



ENGINEERING: A NATIONAL IMPERATIVE

EVERY CHILD SHOULD BE GIVEN THE OPPORTUNITY TO THINK, LEARN, AND ACT LIKE AN ENGINEER.

Our world is full of seemingly insurmountable challenges: poverty, food security, and climate change to name a few. Historically, engineering has provided solutions to the world's most daunting problems. Paramount among these challenges is the need to prepare the next generation of global citizens to solve issues of the ensuing century. While the demands of our world require creative, capable, and diverse problem solving, our children have limited opportunities to engage in engineering as part of a typical educational environment.

Many school systems have turned to STEM education to answer this call. STEM has become a nationwide, educational "buzz word," as students experience robotics, science fairs, and coding with a renewed sense of excitement and engagement. While these experiences are encouraging, they are often fringe practices, more likely to become the exception in education rather than the standard. STEM education in many communities is a fun reprieve from "education (business) as usual," but is not viewed as a long-lasting educational transformation. Evidence also suggests that many programs are simply rebranding science, technology, and/or mathematics programs with the badge of STEM education without adhering to transdisciplinary practices championed by STEM education experts. This is not to say that all STEM education programs fall into this category. There are, in fact, several high-quality STEM programs and frameworks throughout the country that remain committed to integrative, inquiry-driven, and design/problem-based classroom experiences. The inherent broadness of a term such as "STEM," however, allows for the adoption of diluted imitations. This dilution of STEM education from a national perspective prohibits its ability to enact transformative change.

Engineering does not share many of the potential drawbacks of STEM education. For example, engineering is a defined discipline with a millennium of development, practice, refinement, and post-secondary expertise. Engineering is naturally integrative, calling upon scientific knowledge, mathematical truths, and technological capabilities to design solutions to societal, economic, and environmental problems. Yet, engineering should not simply be adopted by existing P-12 educational programs without careful and

informed considerations. Engineering education is a novel, yet emerging trend in P-12 schools, many of which lack validated common classroom practices, teacher training, and curriculum. The nature of design in engineering enables educators to create approachable yet authentic contexts for student learning. Put simply, engineering is uniquely positioned to support transdisciplinary learning experiences to foster rich connections and further knowledge and skills of academic disciplines. If implemented with fidelity and resolution, engineering is poised to deliver on many of the forgotten promises of STEM education.

This unacknowledged truth is detrimental to our regional, national, and global success and the promise of informed and participating citizens. To solve the most difficult economic, environment, and cultural challenges of the future, we must advocate for **all** students to engage in engineering in order to meet these challenges. Such a formidable initiative results in political and economic trials of its own: budget constraints, space in the current school schedule, and teacher professional development all influence educational practice. Even with these obstacles, the last decade has seen the proliferation of engineering in US elementary, middle, and high schools. Science education leaders have acknowledged and positioned engineering as a vehicle for, and a complement to, science learning. The technology education community evolved with a name change of its professional organization, the International Technology and Engineering Educators Association (ITEEA). The 2017 Phi Delta Kappa poll of the public's attitudes toward schools reported that Americans overwhelmingly (82%) view technology and engineering education as an important indicator of school quality.

Consequently, while current initiatives in P-12 engineering education are promising, a clear vision and roadmap elude educators. Little is known about how children progress through engineering learning. Few curricula have explored and investigated how a P-12 articulate engineering program may contribute the general literacy of our children. The *Advancing Excellence in P-12 Engineering Education* represents a mandate—a call to action—to build a community with a shared focus, vision, and research agenda to ensure that every child is given the opportunity to think, learn, and act like an engineer.

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