain, and others with holding on to or increasing their power, what we are left with are conflicts or spurious agreements where the last thing either party is concerned about is caring for the environment and protecting those who are most vulnerable. (Pope Francis, 2015, para. 198).

The work continues.

Bibliography

BEAMES, S., HIGGINS, P.; NICOL, R. *Learning outside the classroom: theory and guidelines for practice*. London: Routledge, 2012.

BENTON-SHORT, L.; SHORT, J. R. *Cities and nature*. London: Routledge, 2013.

BODZIN, A. M.; KLEIN, B. S.; WEAVER, S. (Ed.). *The inclusion of environmental education in science teacher education*. Dordrecht: Springer, 2010.

BRITZMAN, D. *Practice makes practice: a critical study of learning to teach*. New York: SUNY Press, 2003.

BYRNE, T. V. *Where the spirit lives: the history of St. Joseph's Parish – 1856-2006*. Ottawa, 2007. Retrieved from: <https://st-josephs.ca/wp/wp-content/uploads/2011/11/Where-the-Spirit-Lives1.pdf>. Access in: 3 Jan. 2023.

CAPRA, F. *The web of life: a new scientific understanding of living systems*. New York: Anchor Books, 1997.

COLLINS, S. et al. *What "ideas-about-science" should be taught in school science? A Delphi study of the expert community* [Paper presentation]. 2001 Annual Conference of the American Educational Research Association, Seattle, USA, 2001 (April 10-14). Retrieved from https://eprints.soton.ac.uk/aera_epse3_delphi.

CONROY, C. Reconciliation and the doctrine of creation. *Critical Theology*, [S.l.], v. 3, n. 2, p. 19-22, 2021.

DEWEY, J. *Democracy and education: an introduction to the philosophy of education*. [S.l.], 1916. Retrieved from: <https://edtechbooks.org/democracyandeducation>. Access in: 3 Jan. 2023.

FAZIO, X. *Science learning with and in communities: engaging students through authentic community-based science*. [S.l.], 2016. Retrieved from: <https://www.edcan.ca/articles/science-learning-with-and-in-communities/#footnote-261-4>. Access in: 3 Jan. 2023.

FLETCHER, T. Elementary physical education: fitness sessions or whole-child development? *Canadian Journal for New Scholars in Education*, [S.l.], v. 2, n. 1, p. 1-8, July 2009.

FULTON, L.; CAMPBELL, B. *Science notebooks: writing about inquiry*. [S.l.]: Heinemann, 2014.

GARDNER, G. E.; JONES, M. G.; FERZLI, M. Popular media in the biology classroom: viewing popular science skeptically. *The American biology teacher*. Oakland, v. 71, n. 6, p. 332-335, Aug. 2009.

GORDON, D. The concept of the hidden curriculum. *Journal of Philosophy of Education*, Oxford, v.16, n. 2, p. 187-198, Dec. 1982.

GREENWOOD, D. A. A critical theory of place-conscious education. In: STEVENSON, R. B. et al. *International handbook of research on environmental education*. London: Routledge, 2013. p. 93-100.

HALUZA-DELAY, R. Educating for environmental justice. In: STEVENSON, R. B. et al. (Ed.). *International handbook of research on environmental education*. London: Routledge, 2013. p. 394-403.

JENSEN, D. *The myth of human supremacy*. New York: Seven Stories Press, 2016.

KARROW, D. D.; DI GIUSEPPE, M. (Ed.). *Environmental and sustainability education in teacher education: canadian perspectives*. [S.l.]: Springer, 2020.

LYSGAARD, J. A.; BENGTTSSON, S.; LAUGESSEN, M. H. L. *Dark pedagogy: education, horror and the Anthropocene*. [S.l.]: Palgrave Macmillan, 2019.

MARTUSEWICZ, R. A. *A pedagogy of responsibility: Wendel Berry for ecojustice education*. New York: Routledge, 2019.

McMURTRY, A.; REIS, G. The ecology of teaching & learning (science). *Revista Multidisciplinar*, [S.l.], v.1, n. 1, p. 5-16, 2019.

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METZ, K. Rethinking what is "developmentally appropriate" from a learning progression perspective: The power and the challenge. *Review of Science, Mathematics and ICT Education*, Patras, v. 3, n. 1, p. 5-22, 2009.

MILBOURNE, P. Everyday (in)justices and ordinary environmentalisms: community gardening in disadvantaged urban neighbourhoods. *Local Environment*, London, v. 17, n. 9, p. 943-957, 2012.

ONTARIO Ministry of Education (OME). *Science: grade 9. 2022*. Retrieved from: <https://www.dcp.edu.gov.on.ca/en/curriculum/secondary-science/courses/snc1w/program>.

ORLOWSKI, J. (Director). *The social dilemma* [Film]. Exposure Labs, Argent Pictures, and The Space Program. 2020.

ORR, D. *What is education for? Six myths about the foundations of modern education, and six new principles to replace them*. [S.l.], 1991. Retrieved from: <https://www.context.org/iclib/ic27/orr/>. Access in: 3 Jan. 2023.

OSBORNE, J. et al. *What should we teach about science? A Delphi study*. London: King's College, 2001.

PHELPS, N. Infinite ethics: An inclusive vision for a diverse world. In: NOCELLA, II, A.; BENTLEY, J.; DUNCAN, J. (Eds.). *Earth, animal and disability liberation: the rise of the eco-ability movement*. New York: Peter Lang, 2012. p. 205-222.

PLUMWOOD, V. *Environmental culture: the ecological crisis of reason*. London: Routledge, 2002.

POPE FRANCIS. *Laudato Si'* [On Care for Our Common Home] [Encyclical letter]. 2015. Retrieved from: http://www.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html.

PURCELL, M.; TYMAN, S. K. Cultivating food as a right to the city. *Local Environment*, London, v. 20, n. 10, p. 1132-1147, 2015.

RAPHAEL, D. *Poverty in Canada: implications for health and quality of life*. Toronto: Canadian Scholars, 2020.

REIS, G. Making science relevant: conceptual change and the politics of science education. In: ROTH, W. M. (Ed.). *Re/structuring science education: reuniting sociological and psychological perspectives*. Dordrecht: Springer, 2010. p. 233-241. (Cultural Studies of Science Education, 2).

REIS, G. A educação salva? Provocações, inquietações e possibilidades profissionais. In: SILVA, D. M. S. (Org.). *Quem é o/a licenciado/a em ciências naturais/da natureza? Perspectivas profissionais*. Campos dos Goytacazes: Brasil Multicultural, 2019. p. 10-17. (Coletânea de textos do III Concinat).

REIS, G.; GUIMARAES-IOSIF, R.; REIS, J. Media and environmental literacy: Making school relevant. *Revista Txt: leituras transdisciplinares de telas e textos*, Belo Horizonte, v. 5, n. 9, p. 26-40, 2009.

REIS, G.; SCOTT, J. (Ed.). *International perspectives on the theory and practice of environmental education: a reader*. [S.l.]: Springer, 2018.

ROTH, W. M. et al. *Authentic science revisited: in praise of diversity, heterogeneity, hybridity*. [S.l.]: Sense Publishers, 2008.

SCHELL, C. J. et al. The ecological and evolutionary consequences of systemic racism in urban environments. *Science*, New York, v. 369, n. 6510, eaay4497, Sep. 2020.

SINGH, D. *Hope for the science education of youth involved with the justice system*. 2021, 227f. Thesis (Doctorate in Philosophy Degree in Education) – Faculty of Education, University of Ottawa, Ottawa, 2021.

SMITH, G. A. Place-based education: practice and impacts. In: STEVENSON, R. B. et al. (Ed.). *International handbook of research on environmental education*. London: Routledge, 2013. p. 213-220.

SOBEL, D. *Mapmaking with children: sense of place education for the elementary years*. [S.l.]: Heinemann, 1998.

SORENSEN, J. *Critical animal studies: thinking the unthinkable*. Toronto: Canadian Scholars' Press, 2014.

SZTYBEL, D. Animals as persons. In: CASTRICANO, J. (Ed.). *Animal subjects: an ethical reader in a posthuman world*. Waterloo, CA: Wilfrid Laurier University Press, 2008. p. 241-257.

THÉBAUD, S.; CHARLES, M. Segregation, stereotypes, and STEM. *Social Sciences*, Basel, v. 7, n. 7, 2018. Retrieved from: <https://doi.org/10.3390/socsci7070111>.

SOCIAL dilemma, The [film]. Director Jeff Orlowski. Exposure Labs, Argent Pictures, and The Space Program. 2020.

TOLMAN, J. Teaching our cities: place-based education in an urban environment. In: SEYDEL, J et al. (Ed.). *Trailblazers for whole school sustainability: case studies of educators in action*. New York: Routledge, 2022. p. 38-51.

WAKEFIELD, S. et al. Growing urban health: community gardening in South-East Toronto. *Health Promotion International*, Oxford, v. 22, n. 2, p. 92-101, Feb. 2007.

WALTER, P. Theorising community gardens as pedagogical sites in the food movement. *Environmental Education Research*, London, v. 19, n. 4, p. 521-539, 2013.

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WILSON, E. *The creation an appeal to save life on earth*. New York: Norton, 2006.

ZUBOFF, S. *The age of surveillance capitalism: the fight for a human future at the new frontier of power*. [S.l.]: PublicAffairs, 2019.

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