

A Framework for Quality STEM Education

For more information, including professional development on the *Quality STEM Education Framework* please contact margy.stevens@mcesc.org or james.rowley@notes.udayton.edu.

Background

The *Framework for Quality STEM Education* and its accompanying rubrics were developed by the Dayton (Ohio) Regional STEM Center in collaboration with Dr. James Rowley of the University of Dayton's School of Education and Allied Professions. The STEM curriculum development work being done at the Dayton Regional STEM Center is anchored to the quality framework. In addition, the framework plays a critical role in the professional development of STEM teachers and fellows working to advance the quality of STEM education in their respective schools, universities and STEM workplaces.

For information about professional development opportunities for teachers and school administrators based on the Framework for Quality STEM Education, contact Margy Stevens, Director of the Dayton Regional STEM Center at margy.stevens@mcesc.org.

The Purpose of a STEM Education Quality Rubric

The purpose of the quality framework is to support on-going communication between and among STEM stakeholders by creating a common framework for conceptualizing, and a common language for communicating about STEM teaching and learning. In this capacity it can support educational leaders in making informed decisions about the allocation of resources, especially with regard to the planning and delivery of professional development. Finally, at the micro-level, the framework and rubrics can guide teachers in designing quality STEM learning experiences and provide a valuable tool for reflection and self-assessment. Perhaps most importantly, it can serve as the common ground where both teachers and STEM professionals can anchor their collaborative work as they endeavor to build the bridges from classrooms to STEM careers.

An Overview of Key Components

Before presenting the list of ten elements that constitute the Stem Education Quality Framework, the following additional points are important to consider.

- A quality STEM learning experience is not a function of time. A quality STEM experience might take the form of a one class period activity, a three-week unit of instruction, or a semester-long project.
- The absence of one or more STEM quality elements does not mean the experience is not a quality STEM learning experience. In some cases, an element may be purposefully excluded or does not apply. Collectively considered, the elements should have a ceiling effect of helping STEM stakeholders develop a deeper and broader vision of quality STEM Education.

STEM Education Quality Components

#	Components	Descriptions
1	Potential for Student Engagement	<i>Quality STEM learning experiences are designed to engage the minds and imaginations of students of diverse academic backgrounds.</i>
2	Degree of STEM Integration	<i>Quality STEM learning experiences are carefully designed to help students integrate knowledge and skills from Science, Technology, Engineering and Mathematics.</i>
3	Connections to Non-STEM Disciplines	<i>Quality STEM learning experiences help students connect STEM knowledge and skills with academic standards from other disciplines.</i>
4	Integrity of the Academic Content	<i>Quality STEM learning experiences are content-accurate, anchored to the relevant content standards, and focused on the big ideas and foundational skills critical to future learning in the targeted discipline(s).</i>
5	Quality of the Cognitive Task	<i>Quality STEM learning experiences challenge students to develop higher order thinking skills through processes such as inquiry, problem-solving, and creative thinking.</i>
6	Connections to STEM Careers	<i>Quality STEM learning experiences place students in learning environments that help them to better understand and personally consider STEM careers.</i>
7	Individual Accountability in a Collaborative Culture	<i>Quality STEM learning experiences often require students to work and learn independently and in collaboration with others using effective interpersonal skills.</i>
8	Nature of Assessment(s)	<i>Quality STEM learning experiences require students to demonstrate knowledge and skill, in part, through performance-based tasks.</i>
9	Application of the Engineering Design Process	<i>Quality STEM learning experiences require students to demonstrate knowledge and skills fundamental to the engineering design process (e.g., brainstorming, researching, creating, testing, improving, etc.).</i>
10	Quality of Technology Integration	<i>Quality STEM learning experiences provide students with hands-on experience in using multiple technologies. (Examples: computer hardware and software, calculators, probes, scales, microscopes, rulers and hand lenses to name just a few)</i>