part 1:
an overview of sustainability education in action:

Falls Church City Public Schools

by Ray Wu-Rorrer, Peter Mecca, Kenny George, Stephen Knight, Carolyn Pollack, and Valerie Hardy

This reflective essay provides a lesson plan-ready overview of sustainability developed through the efforts of a dedicated team of individuals within the Falls Church City Public School (FCCPS) System. Students in the marquee sustainability education program learn and develop an appreciation for the basics of growing food and the importance of water in an urban area through integrated applications in environmental science, energy, design, technology, and engineering education settings.

As stated in *Standards for Technological and Engineering Literacy (STEL)* (ITEEA, 2020, p. 9), "now is the time for the field of technology and engineering education to clearly, concisely, and accurately define core disciplinary Standards for Technological and Engineering Literacy." The program described in this article specifically addresses multiple core contexts (Figure 1) such as: *1. Computation, Automation, Artificial Intelligence, and Robotics; 4. Energy and Power; 5. Information and Communication; 6. The Built Environment; and 8. Agricultural and Biological Technologies* (ITEEA, 2020).

Figure 1.
Standards for Technological and Engineering Literacy (ITEEA, 2020)

Definition of Sustainability

"Sustainability is a holistic approach that considers ecological, social and economic dimensions" (University of Alberta, 2013, p. 1), recognizing that everyone should be considered equal. Sustainability and sustainable development focus on balancing between the competing needs of moving forward socially and economically, while simultaneously protecting the environment (Purvis, Mao, & Robinson, 2019). Moreover, sustainability is not just about the environment

(Lorek, 2010). Understanding how ecological, social, and economic dimensions interact with each other are intrinsic to sustainability.

The United Nations Global Goals for Sustainable Development

The Sustainable Development Goals (SDGs), commonly referred to as the Global Goals (Figure 2), were integrated to create a balance between the three facets *(economic, social, and environmental)* of sustainable development (Kostoska & Kocarev, 2019). Sustainability literature may center around the UN's more diverse set of sustainable development goals, but "the three pillars themselves were explicitly embedded in their formulation" (Figure 3) (Purvis, Mao, & Robinson, 2019, p. 682).

Three-element Sustainability Concept

The three-element sustainability concept is most often represented by three "pillars" (environmental, economic, and social) physically supporting "sustainability," while the three "dimension" circle concept is most often represented by three overlapping and intersecting circles with sustainability being located in the center (Figure 4). The origins of the "three-pillar" paradigm have been variously attributed to the Brundtland Report, Agenda 21, and the 2002 World Summit on Sustainable Development (Table 1) (Moldan, Janoušková & Hak, 2011). However, there appears to be "no single point of origin of this three-pillar conception, but rather a gradual emergence from various critiques in the early academic literature" (Purvis, Mao, & Robinson, 2019, p. 681). The popular three-dimension circles diagram appears to have been first presented by Barbier (1987), albeit, with a much different focus than the modern usage.

Environmental

Environmental protection is the most commonly referenced element of sustainability

Figure 2.
The Global Goals for Sustainable Development. Adapted from United Nations (2016). About the Sustainable Development Goals. United Nations, New York. www.un.org/sustainabledevelopment/sustainable-development-goals/
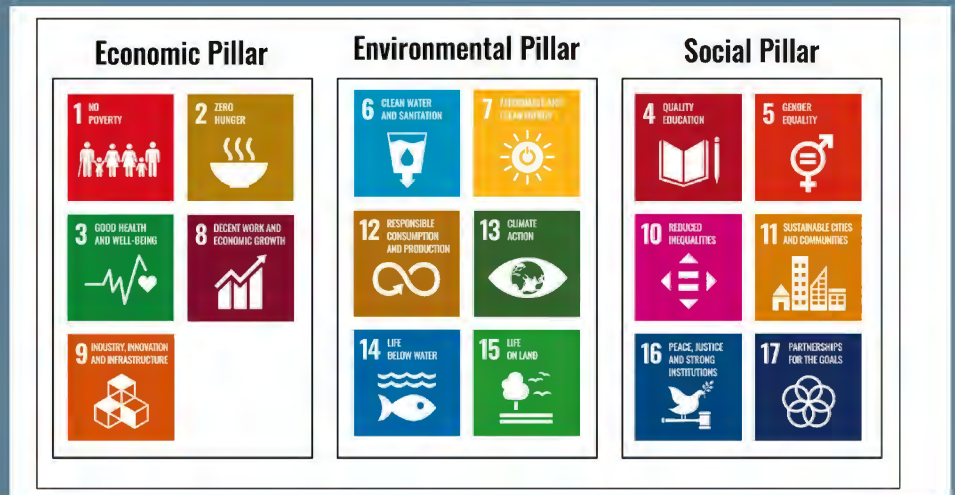

Figure 3.
Sustainable Development Goals Separated Into Three Dimensions. This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. Adapted from United Nations (2016). About the Sustainable Development Goals. United Nations, New York. www.un.org/sustainabledevelopment/sustainable-development-goals/
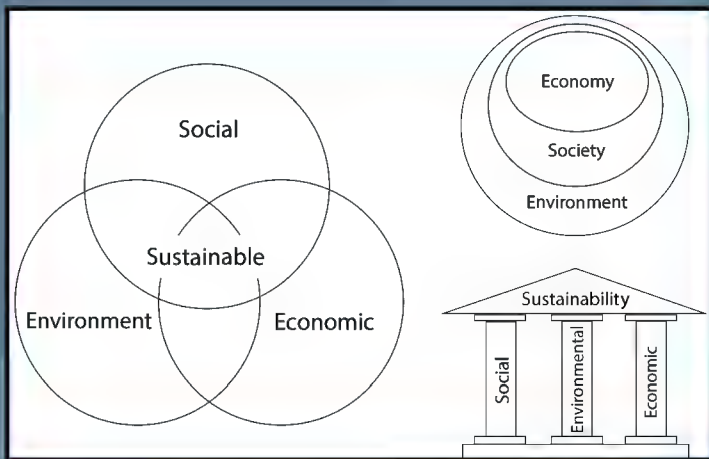
Economic

Economic development is about giving people access to the resources they need without compromising their quality of life, reducing their financial burden and alleviating bureaucracy. Many TEE energy and manufacturing courses explore the relationships among standard of living, economic growth, and energy consumption. This is one issue that proves the most problematic, as most people disagree on political ideology, what is economically sound, and how it will affect business. (University of Alberta, 2013).

Social

There are many facets to this pillar. Most importantly is awareness of and legislative protection of the health of people from pollution and other harmful activities of businesses and other organizations (University of Alberta, 2013). Universal human rights and necessities are attainable by all people who have access to enough resources to keep their families and communities healthy and secure. Healthy communities have leaders who ensure that personal, labor, and cultural rights are respected and that all people are protected from discrimination (Hargreaves & Fink, 2012). Encouraging participation in environmental sustainability and educating about the effects of environmental protection and economic factors on our daily lives are key elements of the social pillar. Technology and Engineering Education courses at the middle and high school levels commonly explore, compare, and contrast quality-of-life issues in both developing and developed nations.

Conclusion

Within the field of Technology and Engineering Education at Falls Church County Public Schools, we must always target the factors that harm the environment, economies, and societies while examining how green

Figure 4.
Three Pillars of Sustainability: In Search of Conceptual Origins. Adapted from Purvis, B., Mao, Y. & Robinson, D. (2019) Three pillars of sustainability: in search of conceptual origins. Sustainable Science 14, 681–695 doi:10.1007/s11625-018-0627-5

and is one of the primary concerns for the future of humanity (Krishna & Manickam, 2017). The environmental pillar defines how we should study and protect ecosystems, air quality, integrity, and sustainability of our natural resources and examines the elements that place stress on the environment (University of Alberta, 2013). Technology plays a vital role in the environmental dimension of the sustainability process. Technology and Engineering Education (TEE) courses naturally include aspects of comparing and contrasting linear ("cradle-to-grave") and cyclical ("cradle-to-cradle") approaches to life cycles of products. Competencies such as these are key hallmarks of the inclusion of sustainability being successfully integrated into existing TEE courses.

Table 1.
Timeline of Sustainable Development

Timeline of the World Community Adopting Sustainable Development

1979 – First World Climate Conference opens up the science of climate change
1987 – Brundtland Report consolidates decades of work on sustainable development
1992 – Rio Earth Summit rallies the world to take action and adopt Agenda 21
1997 – Kyoto Protocol takes the first step toward stopping dangerous climate change
2000 – Millennium Development Goals, social justice meets public health & environmentalism
2006 – Al Gore brings climate change to the mainstream with *An Inconvenient Truth*
2012 – Rio+20 takes stock on 2+ decades of efforts at sustainable development
2015 – UN Sustainable Development Summit, adopted a new 2030 Agenda for Sustainable Development and presentation of The Global Goals for Sustainable Development

(Partially adapted from: University of Alberta, 2013)

design principles and ideas can be integrated within our courses. The United Nations 2030 Agenda and Sustainable Development Goals holistically address the environmental, social, and economic concerns facing our civilization. The transformation from a purely economic model to an integrated and sustainable model of prosperity will take much more than words. It will take action, and lots of it. Given the variability that exists within different communities, it is highly unlikely there will ever be a universal agreement on one best approach to preserve our world for future generations. Instead, we must always strive to examine and educate communities on best practices in sustainability starting early in one's life or career and continuing to promote exponential impacts long-term.

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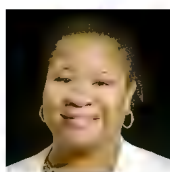
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