STEM-based Education at Laing Middle School

What Does It Mean?

“STEM” is generally understood to be an acronym for science, technology, engineering, and mathematics; but a variety of additional meanings are often attached to those words. Other meanings that are often associated with “STEM” include:

- Individual curriculum subjects titled “science,” “engineering”, “technology,” and “mathematics” that collectively are referred to as “STEM,” but which may be taught separately with little or no integration between them;
- A career cluster (analogous to “Health Care” or “Hospitality”) that includes professions in science, technology, engineering, and mathematics;
- Projects or activities that involve various aspects of science, technology, engineering, and/or mathematics, and which may or may not be linked to specific standards

At Laing Middle School, “STEM-based education” refers to an approach to education in which subject-specific standards are addressed in the context of integrative projects that:

- Include content from all subjects in the curriculum;
- Build technological literacy;
- Exercise globally competitive workplace skills; and
- Provide hands-on experience with practical applications of science, technology, mathematics, and the engineering design process.

In this definition, “technology” is understood to include devices, capabilities, and knowledge that people use to modify the natural world to satisfy human needs and wants. Technology in this sense has many subsets, such as Medical Technology, Manufacturing Technology, and Construction Technology, among others. Education Technology is another subset that refers to devices, capabilities, and knowledge that are used to educate (e.g., computers, interactive whiteboards, internet resources, virtual simulations, etc).
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Why Do We Want to Do It?

Because STEM-based education offers potential benefits to:

• Student learning outcomes;
• Workforce preparation;
• Local, state, and national economies; and
• Global competitiveness.

Research has shown that the teaching methods used in Laing’s STEM-based approach can have significant positive impacts on learning. “Motivation to learn affects the amount of time students are willing to devote to learning. Learners are more motivated when they can see the usefulness of what they are learning and when they can use it to do something that has an impact on others” (Bransford, Brown, and Cocking, 2000). Prince and Felder (2006) report that “students who participate in project-based learning are more motivated, demonstrate better communication and teamwork skills, and have a better understanding of issues of professional practice and how to apply their learning to realistic problems.”

The STEM-based approach provides strong support to new Common Core standards for English language arts and mathematics, as well as Next Generation Science Standards now under development. These standards include new emphasis on technological literacy, communication skills, engineering design, and the applications of science; all of which are key themes included in the STEM approach. The importance of these themes to workforce preparation is underscored by research that cites critical work behavior priorities identified by business and industry employers in the Trident region (Trident Regional Education Center, et al. 2008). These priorities include work ethic, communication skills, critical thinking, problem solving, teamwork, and technology skills; behaviors that are strikingly similar to outcomes shown to result from project-based integrated STEM instruction.

These skills, coupled with improved student literacy in science, technology, engineering, and mathematics, are critical to America’s competitiveness in the global marketplace. Recent reports from the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine (Augustine, et al. 2010) state that a primary driver of the future economy and creation of jobs will be innovation, largely derived from advances in science and engineering. The report notes that while only four percent of the nation’s current work force is composed of scientists and engineers, this group disproportionately creates jobs for the other 96 percent. The report also notes that the United States ranks 27th among developed nations in the proportion of college students receiving undergraduate degrees in science or engineering. Unless these circumstances improve, the report concludes that “the nation’s ability to provide financially and personally rewarding jobs for its own citizens can be expected to decline at an accelerating pace.” The highest priority recommendations for altering this path are
strengthening the public school system and investing in basic scientific research.

The STEM-based approach being developed at Laing Middle School can be an important part of efforts to strengthen the public school system: Tai (Beatty, 2011) provides evidence that students who are exposed to STEM-based programs before they enter college are significantly more likely to graduate with a STEM-related college degree. While the impact of Laing’s STEM program on the professional workforce will not be realized immediately, other impacts such as enhanced student motivation, development of workplace skills, and improved retention of curriculum content will be achieved much more quickly. Moreover, the existence of this program can help send a strong signal to prospective new members of the Trident business community that the local public school system is cognizant of workforce and competitiveness issues and is implementing innovative and effective programs to address them.

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