

Community Involvement in STEM Learning

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Corporations, community groups, and educational institutions face both a significant challenge and opportunity in attracting and preparing the next generation of science, technology, engineering, and math (STEM) workers. In a recent *Quality Progress* article, Veenstra and Walters outlined the critical need for STEM professionals and recommended more industry involvement in supporting education.¹ The contemporary view of K–12 education includes relationships between the schools and community stakeholders such as local business and industry, area colleges, government, and community organizations.² In fact, in a 2011 editorial, Hopen pointed out that “STEM should be a key concern of every employer, employee, and workforce development professional.”³

This article explores community involvement and development within the ISO 26000 social responsibility (SR) umbrella, especially as it relates to STEM learning.⁴ The authors will provide insight to the application of ISO 26000 to support K–12 schools through community involvement by corporations working collaboratively with schools to improve STEM student learning. As ideas for SR continue to expand, this article introduces the idea of community involvement in informal learning and science citizen projects, and concludes with a request for involvement in an ASQ Education Division SR project to further scientific learning in a fun way.

The division has sponsored three highly successful Advancing the STEM Agenda Conferences. Through focus areas on K–12 outreach, collaboration between education and industry, and efforts to increase the number of disadvantaged students in the STEM pipeline, the conferences supported the ideas of SR's community involvement and development. One SR-related conference presentation highlighted the work of Raytheon employees who have volunteered in middle and high school science courses for Raytheon's Leadership and Science Ensures Results (LASER) program. In three years, Raytheon employees have connected with 6,500

students, serving as role models and encouraging involvement in learning science.^{1, 5} Another example featured Ford Motor Company's outreach initiative known as the “High School Science and Technology Program” for southeast Michigan high school students inviting them to attend monthly Saturday morning sessions at the Ford Research and Innovation Center to learn about careers in automotive science and engineering. Ford considers this effort as “leading corporate citizenship” to support STEM education.⁶

Further indication of corporate participation in the SR education movement is evident by a review of the online profiles maintained by STEMconnector⁷ on corporations such as Bayer, General Motors, and 3M that are supporting the STEM agenda and giving back to communities in the spirit of SR. For example, Bayer's profile supports SR: “The Group is committed to the principles of sustainable development and to its role as a socially and ethically responsible corporate citizen. Economy, ecology, and social responsibility are corporate policy objectives of equal rank.”⁸

Informal STEM Learning and Citizen Science: Connections With Social Responsibility Principles

Sometimes labeled “informal science education” or “free-choice learning,” informal STEM learning is typically “voluntary, open-ended, and often unstructured learning.”⁹ Moreover, hallmarks of informal STEM learning may include opportunities that are not constrained to a specific age group, occur at multiple venues, and that may offer learning at varying degrees of complexity.¹⁰

Citizen science typically includes some type of informal STEM learning, but is distinct in that it does so chiefly or in part to “engage the public in large-scale scientific research.”⁹ These programs often involve the collection of data or structured observations carried out by nonscientists spanning a large geographical area.

Both informal STEM learning and citizen science have low barriers to participation. Programs, such

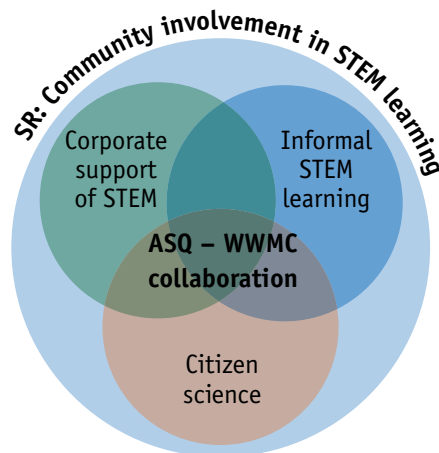
as Cornell’s Celebrate Urban Birds,¹¹ the Sloan Digital Sky Survey’s Galaxy Zoo,¹² or the Water Environment Federation’s World Water Monitoring Challenge (WWMC), provide learning resources, free of charge via the Internet.¹³ These resources may include some combination of text, images, lesson plans, and YouTube videos to instruct participants in observing, measuring, or classifying protocols. Programs such as the WWMC are designed to allow for either a single, stand-alone event, or an ongoing project with multiple measurements or observations over time.

This loosely constrained delivery mode allows for broad individual participation and enables educators from both formal and informal settings to incorporate these programs into existing curriculum or services. Given the asynchronous availability of this content, participants may engage in learning at their own pace and when they have access to computers. As the Web-delivered content, and in some cases supplies are free, informal STEM learning and citizen science programs may be accessible to economically disadvantaged populations. Recognizing both the accessibility and the potential to improve in-class learner outcomes, the National Science Teachers Association (NSTA) “recommends expansion of informal learning opportunities for pre-K–12 students, especially students from communities underrepresented in STEM fields, to promote their interest in and readiness for school science.”¹⁴

An Invitation to Participate in the ASQ Education Division’s Collaboration With WWMC

The division desired a STEM outreach program that would complement its STEM conferences, offer elements of citizen science, and encourage enjoyment of learning science to both adults and children as shown in Figure 1. With this in mind, the division has begun collaboration with the WWMC, an informal STEM learning program with elements of citizen science. The program is managed by the

Figure 1: ASQ-WWMC Collaboration Relationship Model



Water Environment Federation and the International Water Association.¹⁵

The WWMC is an education program that teaches the public by enabling participants to perform basic tests to monitor local surface water quality. Specifically, participants collect “grab samples”—discrete samples taken at a specific time and place—and test each sample for turbidity, temperature, pH, and dissolved oxygen using a set of standard-issue supplies.¹⁶ Data are collected

annually from March 22 (UN World Water Day) until December 31 and then are uploaded to a central database. See Figure 2 for a map of sample locations.^{16, 17} As participants perform the tests using low-cost and complete monitoring kits, they can use free Web-based content to learn about common indicators of watershed health. Additionally, the program provides hands-on learning experiences that help participants use what they have learned to better manage natural resources.

The program directly supports ISO 26000’s core subject, community involvement and development, and secondarily supports another core subject, the environment.⁴ Regarding the former, the WWMC fosters community involvement, as well as education. With respect to the latter, the program creates awareness, develops rudimentary skills, and provides basic equipment and supplies to begin assessing certain types of pollution while educating students about sustainable resource

Figure 2: Geographical Distribution of 2013 Grab Samples in WWMC Central Database



use, protection of the environment, biodiversity, and restoration of natural habitats. It also has the potential of reaching out to economically disadvantaged and under-represented populations.

Support for Next Generation Science Standards

While the WWMC is designed to function as a stand-alone informal STEM learning program, it can be integrated into existing science curricula. Moreover, the program parallels elements of the Next Generation Science Standards (NGSS). Specifically, the program is a resource for teaching participants about water quality, the importance of water in ecosystems, and factors that affect water quality. These focus areas support NGSS Earth and Space Science standards 2C: The Role of Water in Earth's Surface Processes, 3A: Natural Resources, and 3C: Human Impacts on Earth Systems; and Life Science standard 2A: Interdependent Relationships in Ecosystems.¹⁸

Goals and Next Steps

Through this collaboration, the division will directly support informal STEM learning throughout the United States and the world. Potentially it will grow to include participating schools, after-school programs, and corporate SR programs. These organizations can support STEM learning outcomes within their student bodies or communities by organizing a water quality monitoring event or ongoing project.

Your Help Is Needed

Resources for quality professionals who are interested in helping grow this outreach program are listed as follows:

- For more information on how to receive free kits, visit http://www.monitorwater.org/Kit_Donations.aspx.
- Details on how to purchase kits for your organization or for local distribution to schools, government agencies, or nonprofit groups, is available at <http://www.monitorwater.org/TestKits.aspx>.
- To donate monitoring kits, visit <http://www.monitorwater.org/Donate.aspx>.

In addition, the WWMC welcomes advice from quality professionals on distribution of the quality test kits, of analysis and presentation of the water quality data, and survey response rates.

Conclusions

There is a vital and growing need for new STEM professionals, and community partnerships between industry and educational institutions can help to meet this demand. These types of partnerships support social responsibility goals, as articulated by the ISO 26000 guidance. Building on the work and findings of corporations that have presented at the STEM conferences, the division seeks to enable other companies, schools, and community groups to follow suit. By supporting STEM student learning through informal settings and citizen science, such as the division-WWMC collaboration, organizations can make science attractive and accessible to more students, including economically disadvantaged and under-represented populations.

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