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Secção 3: *Articulação entre Investigação & Práticas em Educação em Ciências, Matemática e Tecnologia (fase 2)*

THE WAY FORWARD: SCIENCE IS IMPERATIVE FOR HUMAN SURVIVAL

O CAMINHO A SEGUIR: A CIÊNCIA É IMPERATIVA PARA A SOBREVIVÊNCIA HUMANA

EL CAMINO HACIA ADELANTE: LA CIENCIA ES IMPERATIVA PARA LA SUPERVIVENCIA HUMANA

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ABSTRACT | The global climate emergency highlights the importance of education and community-based action to address the challenges facing humanity. The climate emergency is serious. Human survival is at risk. We must become empowered to take deliberative action and be a part of the solution. The time to act upon the environment and climate change warnings issued by scientists is now.

RESUMO | A emergência climática global destaca a importância da educação e da ação comunitária para enfrentar os desafios com os quais a humanidade se depara. A emergência climática é grave. A sobrevivência humana está em risco. Devemos ter o poder de tomar uma ação intencional e fazer parte da solução. É agora o tempo de agir face aos avisos dos cientistas sobre o meio ambiente e as mudanças climáticas.

RESUMEN | La emergencia climática mundial destaca la importancia de la educación y la acción comunitaria para abordar los desafíos que enfrenta la humanidad. La emergencia climática es grave. La supervivencia humana está en riesgo. Debemos estar capacitados para tomar medidas deliberativas y ser parte de la solución. Ahora es el momento de actuar atendiendo a las advertencias sobre el medio ambiente y el cambio climático emitidas por los científicos.

1. INTRODUCTION

In January 2020, we embarked on this project with a common goal: to reflect upon the climate emergency warning issued by Ripple et al. (2020), to offer insights with respect to the need to transform education in response to environmental issues and climate change, and to offer ideas for a Science, Mathematics & Technology Education research agenda (see Costa, Loureiro, & Sánchez, 2020; Kyle, 2020; Marín, 2020; Rodrigues, 2020). At the time, the world was – and continues to be – facing a climate emergency, youth were – and continue to be – demanding governments, policymakers, educators, CEOs of major corporations, and adults do more to address climate change. However, in less than 3 months the world and the lives of citizens have been transformed by a global pandemic.

On 30 January 2020, the World Health Organization (WHO) (2020a) declared the outbreak of novel coronavirus (2019-nCOV) a Public Health Emergency of International Concern (PHEIC). On 11 February 2020, the WHO announced the name for the new coronavirus disease: COVID-19. As of 4 April 2020, the WHO (2020b) reports over 1M confirmed cases of COVID-19; 57,206 confirmed deaths; and outbreaks in 208 countries, areas or territories. Many questions remain with respect to the ultimate reach of the pandemic and what the full impact of this humanitarian crisis will be. To date, there has been a significant impact upon citizens, upon the global economy, and upon the environment. The behavioral changes of humans – e.g., social and physical distancing, self-quarantines, working from home, school and business closures, cancelled meetings and events – are visible from space (NASA Earth Observatory, 2020a, 2020b; Space.com, 2020). The virus outbreak also highlights structural inequalities that are not visible from space but are felt in the lived daily experiences of individuals in low income jobs and individuals living in poverty around the world.

Like the warnings focused upon the environment and climate change issued by scientists for over a century, global public health officials have been warning of the need to prepare for possible pandemics for decades. Both crises highlight that science is imperative for human survival.

2. THE RELATIONSHIP BETWEEN SOCIETY AND THE ENVIRONMENT

Costa, Loureiro, and Sánchez (2020) focus upon teacher education and the need to contextualize global climate change. Using anti-hegemonic cinema, they afford prospective educators with the opportunity to see climate change through the lens of its impact upon society and the environment. Their focus upon place-based environmental disasters, enables educators to identify the power relationships that exist in society and the need to address social inequities. Through anti-hegemonic cinema, educators are able to see and critically reflect upon: the psychological and social trauma amongst the people affected; the impact of disasters upon the local environment and biodiversity; the destruction of the pristine 'place' that villagers and locals call home; the underlying environmental inequities within communities; the vulnerability of communities; as well as, the impact upon the local economy and the livelihoods of so many individuals. By making the invisible visible through political ecology, educators can hear the voices of individuals on the frontline of climate change disasters – often the poor and the vulnerable – and begin to reflect upon ways through education and community-based initiatives to prevent environmental degradation within local communities.

Costa, Loureiro, and Sánchez (2020) raise our collective consciousness to the reality that environmental degradation due to climate change impacts both the environment and people. I value their attention to the human dimension of climate change. I am often surprised that much of the literature regarding climate change focuses exclusively upon environmental degradation of ecosystems and biodiversity, while failing to recognize the significant impact climate change has upon human health (see World Health Organization, 2018; 2020c), as well as agriculture, food stability, and the global spread of infectious diseases

As nature is exploited, so too people are exploited as well. Many of the adverse effects of climate change are experienced by poor and low-income communities. Costa, Loureiro, & Sánchez (2020) assert "there is a pedagogical dimension to these conflicts, as they are capable of promoting an understanding of the contradictions that the exploitation of nature can generate" (p. 166). They maintain:

> The shared production of anti-hegemonic films generates fundamental positions for community-based educational practices, such as: i) knowing how to listen; ii) putting oneself in the place of the other; iii) generating empathy; iv) fighting for transformations; v) working collectively (p. 166).

3. SOCIAL JUSTICE

Marín (2020) observes social issues are often separated from environmental issues in science education. Science teaching and learning is therefore decontextualized from the lived daily experience of learners and the communities in which they reside. I would contend that the link between science and real-world experiences is almost always tenuous in the minds of learners. The lack of curricular connections between science and learners' day-to-day lived experiences obscures and diminishes the relevance of science in their lives. Scientific practices are political in ways central to their epistemic success (see Brown & Malone, 2004). Fischer (1998) notes sociological research has documented the extent to which science is as much a socio-cultural activity as a technical enterprise. He asserts full understanding of scientific findings is incomprehensible apart from the socio-cultural settings, which offer purpose and meaning. Thus, I would maintain as a result of formal science instruction, students - and citizens alike - have been denied access to this essential feature of science. As a result of such instruction, Marín (2020) observes learners are not afforded opportunities to deliberate inequities related to social issues in the sciences, and in particular to climate change mitigation and adaptation.

Marín (2020, p. 146) states:

> My practice as a science teacher, as well as that of other teachers who work in contexts of deep social inequality…is guided by the need to promote science teaching practices that address the educational demands proposed by the global climate emergency, but also the problematization of social inequality.

Through such an orientation to teaching and learning, teachers can enhance the scientific and citizenship skills amongst learners, as well as a critical political literacy with respect to local and global inequalities. Moreover, Marín (2020) highlights the importance of identifying local issues with scientific, social, and political components around which community-based research endeavors can be conceptualized in ways that community knowledge can address the

environmental issues and problematize the social inequities. The overarching goal is to educate citizens who can address environmental issues facing humanity that are yet unforeseen and bring about social transformation. Marín's educational vision is that education in science and technology ought to be contributing to the development of community and community processes to address the current and emerging climate challenges.

4. ACTING LOCALLY TO EDUCATE GLOBALLY

In light of the 17 Sustainable Development Goals (United Nations, 2015) and the European Parliament (2019) resolution on the climate and environment emergency, Rodrigues (2020) emphasizes how fostering emotional connections with nature is imperative to addressing the environmental challenges facing humanity and the climate change emergency. She states:

> Exploring local environmental problems, using nature as a classroom and inspiration across different disciplines, promoting field trips to nearby natural areas or recreating ecosystems in the school playground and involving students and their families in projects with visibility, usefulness and value to the community can foster this emotional connection (p. 170).

Rodrigues (2020) presents a powerful story of the ways in which community-based, intergenerational learning can be so impactful for everyone who participates. What emerges is a shared understanding and mutual respect for working together to address community issues.

The essence of education is dialogic co-construction of meaning. In the scenario portrayed by Rodrigues, the circle of this dialogue extends to parents / grandparents, and the community. Through such engagement, students, family, and community members develop complex conceptual relationships and construct notions of the knowledge relevant to address issues and/or problems, they deliberate how to take action to bring about change, as well as how to mitigate the global problem of climate change within their local community. Rodrigues offers wonderful examples of how knowledge is constructed, how students and community members promote biodiversity, and how behaviours change as a result of the community learning process with a focus upon the environment and sustainability. The value of integrating traditions and customs as part of the intergenerational learning experience is a valuable component of being able to compare the past with the present, while at the same time generating ideas for creating projects for the future, such as the "A Forest for the Climate" community initiative. As a result of their successes, the students and their parents are motivated to continue to act locally, while contributing to educate the community on the global climate and environment emergency.

5. CONCLUSION

In issuing their warning of a global climate emergency, Ripple et al. (2020) assert "mitigating and adapting to climate change while honoring the diversity of humans entails major transformations in the ways our global society functions and interacts with natural ecosystems" (p. 11). In our response to the climate emergency (see Costa, Loureiro, & Sánchez, 2020; Kyle, 2020; Marin, 2020; Rodrigues, 2020), we offer insights with respect to the need to transform education in response to environmental issues and climate change. We highlight the importance of incorporating local knowledge, culture, and history to address the global complexities of

climate change and the threats facing local communities. We focus upon the imperative of placed-based education and community-based initiatives to facilitate social transformation. We recognize that climate change conscious education needs to be linked to an understanding of the impacts on the environment and society.

Climate change impacts human health, leads to temperature related illnesses, impacts air quality affecting respiratory and cardiovascular systems, increases the occurrence and severity of extreme weather events, increases vector-borne diseases and water related illnesses, and impacts food safety and nutrition (see USGCRP, 2016). The effects of climate change will fall especially hard upon the most vulnerable people throughout the world; those who have the fewest resources to protect themselves and the fewest options when disaster strikes. Education must be oriented toward social justice issues and social inequities.

Through education we ought to strive to ensure citizens make better decisions for the planet and the future. The warnings of global public health officials of the need to prepare for possible pandemics have been ignored for decades. Similarly, the warnings issued by scientists focused upon the environment and climate change have been ignored for over a century. The denial of science is hindering the response to both the global pandemic and the climate crisis. COVID-19 offers a case study in global crisis management. A lesson that should be learned from both the COVID-19 humanitarian crisis and the global climate emergency is that science is imperative for human survival. There are stark differences between the two crises: in the context of pandemics, the costs are immediate and visible; in the context of climate change, the costs are slow and steady, but equally as deadly. The question before humanity is: How will we pivot to the future to address the climate emergency?

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