STEM Disciplines
California Department of Education

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Students learn not only in the classroom but also in the real world, and the importance of expanded, informal, and K-12 regular school day learning integration has been emphasized recently by the 2011 convening of the Committee on Integrated STEM Education by the National Academy of Engineering and the National Research Council (NRC), and the NRC convening, STEM is Everywhere. The most effective STEM education takes place where expanded, informal learning, and K-12 regular day instruction are integrated and the unique potential of each of these environments is fully leveraged for high-quality STEM education, often referred to as STEM ecosystems. (Change the Equation, 2012).

The Four STEM Disciplines Described

Science is the study of the natural world, including the laws of nature associated with physics, chemistry, and biology and the treatment or application of facts, principles, concepts, and conventions associated with these disciplines. Science is both a body of knowledge that has been accumulated over time and a process—scientific inquiry—that generates new knowledge. Knowledge from science informs the engineering design process

Technology, while not a discipline in the strictest sense, comprises the entire system of people and organizations, knowledge, processes, and devices that go into creating and operating technological artifacts, as well as the artifacts themselves. Throughout history, humans have created technology to satisfy their wants and needs. Much of modern technology is a product of science and engineering, and technological tools are used in both fields.

Engineering is both a body of knowledge—about the design and creation of human-made products—and a process for solving problems. This process is design under constraint. One constraint in engineering design is the laws of nature, or science. Other constraints include time, money, available materials, ergonomics, environmental regulations, manufacturability, and reparability. Engineering utilizes concepts from science and mathematics as well as technological tools.

Mathematics is the study of patterns and relationships among quantities, numbers, and space. Unlike in science, where empirical evidence is sought to warrant or overthrow claims, claims in mathematics are warranted through logical arguments based on foundational assumptions. The local arguments themselves are part of mathematics along with the claims. As in science, knowledge in mathematics continues to grow, but unlike in science, knowledge in mathematics is not overturned, unless the foundational assumptions are transformed. Specific conceptual categories of K-12 mathematics include numbers and arithmetic, algebra, functions, geometry, and statistics and probability. Mathematics is used in science, engineering, and technology

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Source: Adapted from the National Academy of Engineering and National Research Council, 2009.