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# *YOUTH ARE DEMANDING ACTION REGARDING CLIMATE CHANGE: WILL EDUCATORS HAVE THE WISDOM AND COURAGE TO RESPOND?*

## A JUVENTUDE EXIGE AÇÕES RELATIVAS ÀS MUDANÇAS CLIMÁTICAS: TERÃO OS EDUCADORES SABEDORIA E CORAGEM PARA RESPONDER?

## LOS JÓVENES EXIGEN QUE SE TOMEN MEDIDAS EN RELACIÓN CON EL CAMBIO CLIMÁTICO: ¿TENDRÁN LOS EDUCADORES LA SABIDURÍA Y EL CORAJE PARA RESPONDER?

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**ABSTRACT** | In the late-19th century, scientists began issuing warnings about humanity raising the planet's average temperature by burning fossil fuels such as coal. For over a century, scientists published warnings focused upon the environment and climate change. Fortunately, youth around the world are taking action to ensure that preventing climate change is a global priority. On 15 March 2019, hundreds of thousands of youth around the world walked out of school demanding governments, policymakers, educators, CEOs of major corporations, and adults do more to address climate change. Ironically, many politicians and educators expressed concern that the protests were interfering with education. Really? I wonder why raising consciousness regarding a global crisis facing humanity is an infringement upon one's education. I hope educators will have the wisdom and courage to respond to the demands of youth, transform educational practice, and engage with a research agenda focused upon the global challenges facing humanity.

**KEYWORDS**: Environmental education, Science education, School-community initiatives, Youth-led activism.

**RESUMO** | No final do século XIX, cientistas começaram a advertir sobre a humanidade estar a aumentar a temperatura média do planeta, ao queimar combustíveis fósseis como o carvão. Há mais de um século, cientistas publicaram alertas focados nas mudanças climáticas e ambientais. Felizmente, jovens de todo o mundo estão agindo para garantir que prevenir a mudança climática é uma prioridade global. A 15 de março de 2019, centenas de milhares de jovens em todo o mundo saíram de suas escolas exigindo que governos, políticos, educadores, CEOs de grandes empresas e adultos fizessem mais pelas mudanças climáticas. Ironicamente, muitos políticos e educadores expressaram preocupação pelo facto de os protestos poderem interferir com a educação. Sério? Eu me pergunto porque será que aumentar a consciência em relação à crise global enfrentada pela humanidade é uma violação à educação de alguém. Espero que os educadores tenham sabedoria e coragem para responder às exigências dos jovens, transformando a prática educacional e envolvendo-se com uma agenda de pesquisa voltada para os desafios globais que a humanidade enfrenta.

**PALAVRAS-CHAVE**: Educação ambiental, Educação científica, Iniciativas escola-comunidade, Ativismo juvenil.

**RESUMEN** | A finales del siglo XIX, los científicos comenzaron a advertir a la humanidad sobre el aumento de la temperatura media del planeta por la quema de combustibles fósiles, como el carbón. Durante más de un siglo, los científicos publicaron advertencias centradas en el cambio climático y ambiental. Afortunadamente, los jóvenes de todo el mundo están actuando para asegurar que el cambio climático sea una prioridad mundial. El 15 de marzo de 2019, cientos de miles de jóvenes de todo el mundo salieron de sus escuelas exigiendo que los gobiernos, los políticos, los educadores, los directores generales de las grandes empresas y los adultos hiciesen más por el cambio climático. Irónicamente, muchos políticos y educadores expresaron su preocupación de que las protestas estuviesen interfiriendo con la educación. ¿En serio? Me pregunto por qué la sensibilización sobre la crisis mundial que enfrenta la humanidad es una violación de la educación de alguien. Espero que los educadores tengan la sabiduría y el coraje de responder a las demandas de los jóvenes transformando la práctica educativa y comprometiéndose con un programa de investigación centrado en los desafíos mundiales a los que se enfrenta la humanidad.

**PALABRAS CLAVE**: Educación ambiental, Educación científica, Iniciativas escolares- comunitarias, Activismo juvenil.

## 1. INTRODUCTION

In January 2020, over 11,000 scientists from 153 countries declared unequivocally a global climate emergency by asserting "scientists have a moral obligation to clearly warn humanity of any catastrophic threat" (Ripple et al., 2020, p. 8). They proclaimed, "our vital signs are designed to be useful to the public, policymakers, the business community, and those working to implement the Paris climate agreement, the United Nations' Sustainable Development Goals, and the Aichi Biodiversity Targets" (p. 8).

Scientists began issuing warnings about humanity raising the planet's average temperature by burning fossil fuels in the late-1800s. In 1992, the Union of Concerned Scientists issued a warning to humanity; over 1,700 scientists, representing 71 countries and 104 Nobel laureates, advocated a new environmental ethic to address the critical stress being imposed upon the planet by human activity. They asserted:

> Human beings and the natural world are on a collision course. Human activities inflict harsh and often irreversible damage on the environment and on critical resources. If not checked, many of our current practices put at serious risk the future we wish for human society…and may so alter the world that it will be unable to sustain life in the manner we know. (Union of Concerned Scientists, 1992, Introduction section)

The first international conference on the environment, The United Nations Conference on the Human Environment (UNCHE), was held in Stockholm, Sweden in June 1972. At the request of the Swedish government, The United Nations General Assembly convened the UNCHE. Representatives from 113 nations and over 400 non-governmental organizations (NGOs) attended the conference, in which they discussed common environmental concerns and produced 26 Principles (see United Nations, 1972, 2020; United Nations Environment Programme, 2002). The legacy of the conference was the establishment of the United Nations Environment Programme (UNEP).

On 18 February 2020, Inger Andersen, UNEP Executive Director, in her address to the 149th meeting of the Committee of Permanent Representatives to the United Nations Environment Programme in Nairobi, Kenya, reflected upon the catastrophic start to 2020 with the devastating bushfires in Australia, the warmest January on record, floods in the Horn of Africa, and locust invasions in East Africa. She proclaimed, "it is clear that now, at this moment in time, we simply have no choice but to take action and pull back from planetary instability and reverse the loss of nature". She noted preparations are underway to commemorate the 50th Anniversary of the establishment of UNEP in 2022. She offered a vision of hope for the future:

> I expect the international community, based on the hard work we will do this year, to have set the right targets and goals for nature. I expect us to have begun implementing them. I expect to see real progress on cutting greenhouse gas emissions, protecting and restoring ecosystems and biodiversity, reducing pollution and helping vulnerable communities cope. In short, I expect us to be travelling down the long road to reversing the planetary instability that humanity has created. (Andersen, 2020, UNEP at 50 section)

I envision it will be a long - and most likely winding - road. I wonder, if we knew in 1972 what we know today, would the planet be in a better place? And, knowing what we know today, do we have the wisdom and courage to take action to transform our lives, to save the planet…and to act on behalf of future generations? In the almost 50 years since the inception of the UNEP,

there have been numerous international conferences and treaties focused upon the environment and climate change, and there have been strides in addressing environmental issues, identifying global challenges facing humanity, and articulating Sustainable Development Goals (SDGs). However, the time to take deliberative action is now.

## 2. THE GLOBAL CLIMATE CHALLENGE

The reality of climate change is "it's affecting everything: not just weather patterns, ecosystems, ice sheets, coastlines, and cities across the planet, but the health, safety, and security of every person alive and the generations to come" (Foley, 2017, p. ix). In a Keynote Address in October 2012, Rebecca Tarbotton, former Executive Director of the Rainforest Action Network (RAN), proclaimed:

> We need to remember that the work of our time is bigger than climate change. We need to be setting our sights higher and deeper. What we're really talking about, if we're honest with ourselves, is transforming everything about the way we live on this planet. (Tarbotton, 2012, 12:57)

Where does such transformation begin? For too long the public has been in a state of climate change denial, too busy to be bogged down with information perceived to be confusing and abstract, while at the same time believing government is responsible for responding to global issues facing humanity, the most significant of which is climate change.

Vandenbergh and Gilligan (2017) assert it is time to look beyond politics to address the climate change threats facing society. Initiatives by the private sector - businesses, advocacy groups, NGOs, religious organizations, philanthropists, educators, individuals, and households – can all play an important role in the response to climate change. They highlight how private sector initiatives offer promising opportunities to reduce the risks of climate change.

There is an emerging public urgency for action to address climate change. Political activists are demanding public officials regulate greenhouse gas (GHG) emissions. Yet, Gilligan and Vandenbergh (2020) note this sense of urgency contrasts with the slow pace and limited accomplishments of political institutions to reduce GHG emissions over the past several decades. They point out while political institutions face structural barriers to taking action to cut emissions, "private environmental governance has great potential to avoid many of those structural obstacles and thus to achieve rapid emissions reductions" (p. 5). Research has demonstrated private-governance initiatives can make important and rapid contributions to reducing GHG emissions.

Many private sector initiatives are placed-based or regional. When such private sector initiatives are undertaken, they typically address an issue with a global scope - that is, emanating from one or more of the 17 Global Goals for Sustainable Development (United Nations, 2015) - but the impact of the initiative is local. Educators ought to assume leadership in the context of private-governance initiatives. It is this place-based orientation that enables educators to focus upon sustainable development, empowerment and social transformation in ways meaningful and relevant to the current generation of youth (Kyle, 2020). I believe this creates tremendous opportunities for an emerging Science, Mathematics, and Technology Education research agenda focused upon global challenges of local significance and climate change.

I propose educators identify ways in which this placed based notion of contributing to climate change can become school-community based initiatives. Schools and communities ought to partner with local businesses/industries/NGOs, social service agencies, and / or partner schools internationally to identify ways in which the local communities can work towards climate change solutions. Transformative action research projects should be developed so that schools and communities share their initiatives and accomplishments. Such school-private climate governance initiatives would ensure students and communities become active agents in the process of transformation. Ideally such an educational orientation would facilitate the emergence of youth-led community organizing, a movement that empowers youth while enabling them to make substantive contributions to their communities (see Delgado & Staples, 2008). Educational experiences ought to be intergenerational, community-based, oriented toward self- and social empowerment and transformative (Kyle, 2020; Onwu & Kyle, 2011). Youth have a significant role in contributing to the social and environmental changes that must transpire.

### 2.1 Intergenerational, community-based initiatives oriented toward self- and social empowerment and social transformative

"Learning that empowers should facilitate learners' abilities to understand their world, engage with and critically examine issues, and offer an inspiration to get involved in decision-making and action-taking" (Saiti, Kyle, Sinnes, Nampota, & Kazima, 2014, p. 188). Through community-based initiatives, Saite et al. report on how students in a rural community in Malawi identified the major trends of environmental degradation since the 1950s. Using Participatory Rural Appraisal (PRA) tools (Narayanasamy, 2009), which seek to understand poverty from the perspective of a range of stakeholders and to involve stakeholders directly in planning follow-up activities, students experienced real-world participation in their community; enhanced their ability to identify, analyze and suggest solutions for real-world problems; and acquired knowledge of the local environment - all indicators of a self- and socially-empowering learning experience, which ultimately led to social transformation within the community.

In 2016, UNESCO launched a 2-year pilot program, under the auspices of the UNESCO Global Action Programme on Education for Sustainable Development, to make climate change a priority in every part of school life. The Implementing a Whole-School Approach to Climate Change program involved 258 schools from 25 countries, including 7 Least Developed Countries (LDCs) and 3 Small Island Developing States (SIDS). These schools were members of the UNESCO Associated Schools Network (ASPnet), which unites 11,700 schools in 182 countries (see, https://aspnet.unesco.org/en-us). Sabine Detzel, International Coordinator of the UNESCO ASPnet, states the whole-school approach is "not a project about teaching and climate change, or teaching about sustainable development" (UNESCO, 2019, 2:36), rather:

> This project is about really trying to transform an entire school, of mobilizing every single actor in a school, but also the community around it. And trying to look at every single aspect and dimension of a school's life, and trying to see how we can include concerns about sustainable development and climate change in it. (UNESCO, 2019, 2:40)

The whole-school approach to climate change includes school governance, teaching content and methodology, campus and facilities management, as well as partnerships with the broader communities. Thus, it involves the active involvement of all internal and external school stakeholders; students, teachers, principals, school staff at all levels; and the wider school

community, such as families and community members, in reflecting and acting on climate change (UNESCO, 2016). The program is an interdisciplinary approach oriented toward ensuring environmental awareness, action-taking, community transformation, and empowering youth and communities to protect the environment. UNESCO has plans to upscale the program in the future to all 11,700 ASPnet schools and communities.

Many NGOs have emerged with regional and global education initiatives focused upon environmental issues and climate change (e.g., Slow Food International, Cool Earth, Youth Climate Lab, UNICEF's Youth for Climate Action, 350.org). With a focus upon environmental justice, intergenerational and intragenerational equity, self- and social-empowerment, and social transformation, such organizations are striving to facilitate action toward a better world.

## 3. THE GLOBAL ECONOMIC SYSTEM

Ascertaining that human activities are responsible for global climate change - attribution - is one of the most active areas of climate research (see, Ornes, 2018). The warming of the Earth's surface is both attributed to human activities and altering the climate system. While caused by human activity, climate change is the product of a social, political, and economic system, which has failed to respond to the challenges of climate change. In fact, capitalism has obstructed actions to ameliorate climate change with its focus upon:

- the drive for economic growth and short-term corporate profits;
- consumerism / consumption;
- corporate greed vis-à-vis free trade, deregulation, and privatization;
- the overconsumption of natural resources; and
- the blatant disregard for science.

Turner (2019) notes how venture capitalists have been financing technological breakthroughs, yet their efforts have been dwarfed by industry lobbyists arguing successfully against mandatory regulations and / or carbon taxes. Klein (2014) observes how in the battle between capitalism and the planet the planet always loses to the demand for economic growth, which is used as the rationale for delaying climate action or for breaking existing emission commitments. The planet would be well on the way to achieving a zero-carbon economy if adequate policies had been adopted 30+ years ago. Instead, Klein (2014) asserts "privatization of the public sphere, deregulation of the corporate sector, and lower corporate taxation, paid for with cuts to public spending" (p. 19) has sabotaged our ability to respond to the climate challenge. She states:

> The twin signatures of this era have been the massive export of products across vast distances (relentlessly burning carbon all the way), and the import of the uniquely wasteful model of production, consumption, and agriculture to every corner of the world (also based on the profligate burning of fossil fuels). Put differently, the liberation of world markets, a process powered by the liberation of unprecedented amounts of fossil fuels from the earth, has dramatically sped up the same process that is liberating Arctic ice from existence. (Klein, 2014, pp. 20 – 21)

The Intergovernmental Panel on Climate Change (IPCC, 2019) reports unless we change course in terms of GHG emissions, then temperatures will continue to rise over the next century,

resulting in more drought, more crop failures, more famine, water scarcity, and the displacement of millions of people due to rising sea levels, extreme weather events, and flooding. In addition, the potential of tropical diseases spreading to regions where they don't currently exist is likely due to increased temperatures. Scarcity of basic human needs could lead to conflict in regions around the world. Imagine a world in which we see mass migrations of people in search of food, water, and other basic human needs. Presently, food insecurity is a critical "factor driving international migration, along with conflict, income inequality, and population growth. The act of migration itself causes food insecurity, given the lack of income opportunities and adverse conditions compounded by conflict situations" (IPCC, 2019, p. 516). In addition, 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.

When reporting on the situation in Least Developed Countries (LDCs), Barakat and Endalew (2019) assert the IPCC statements regarding the impacts of increased warming on the poorest and most vulnerable is made with the highest levels of certainty and likelihood, making it hard to ignore these countries' consistent calls for action. They note "the incidence of heat-related deaths, vector-borne diseases, water stress and poverty are expected to be significantly higher at 2°C when compared to 1.5°C of warming with LDCs among those at disproportionately higher risk" (p. 7). Moreover, they point out:

> LDCs aren't the only countries that are vulnerable to climate change impacts; many small island developing states (SIDS) face existential challenges, and some islands are trying to do everything in their power to avoid being swallowed up by rising seas altogether. It's these groups of very vulnerable countries, LDCs and SIDS, which have contributed little if at all from the climate crisis, yet suffer the worst from it and have the least means to deal with it. (p. 7)

Despite decades of warnings from scientists and now the awareness of the lived experiences of millions suffering the devastating effects of climate change, multi-national corporations and many politicians wish to maintain the status quo. They are more interested in short term profits for fossil fuel companies - oil, natural gas, and coal - than in the future of the planet. For example, in 2014, public companies involved in extracting, transporting, refining, distributing and trading in fossil fuels in the United States and Canada had a profit of $257 billion. Despite these profits, the fossil fuel industry receives tens of billions of dollars in subsidies every year, a direct expense to taxpayers. While these companies reap their benefits, communities around the world suffer the impacts of climate change, oil spills, and water contamination from fracking, drilling and mining (see Oil Change International, 2015).

Pacheco et al. (2017) affirm fundamental changes must occur at the level of the ultimate cause of the environmental crisis—that is, the global economic system dependent on growth. They stress the need for a global transformative change in which the conservation of the environment, not economic growth, is the driving force of development. They note economic growth "becomes a tool for conservation development, but under special and limited circumstances. It stops being the goal and reason of (the old) 'development'" (p. 397).

I concur with the assertion of Pacheco et al. (2017). And, I believe this very issue ought to frame an emerging Science, Mathematics, and Technology Education research agenda focused upon global challenges of local significance and climate change. That is, are the paradigms of

conservation and economic growth allies in some regions of the world, while not in others? Pacheco et al. (2017) state "the new conservation paradigm is based, at the personal and societal level, on major changes in values, lifestyles, and behavior" (p. 398). They go on to say that at the political level "it is based on finally accepting that continuous economic growth is impossible, and that the environment has to be considered as the base and framework for human and cultural survival (p. 399). Once again, I propose educators identify ways in which this placed based notion of contributing to climate change can become school-community based initiatives.

## 4. SOCIAL MOVEMENTS

I maintain the warnings of scientists without action are in vain. Fortunately, youth around the world are beginning to take action to ensure climate change becomes a global priority. On 15 March 2019, tens of thousands of youth around the world - in what may be one of the largest environmental protests in history - walked out of school to demand governments, policymakers, CEOs of major corporations, and adults do more to address climate change (Warren, 2019; see also Common Dreams, 2019). Ironically, many politicians and educators expressed concern regarding the protests interfering with education. However, scientists around the world voiced their support for the youth movement. Thackeray et al. (2020) offer the following reflection on science and activism in the context of the School Strike for the Climate:

> Science without activism is powerless to enact change, but activism without science will enact change without knowledge of the direction in which change is needed. To make constructive progress, both science and activism are needed to move society in the right direction with strength and purpose. (p. 3)

I contend youth should not be disenfranchised in their educational opportunities due to poor political leadership. Rather, educators ought to facilitate ways for youth to express their political agency. O'Brien, Selboe, and Hayward (2018) highlight diverse ways in which youth are challenging power relationships and political interests to promote climate-resilient futures. As Greta Thunberg (2019) has proclaimed:

> We are not in school today. We are not at work today. Because this is an emergency. And we will not be bystanders.
>
> Some would say we are wasting lesson time; we say we are changing the world. So that when we are older we will be able to say we did everything we could. And we will never stop doing that. We will never stop fighting for the living planet and for our future. (pp. 104 - 105)

Xiuhtezcatl Martinez is a 19-year-old indigenous climate activist, hip-hop artist, and a leader amongst the global youth environmental movement. He started speaking about the environment at the age of 6 and presently is a Youth Director of Earth Guardians, an organization that educates youth across the world to use civic engagement and the arts to help solve environmental issues. He often uses music to convey powerful environmental messages. Martinez (2020) explains his passion as follows:

> I want to inspire people to bring activism into what they love to do. Whether you're an entrepreneur, poet, scientist, athlete, or artist, you can find ways to use what you're passionate about to have an incredible impact. Our movement desperately needs a

> diversity of new ideas and ways of thinking to bring forth real change. That's why we need more than traditional activist tactics. Some of the most impactful work being done in my generation is from people spreading awareness through art, music, and other creative means. (p. 212)

Youth activists from African nations, such as Vanessa Nakate (Uganda), Makenna Muigai (Kenya), and Ayakha Melithafa (South Africa), and climate scientist Ndoni Mcunu (South Africa) attended the January 2020 World Economic Forum in Davos, Switzerland. They highlighted the challenges on the continent, which has 15% of the global population, yet is expected to endure about 50% of the global climate change adaptation costs. As a climate justice advocate, Nakate founded the Youth for Future Africa and the Rise Up Movement in Africa. Melithafa contributed to the Project 90 by 2030 YouLead initiative, a South African organization committed to a 90% reduction in carbon by 2030.

Social movements often capture the humanizing, lived experiences of individuals within local communities as well. Méndez (2020) notes "environmental justice groups center their advocacy on community-specific public health campaigns" (p. xii). In his book, *Climate Change from the Streets*, he offers an urgent and timely analysis of the contentious politics of incorporating environmental justice into global climate change policy. He tells the compelling story of people, place, and power in the context of climate change and inequality. He explores the California (USA) environmental justice movement and the advocacy work on climate change and articulates the perspectives and influence low-income people of color bring to their local communities. Méndez highlights the importance of incorporating local knowledge, culture, and history into policymaking to address the global complexities of climate change and the threats facing local communities.

The Green New Deal (GND), US House Resolution 109 (116th Congress, 2019-2020) (https://www.congress.gov/bill/116th-congress/house-resolution/109/text), offers a set of goals for addressing climate change (see also Klein, 2019). The primary goal of the plan "is to bring U.S. greenhouse gas emissions down to net-zero and meet 100% of power demand in the country through clean, renewable, and zero-emission energy sources by 2030" (Dsouza, 2019, What's in the Green New Deal? section). The plan emphasizes environmental and social justice and "acknowledges how historically oppressed groups—indigenous peoples, people of color, the poor, and migrants—are more likely to be affected by climate change" (Dsouza, 2019, Ocasio-Cortez's GND section).

## 5. REFLECTION AND RECOMMENDATIONS FOR ACTION

As I reflect upon the ways in which we can improve research and educational practice in Science, Mathematics, and Technology Education (SM&T Education) in the era of the current climate emergency, I believe three central questions articulated in Rethinking Education: Towards a Global Common Good (UNESCO, 2015) ought to frame our thinking:

- What education do we need for the 21st century?
- What is the purpose of education in the current context of societal transformation?
- How should learning be organized?" (p. 3)

Within such a research agenda, educators should challenge the decades honored curricular focus upon universalism and standardization. I maintain the imposition of standards and accountability represents the antithesis of what an education ought to be. Learners should be afforded the opportunity to experience a more progressive education (Dewey 1990/1900), oriented toward real-world, experiential, context-based approaches to teaching and learning. As part of this research agenda, educators would be investigating the complex process of teaching and learning when education is viewed as a public good; as being of value to all in society, and a society to which all ought to contribute. In addition to challenging the notion of universalism and standardization, progressive education requires a different form of assessment oriented toward performance observations and active assessment of learning. The goal of assessment ought to be oriented toward self- and social empowerment, action-taking, and transformation. Such an agenda ought to be inspired by "the humanistic values that should be the foundations and purpose of education", which include "respect for life and human dignity, equal rights and social justice, cultural and social diversity, and a sense of human solidarity and shared responsibility for our common future" (UNESCO, 2015, p. 38).

The 17 Sustainable Development Goals (United Nations, 2015) offer a starting point for educators to begin to collaborate with youth, schools, and communities to initiate a research agenda that extends well beyond 2030. Addressing and achieving the SDGs is imperative since for the past 50 years humanity increasingly operates in overshoot. Earth Overshoot Day marks the date when humanity's demand for ecological resources and services each year exceeds what Earth can regenerate in that year. In 2019, Earth Overshoot Day was 29 July (see https://www.overshootday.org/ and https://www.footprintnetwork.org/). An awareness of the SDGs and the concept of Earth Overshoot Day ought to be a part of the discourse of every citizen on the planet. SM&T educators ought to view education as a primary means of investing in human resources. The youth of today must be able to address complex everyday issues yet unforeseen. This is not a modest goal. We must ensure all learners have access to an equitable education. I propose learning opportunities be transformed to ensure the active engagement of youth and communities in the context of experiential learning (see Kolb, 1984). Educators ought to be purposefully engaging with learners in direct experience and focused reflection to increase knowledge, develop skills, clarify values, and develop the capacity of learners to contribute to their communities (Kyle, 2020). The research agenda ought to identify ways in which educators can facilitate dialogue, action, and social transformation by collaborating with youth, schools, and communities. Engaging in such initiatives would ensure students and communities become active agents in the process of addressing climate change.

The transformation of teaching espoused herein ought to facilitate the emergence of youth-led community organizing, a movement that empowers youth while enabling them to make substantive contributions to their local communities, nationally, and globally. The youth of today are exhibiting inspiration, leadership, and vision with respect to climate change and other global issues facing humanity. Schools and communities throughout the world should facilitate their dreams to reverse the negative impact upon the planet and leave a better world for future generations. The planet awaits new leadership.

## REFERENCES


Andersen, I. (2020, February 18). The Executive Director's statement to the 149th meeting of the Committee of Permanent Representatives. https://www.unenvironment.org/news-and-stories/speech/executive-directors-statement-149th-meeting-committee-permanent

Barakat, S., &, Endalew, G. J. (2019). *LDCs, negotiations and the climate crisis: Will the poorest countries benefit from the COP24 climate package?* International Institute for Environment and Development (IIED). https://pubs.iied.org/pdfs/10200IIED.pdf

Common Dreams. (2019, September 18). Ahead of climate strike, Greta Thunberg tells US lawmakers to Their faces: Sorry, you're not trying 'hard enough'. Retrieved from https://www.commondreams.org/news/2019/09/18/ahead-climate-strike-greta-thunberg-tells-us-lawmakers-their-faces-sorry-youre-not

Delgado, M., & Staples, L. (2008). *Youth-led community organizing: Theory and action*. Oxford University Press.

Dewey, J. (1990/1900). *The school and society*. University of Chicago Press. (Originally published in 1900).

Dsouza, D. (2019, October 28). The Green New Deal Explained. https://www.investopedia.com/the-green-new-deal-explained-4588463

Foley, J. (2017). Foreword. In P. Hawken (Ed.), *Drawdown: The most comprehensive plan ever proposed to reverse global warming* (p. ix). Penguin Books.

Gilligan, J. M. & Vandenbergh, M. P. (2020). A framework for assessing the impact of private climate governance. *Energy Research & Social Science*, 60, Article 101400. https://doi.org/10.1016/j.erss.2019.101400

IPCC. (2019). Climate change and land: An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. https://www.ipcc.ch/site/assets/uploads/sites/4/2020/02/SRCCL-Complete-BOOK-LRES.pdf

Klein, N. (2014). *This Changes everything: Capitalism vs. the climate*. Simon & Schuster.

Klein, N. (2019). *On fire: The (burning) case for a Green New Deal*. Simon & Schuster.

Kolb, D. (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs: Prentice-Hall.

Kyle, W. C., Jr. (2020). Expanding our views of science education to address sustainable development, empowerment, and social transformation. *Disciplinary and Interdisciplinary Science Education Research*, 2, Article 2. https://doi.org/10.1186/s43031-019-0018-5

Martinez, X. (2017). *We rise: The Earth Guardians guide to building a movement that rescues the planet*. Rodale.

Méndez, M. (2020). *Climate change from the streets: How conflict and collaboration strengthen the environmental justice movement*. Yale University Press.

Narayanasamy, N. (2009). *Participatory Rural Appraisal: Principles, methods, and application*. Sage Publications.

O'Brien, K., Selboe, E., & Hayward, B. M. (2018). Exploring youth activism on climate change: Dutiful, disruptive, and dangerous dissent. *Ecology and Society*, 23(3), 42. https://doi.org/10.5751/ES-10287-230342

Oil Change International. (2015, May). $257 billion. http://priceofoil.org/profits-oil-gas-coal-companies-operating-u-s-canada/

Onwu, G. O., & Kyle Jr., W. C. (2011). Increasing the socio-cultural relevance of science education for sustainable development. *African Journal of Research in Mathematics, Science and Technology Education*, 15(3), 5–26.

Ornes, S. (2018). Core Concept: How does climate change influence extreme weather? Impact attribution research seeks answers. Proceedings of the National Academy of Sciences, 115(33), 8232-8235. https://doi.org/10.1073/pnas.1811393115

Pacheco, L.F., Altrichter, M., Beck, H., Buchori, D., & Owusu, E.H. (2017). Conservation as the new paradigm for development. In A. A. Aguirre & R. Sukumar (Eds.), *Tropical conservation: Perspectives on local and global priorities* (pp. 390 – 402). Oxford University Press.

Ripple, W. J., Wolf, C., Newsome, T. M., Barnard, P., & Moomaw, W. R. (2020). World scientists' warning of a climate emergency. *BioScience*, 70 (1), 8–12. https://doi.org/10.1093/biosci/biz088

Saiti, A., Kyle, W. C., Jr., Sinnes, A. T., Nampota, D., & Kazima, M. (2014). Developing relevant environmental education in a rural community in Malawi. *Brazilian Journal of Research in Science Education*, 14(2), 185-198. Retrieved from https://periodicos.ufmg.br/index.php/rbpec/article/view/4360

Tarbotton, R. (2012, October). Keynote Address. https://www.ran.org/the-understory/rainforest_action_network_mourns_the_unexpected_loss_of_our_visionary_executive_director_rebecca_tarbotton/

Thackeray, S.J., Robinson, S.A., Smith, P., Bruno, R., Kirschbaum, M.U.F., Bernacchi, C., Byrne, M., Cheung, W., Cotrufo, M.F., Gienapp, P., Hartley, S., Janssens, I., Hefin Jones, T., Kobayashi, K., Luo, Y., Penuelas, J., Sage, R., Suggett, D.J., Way, D. and Long, S. (2020). Civil disobedience movements such as School Strike for the Climate are raising public awareness of the climate change emergency. *Global Change Biology*. 1-3. https://doi.org/10.1111/gcb.14978

Thunberg, G. (2019). No one is too small to make a difference. Penguin Books.

Turner, A. (2019, September 3). Is capitalism incompatible with effective climate change action? World Economic Forum. https://www.weforum.org/agenda/2019/09/is-capitalism-incompatible-with-effective-climate-change-action

Union of Concerned Scientists (UCS). (1992). 1992 World scientists' warning to humanity. Cambridge, MA: UCS. https://www.ucsusa.org/resources/1992-world-scientists-warning-humanity

United Nations. (1972, June). Report of the United Nations Conference on the Human Environment (UN Publication No. A/CONF.48/14/Rev1). http://www.imo.org/en/KnowledgeCentre/ReferencesAndArchives/HistoryofMARPOL/Documents/A%20CONF.48%2014%20Rev.1.pdf

United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. Resolution A/Res/70/1. Retrieved from: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

United Nations. (2020). *Declaration of the United Nations Conference on the Human Environment (Stockholm Declaration), 1972 and the Rio Declaration on the Environment and Development, 1992*. https://legal.un.org/avl/ha/dunche/dunche.html

United Nations Environment Programme (UNEP). (2002). *Global environment outlook 3: Past, present and future perspectives*. Earthscan Publications. https://wedocs.unep.org/bitstream/handle/20.500.11822/8609/GEO-3%20REPORT_English.pdf?sequence=7&isAllowed=y

UNESCO. (2015). *Rethinking education: Towards a global common good?* UNESCO. Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000232555

UNESCO. (2016). *Getting climate-ready: A guide for schools and climate action*. UNESCO. Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000246740

UNESCO. (2019, June 5). *UNESCO Associated Schools 4 Climate – Documentary* [Video]. YouTube. https://www.youtube.com/watch?v=RkoXX4m9wR8

Vandenbergh, M. P., & Gilligan, J. M. (2017). *Beyond politics: The private governance response to climate change*. Cambridge University Press.

Warren, M. (2019, March 14). Thousands of scientists are backing the kids striking for climate change: Students around the world are walking out of school to urge governments to do more about global warming. Nature, 567, 291 - 292. https://www.nature.com/articles/d41586-019-00861-z