STEM EDUCATION AND EDUCATION FOR SUSTAINABILITY (EFS): FINDING COMMON GROUND FOR A FLOURISHING FUTURE

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ABSTRACT

Set within the complex discourse about the nation's need for more advancement and collaboration in the fields of Science, Technology, Engineering, and Mathematics (STEM), as well as ensuring a sustainable, flourishing future for the environment, this paper considers the implications for STEM Education and Education for Sustainability (EfS). It is education, reflected in curricula and in the classroom, which will influence the next generation of leaders in the country, who in turn will make decisions in relation to STEM and how it can be used to ensure a sustainable society. This position paper presents a summary of the literature surrounding the two areas and the resulting perceived conflict, first presenting the STEM perspective, and second the critique from the EfS perspective. This is followed by a consideration of how EfS and STEM Education can be integrated in authentic and meaningful ways. Examples of learning activities that have been implemented are provide and guidelines are suggested for future initiatives.

Introduction: the STEM Perspective

Within Australia, the cause of STEM education has been taken up enthusiastically by the Office of the Chief Scientist (OCS) (e.g., 2012a, 2012b, 2013, 2014). *Mathematics, Engineering and Science in the National Interest* (2012a) sets out a series of recommendations to improve teaching in these subjects across all levels of education and teacher professional learning. It was justified on the following grounds:

> There is a global perception that a workforce with a substantial proportion educated in Mathematics, Engineering and Science (MES) is essential to future prosperity (p. 6).
>
> Investing in mathematics, engineering and science is the key to productivity growth and higher living standards for our community … The objective here is to position the Australian economy as a whole for the future. (p. 26)

In the same year the OCS (2012b) released its *Strategic Research Priority Setting: Key Messages*, which included five societal challenges:

- Living with a changing environment,
- Promoting population health and wellbeing,
- Managing our food and water assets,

- Securing Australia's place in a changing world, and
- Lifting productivity and economic growth. (p. 12)

These five challenges were repeated in the OCS's position paper of 2013, *Science, Technology, Engineering, and Mathematics in the National Interest: A Strategic Approach* (p. 5). Elsewhere in the document there was one mention of environment in a similar context to the first dot point:

> By 2025…The education system will provide all Australians with the capacity and confidence to make informed choices on complex matters where STEM offers options that have ethical, economic or environmental dimensions. (p. 7)

In relation to Australia's Global Influence in the document, there is a potential contribution in areas that could be linked to the natural environment.

> Australia's STEM is respected for its contribution to international solutions to global challenges, especially in systems science where, for example, oceans, atmosphere, space and epidemiology are global responsibilities. (p. 23)

Among the key objectives in relation to New Knowledge is "Support our need to understand both the natural world and the constructed world" (p. 17). This is not spelled out specifically but the focus is on the quality of research generally and its funding. Although "benefit to the community" (e.g., p. 11) is stressed, this is seen in the key objective of the STEM Strategy as:

> To utilise fully Australia's capacity in STEM to secure social, cultural and economic prosperity for all Australians while positioning Australia to advantage in a changing world. (p. 8)

The *Strategic Approach* led to an Agenda for Change in *Science, Technology, Engineering and Mathematics: Australia's Future* (OCS, 2014). The four recommendations for achieving a stronger Australia with a competitive economy relate to: (i) Australian Competitiveness, (ii) Education and Training, (iii) Research, and (iv) International Engagement. The objective for Education and Training is that "Australian education, formal and informal, will prepare a skilled and dynamic STEM workforce, and lay the foundations for lifelong STEM literacy in the community" (p. 6). STEM literacy is not defined but science literacy and mathematical literacy are noted with "a core STEM education for all students‒encompassing inspirational teaching, inquiry-based learning and critical thinking‒placing science literacy alongside numeracy and language proficiency as a priority" (p. 20). This is to be addressed through STEM-equipped teachers.

> Curricula and assessment criteria should prioritise curiosity-driven and problem-based learning of STEM‒STEM as it is practised‒alongside the subject-specific knowledge that STEM requires. … Students must have clear pathways from the classroom to a career in the STEM economy. Our needs and our capabilities must align. (p. 21)

These documents pay virtually no attention to issues associated with the environment and sustainability in relation to the goals of the nation to be supported by STEM advancements. It is interesting then to read *The Curious Country* (Dayton, 2013), a book with six chapters focussing on the concerns of Australians about science and issues they wanted addressed. The issues were gauged from a survey of 1186 Australians, aged 18 to 65. Four of the six chapters addressed the first four of the societal challenges listed in the *Key Messages* (OCS, 2012b). The only challenge not supported in the survey and book was "Lifting productivity and economic growth." Climate change was significant in sections of the chapters on "Living in a changing environment" and "Managing our food and water assets," with an entire chapter devoted to "Sustainable energy and productivity." The gap left by *The Curious Country* in relation to productivity and economic growth was filled more than adequately by the OCS's position paper (2013) and agenda for change (2014).

The implications for the fifth challenge are quite clear however. More recently, when Dr Alan Finkel was appointed Australia's new Chief Scientist, he affirmed the relationship between STEM and STEM education in his comments following his appointment (Lee & Hannam, 2015):

> My personal experience across research, business and STEM education will guide my ability to formulate relevant advice … We exist in a competitive international environment

> and to compete effectively, business needs science, science needs business, Australia needs both. (para. 4)

In similar vein, Hackling, Murcia, West, and Anderson (2014) in their *Optimising STEM Education in WA Schools* note that:

> Education in science, technology, engineering and mathematics (STEM) is a powerful and productive driving force for economic growth. A strong STEM education system provides the essential underpinning of an innovative and scientifically literate culture that:
>
> - develops the capabilities for individuals to function effectively within a science and technology based society,
> - provides an ever widening range of career opportunities and,
> - builds the productive capacity required to drive a prosperous economy and enhanced well-being in an increasingly competitive world. (p. 1)

The report goes on to lament the fact that "the limited numbers and quality of school and university graduates in STEM fields place serious constraints on Western Australia's capacity for innovation and economic growth" (p. 10).

The question of the degree of acknowledgement of environmental sustainability within STEM education is partially answered by the proceedings of the Australian Council for Educational Research (ACER) Research Conference 2016. The title of the conference was *Improving STEM Learning: What Will it Take?* and the proceedings included two keynote addresses, 13 invited papers by prominent Australian educators, and two posters. In the 100 pages of the proceedings, the first reference to environmental sustainability was on page 90, where it was mentioned in relation to STEAM (Science, Technology, Engineering, Arts, and Mathematics) education and the UN 2030 Agenda for Sustainable Development (United Nations, 2015).

In their report to the Office of the Chief Scientist *Transforming STEM teaching in Australian primary schools: everybody's business*, Prinsley and Johnston (2015) justify their report with the following introductory statement.

> A strong economy in the twenty-first century prospers through science, technology, engineering and mathematics (STEM). Across the world, nations are competing for the high-growth firms and highly capable workers of the future; and securing the pipelines in their education systems today. They know that children entering the education system in 2016 will be joining a very different workforce in 2030. They see the rising premium on skills in STEM. In these nations, STEM education counts. (p. 1)

With these views, perhaps one can question whether the challenge of "Living in a changing environment" is really meant to feature a concern about making that environment sustainable so that a sustainable economy can develop within it. It is the challenge of the notion of growth that sees STEM and EfS taking different positions.

Critiques of STEM

The current criticism of STEM from the environmental science and EfS communities arises from the recognition of the loss of natural capital and especially climate change due to continued economic growth (Thiele, 2013). From the second half of the 20th century it has become increasingly clear that continued growth, driven by development of the technologies and mindsets and powered by fossil fuels, is unsustainable on an planet with finite material resources, and has led to massive over-exploitation of the world's ecosystem (Thiele). It now is commonly accepted by the science community that Earth has entered the *Anthropocene*, a new geological epoch that represents a new phase in the history of both "humankind and of the Earth, when natural forces and human forces became intertwined, so that the fate of one determines the fate of the other" (Zalasiewicz, Williams, Steffen, & Crutzen, 2010, p. 2231). The University of Leicester's Anthropocene Working Group (2016) confirmed this nomenclature with the following statement:

> Changes to the Earth system that characterize the potential Anthropocene Epoch include marked acceleration to rates of erosion and sedimentation; large-scale chemical perturbations to the cycles of carbon, nitrogen, phosphorus and other elements; the inception of significant change to global climate and sea level; and biotic changes such as unprecedented levels of species invasions across the Earth. Many of these changes are geologically long-lasting and some are effectively irreversible.
>
> These and related processes have left an array of signals in recent strata, including plastic, aluminium and concrete particles, artificial radionuclides, changes to carbon and nitrogen isotope patterns, fly ash particles, and a variety of fossilizable biological remains. Many of these signals will leave a permanent record in the Earth's strata. (paras. 8, 9)

Ironically, at the same time, economic growth continues to be a key priority of nations (Thiele, 2013). It has become so inextricably linked with deeply held beliefs and values that promote progress, success, consumption, efficiency, winning, productivity, competitiveness, risk taking and power over others through the mechanisms of the free market, that for many it is impossible to envision a different world (Smith, 2007). Further, this version of progress is increasingly dependent on the power of technology. Milbrath (1989) has termed this set of values the "Dominant Social Paradigm" (DSP) (see also Shafer, 2006). Slaughter (2016) describes the DSP as the "meta problem" of our day and summarises its principles as:

- The Western worldview is defective because it provides us with a thin, instrumental view of the world, which, though successful in the short term, cannot be maintained in the long term,
- Dominant political and economic powers in the world are generally not interested in the real future,
- Significant arenas of human experience have been marginalised or overlooked by Western institutions,
- Modern technologies do little or nothing to assist people in solving the perennial problems of human existence but they are represented as if they were of central and vital importance, and:
- The ideology of material growth has only been viable for a short time and cannot be sustained. (para. 21)

Slaughter (2016) concludes somewhat optimistically that "it is possible to re-design the Western worldview by retiring defective components and replacing them with consciously chosen equivalents." (para. 21).

Since World War II the world has seen the further sharpening of the what was to become known as the DSP into what has come to be known as *neoliberalism*; what is different now is the intensification of this agenda for national governments to the exclusion of all else (Carter, 2016). For Carter neoliberalism "is the deliberate intervention by government to encourage particular types of entrepreneurial, competitive and commercial behaviour in its citizens with the market as the regulatory mechanism. It is also the management of populations to cultivate individualistic, competitive, acquisitive and entrepreneurial behaviour" (p. 33). As Carter also notes, there has always been a reciprocal and mutually productive relationship between the economy and STEM. In STEM discourses emanating from the current Australian government, as we have already seen, economic growth is taken as a given, particularly those concerned with technological innovation. At the same time, critiques of economic growth and its ecological impacts, as well as alterative economic models where STEM could equally provide insights such as zero-growth, decoupling, de-growth, steady state and ecological macro-economics are rarely mentioned or even understood (see for example Jackson, 2009; Washington & Twomey, 2016). Instead, where it does address sustainability concerns, technical solutions are actively promoted though STEM without examining of the deep structures that unpin the neoliberal worldview, without which, in our view, it is unable to contribute fully to sustainability.

Further to this end is the recent appointment in Australia of the new Chief Scientist, Dr Alan Finkel who has strong entrepreneurial credentials. Carter (2016) notes that Dr Finkel's background was particularly highlighted when his appointment was announced by Prime Minister Malcolm Turnbull. In a statement from the Office of the Prime Minister, Turnbull made it clear that:

> [s]cience and innovation are at the centre of the Government's agenda and key to Australia remaining a prosperous, first world economy with a generous social welfare safety net. The Australian Government recognises the importance of science, innovation and technology to our future prosperity and economic security as a nation in a rapidly expanding and diversifying global economy … Dr Finkel is renowned for his outstanding research, industrial and entrepreneurial achievements in Australia and overseas ... His will be a vital role in shaping Australia's economic future and leading our national conversation on science, innovation and commercialisation across the research, industry and education sectors and with the wider community. (Prime Minister of Australia, 2015, paras. 5-9)

Education for Sustainability (EfS)

Education for Sustainability (EfS) (known as Education for Sustainable Development, ESD in the global North), arises from a different worldview and value position from neoliberalism. Compared with STEM education, the emergence of EfS is relatively recent, coming into use after the Brundtland Report (1987), and it continues to evolve. EfS is based on the recognition that economic growth and continued resource extraction cannot continue on a finite planet without exacerbating the already serious environmental and social disruptions that have led to the Anthropocene. EfS encompasses a range of understandings and processes located within a worldview and value system that understands Earth as an interconnected, complex and finite system. The '*for*' in EfS is critical and deliberate. EfS's critique of the neoliberal values behind STEM and therefore STEM education are based in the understanding that flourishing of human life cannot be achieved by technological solutions, political regulation, or financial instruments alone, as cogently pointed out in the 2005-2014 *UN Decade of Education for Sustainable Development (UN DESD)* (United Nations, 2002). As such, EfS goes well beyond merely providing information about the environment. As the *UN DESD* puts it:

> [s]ustainable development cannot be achieved by technological solutions, political regulation or financial instruments alone. We need to change the way we think and act. This requires quality education and learning for sustainable development at all levels and in all social contexts. Education for Sustainable Development is about enabling us to constructively and creatively address present and future global challenges and create more sustainable and resilient societies. (para. 1)

Compared with STEM education, EfS is explicitly critical, activist, and socially transformative of people and of human thinking, rather than socially productive (Wade, 2008). EfS aims to develop the knowledge, competencies, and especially worldviews necessary for people to contribute to more sustainable patterns of living for all species and the integrity of ecosystems. EfS links environmental, social, and economic thinking with an expanded emphasis on integrated and holistic thinking, futures, and ecological and social justice (<sustainability.edu.au>), drawing on systemic thinking, collaboration, ethics and values, critical thinking, and life-long learning. It actively encourages reflection, examination, and critique of the assumptions, worldviews, myths, and metaphors underpinning education and its contribution to unsustainability through over-consumption. This is achieved through building ecological literacy and participatory competence (Smith, 2007).

It could be argued that STEM education also addresses sustainability, but we maintain that it does so only from a neoliberal, technical growthist perspective, which is not sufficient to move us towards a sustainable society. In contrast, EfS provides change strategies to assist students and the education community in general to move towards sustainability.

The principles and components of EfS in Australia were first outlined in the document *Living Sustainably: the Australian Government's National Action Plan for Education for Sustainability*

(Department of the Environment, Water, Heritage, and the Arts, 2009). Interestingly, this plan does not mention economic growth or the role of markets.

The principles are:

- **Transformation and change:** developing the skills, capacity and motivation to plan and manage change towards sustainability,
- **Education for all and lifelong learning:** for people of all ages and backgrounds, at all stages of life, all possible learning spaces, formal and informal, in schools, workplaces, homes and communities,
- **Systems (and network) thinking:** understanding the bigger picture, the connections between environmental, economic, social and political systems to create solutions that go beyond just addressing the isolated symptoms of a larger problem,
- **Envisioning a better future:** developing and harnessing the energy to build towards a shared vision for a sustainable future. As Lowe (2012) puts it, the only common future is a sustainable future,
- **Critical thinking and reflection:** reflecting on challenge, personal perceptions and experiences, assumptions and accepted ways of interpreting and engaging with the world in thinking about sustainability, i.e. the important role of 'interiors' - mental models, values, culture and worldviews (see Riedy, 2016),
- **Participation:** providing and using skills to allow participation, engaging groups and individuals in sustainability action,
- **Partnerships for change:** seeking and building partnerships to build networks and relationships, and improve communication between different sectors of society towards a sustainable future. (p. 9)

The document also recommended embedding sustainability in the national curriculum, and this objective now appears as a cross-curriculum priority as well as in science and geography in the current curriculum (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2015).

> Sustainability addresses the ongoing capacity of Earth to maintain all life… Education for sustainability develops the knowledge, skills, values and world views necessary for people to act in ways that contribute to more sustainable patterns of living… Sustainability education is futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through informed action. (<http://www.australiancurriculum.edu.au/crosscurriculumpriorities/sustainability/overview>)

The description is amplified in three Key Concepts related to Systems, Worldviews, and Futures, which are then related specifically to nine of the Learning Areas of the Curriculum.

Given the ecological crisis humanity and hence the rest of nature finds itself in, one might imagine that EfS would play a critical and leading role in what Thomas Berry (1999) has called the *Great Work* – the transformation of society towards a sustainable future. It seems, however, that in schools, students continue to experience a profound, but largely unconscious dissonance between what they hear about the state of the planet and their lived experience of education – there is a crisis of praxis (Smith, 2007). The underlying message transmitted through much of education, not just STEM, remains "do well, get a good job and consume", and in spite of the *UN DESD*, education that explicitly addresses the ecological crisis continues to play a minor role (Smith). Sadly, it is our view that Orr's (1999) well-known statement remains all too pertinent some 17 years later:

> The Western education system … prepares students almost exclusively for an urban existence and dependence on fossil fuels and global trade. Children are taught from an early age how best to compete with each other rather than how best to work towards and live in a sustainable society. (p. 166)

Finding Common Ground?

Given our perception from the documents from the OCS that environmental concerns are of limited interest in the encouragement of STEM expertise and careers to benefit Australia, followed by the strong condemnation from the environmental sustainability sector as noted earlier, the question must be asked about how STEM and EfS can be linked in the school classroom. There is no doubt that the issues associated with environmental sustainability, both in Australia and internationally, require STEM skills and understanding for their resolution, especially but not exclusively those of science. It is a matter of systems and schools recognising the opportunities to do so. Following the UN Decade of Education for Sustainable Development, there still exist contexts related to STEM, for example, with the *Australian Sustainable Schools Initiative (AuSSI)* (Australian Government Department of Sustainability, Environment, Water, Population and Communities, 2011) offering activities based on Water, Waste, Energy, Biodiversity, Climate change, and Transport.

Education generally and education systems are known for adopting popular fads with enthusiasm, which may perhaps last a decade and then fade as a new fad enters the scene (Donnelly, 2003). A concern in the sphere of this paper is that, based on the UN's Decade of Education for Sustainable Development from 2005-2014, EfS became a focus in schools (e.g., *AuSSI*), with Sustainability even gaining a place as a cross-curriculum priority in the *Australian Curriculum* (ACARA, 2015). Some evidence that from the current government's perspective, EfS is now fading is found in the archiving of material on the Department of the Environment and Energy's *Sustainability Education* website (<www.environment.gov.au/sustainability/education>). It appears that STEM may be the recycled fad in education with the Australian Government's *Restoring the focus on STEM in schools initiative* (Australian Government Department of Education and Training, 2015). Let it be hoped that in doing so EfS is not forgotten and instead used as a context within which STEM education is meaningfully applied.

Fortunately there are some signs that both STEM and sustainability proponents are coming to appreciate the need in the education sector to promote the other. At the university level Hopkinson and James (2010) review and highlight some examples in the United Kingdom of "embedding education for sustainable development within science and related curricula in ways that are meaningful to staff and students" (p. 365). Expressing the belief that STEM has great relevance to sustainability initiatives, they argue for ways of "greening STEM." They do this not only in covering course content but also in the related areas of responsible laboratory practices, fieldwork practices, and practical experiences. Again from the United Kingdom, Pitt (2009) considers the perspective of the Design and Technology curriculum in secondary schools, advocating the need to use "sustainability contexts for STEM activities to provoke critical discourse within schools and wider communities, thereby creating new opportunities for ESD" (p. 37).

In the United States very practical suggestions for promoting STEM with high school students are described by Pecen, Humston, and Yildiz (2012) based on renewable energy applications. Contexts include solar power, wind power, and hydrogen fuel cells. The authors also recognise the need for professional development of teachers to implement the activities. At the fourth grade level, Farmer, Tank, and Moore (2015) set a context of helping people of Popa Island design a catchment and water storage system, to report on students' development and reinforcement of measurement of volume skills as part of STEM. This is an example of how the mathematics curriculum is able to make a contribution to EfS.

In Australia, the Australian Academy of Technological Sciences and Engineering (ATSE), is a STEM-supportive organisation known for its educational *STELR* project (Science and Technology Education Leveraging Relevance) (ATSE, 2010, 2016). The project's primary aim is to address the problem of low participation rates in STEM subjects at the upper secondary school level by relating these subjects to highly relevant issues affecting all students. *STELR* taps into the high level of concern that the majority of students have about global warming and climate change. By basing the *STELR* modules around sustainable energy technologies, students see the *STELR* activities as being relevant to their lives (2016). The implementation of this initiative has been through the Renewable Energy project, which initially provided teacher and student resources for units of high school study, including Global warming, Energy and energy transformations, Renewable energy resources, Solar cells, and Wind turbines (2010). The ATSE website advertises that “*STELR* is a ready-to-use STEM resource” that is “the way STEM should really be taught” (ATSE, www.stelr.org.au). New modules include Sustainable housing, Water for the 21st century, and Carbon dioxide-Friend or foe? The *STELR* modules reflect the work of the major forums and groups within the ATSE.

STEM provides opportunities to re-label experiences in order to attract more attention and perhaps more funding for research in schools. Some of the best examples are related to science and arise from the *Primary Connections* publications of the Australian Academy of Sciences <primaryconnections.org.au>. Topics available include ecosystems and food webs, human impact on environments, life and living, and adaptations. The recently launched Framework document *Education for Sustainability in the Archdiocese of Melbourne* (Catholic Education Melbourne, 2016) includes the sustainability science topics energy, water, materials and waste, and biodiversity and ecosystems. These science-based aspects of EfS can also be related to STEM as a way of reminding students of the various disciplines that can contribute to solutions.

Another link between STEM and EfS is through data handling and statistical analysis. Introducing investigations requiring the collection and analysis of data, related to the mathematics curriculum, can investigate issues of environmental sustainability discussing science and using technology as a basis for data analysis. As an example, Watson and English (2015) asked students in Year 5 to devise criteria and collect data for investigating an EfS research question, “Are we environmentally friendly?” The activity used survey questions from the Australian Bureau of Statistics (ABS) *CensusAtSchool* website (<www.abs.gov.au/censusatschool>). Students answered the questions for their class and then considered samples from the ABS *CensusAtSchool* “population” to generalise their conclusions across Australia. The STEM connections are very clear in discussing the scientific aspects related to the survey questions on saving of water, saving electrical power, and recycling rubbish, as well as in using technology to gather and analyse data and in employing the skills from the statistics strand of the mathematics curriculum.

How Many Literacies?

Another cause that has grown out of the mid-20th century concern for Literacy, followed by Numeracy (e.g., Cockcroft, 1982, para. 36), has been to add the adjective of one’s favourite field to the noun literacy. The authors are both guilty of this trend, in promoting Ecoliteracy (Smith, 2007) and Statistical Literacy (Watson, 2006). Numeracy itself has even been renamed Quantitative Literacy (Steen, 1997) and Mathematical Literacy is used by the OCS (2014). Technology and Engineering Literacy is now assessed in the United States (<nces.ed.gov/nationsreportcard/tel/>) and Scientific Literacy is well known (OECD, 2009, p. 14). Now the term STEM Literacy is on the scene (e.g., <https://y4y.ed.gov/learn/stem/introduction/stem-literacy>). Although the OCS (2013) uses the term, it does not provide a definition. The definition from the US Department of Education, Office for Elementary and Secondary Education (n.d.), *You for Youth* site seems quite sensible, being based on the disciplines.

> STEM literacy relates to a student’s ability to understand and apply concepts from science, technology, engineering and mathematics, including computer science and interdisciplinary strategies, in order to make informed decisions, create new products and processes, and *solve problems*.
>
> - **Scientific literacy** is the ability to use knowledge in the sciences to understand the natural world.
> - **Technological literacy** is the ability to use new technologies to express ideas, understand how technologies are developed and analyze how they affect us.
> - **Engineering literacy** is the ability to put scientific and mathematical principles to practical use.

- **Mathematical literacy** is the ability to analyze and communicate ideas effectively by posing, formulating, solving and interpreting solutions to mathematical problems. (para. 1)

Following this, ecoliteracy requires an understanding of three fundamental scientific principles (Smith, 2007). The first is a recognition that life's basic pattern of organisation is the systemic network, a set of dynamic, interacting, interdependent components that form an integrated whole. The second is the understanding that matter is finite and cycles continually through Earth's geobiophysical systems. The third is the recognition that the vast majority of ecological systems are sustained by the continual flow of energy from the sun through the process of photosynthesis. With these two literacies satisfied, for both STEM Education and EfS, Australia's future leaders should be able to develop a good grounding in the critical existential issue of how humanity can adapt to the Anthropocene.

It is likely that many STEM advocates do not even realise the neoliberal worldview from which they operate (Carter, 2016). They may assume that when needed in order to solve their economic or internationally competitive sustainability issues, of course they will apply STEM to solve environmental problems. STEM needs a sustainable environment in which to achieve its economic aims and the environmental movement needs STEM to secure that environment. Davis (2012) concurs, stating that "the emphasis placed on scientific and technological solutions to sustainability issue has led to an emphasis on STEM education as education's main way of addressing sustainability" (p. 1). Perhaps focusing on school education and combining the two literacies can produce a citizenry that will be able to solve problems for a sustainable society so that STEM and EfS can finding common ground for a flourishing future.

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