



integrative STEM education for children and our communities

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Recently, Learning by Doing Research articles were published in *Technology and Engineering Teacher* (Moye, Dugger, & Starkweather, 2014). The articles reminded me of why I chose to study Industrial Arts many years ago. Industrial Arts provided me with rich “learning by doing” opportunities. I learn best by doing. American philosopher and educational reformer John Dewey argued that curriculum should be relevant to students’ lives. He saw “learning by doing” and “development of practical life skills” as crucial to children’s education (Dewey, 1938).

Our origins in manual training make us perfect candidates for helping elementary teachers make sense of integrative science, technology, engineering, and mathematics (STEM) teaching and learning. Integrative STEM education gives shape and meaning (relevance) to our human-made world and can open doors for “all kinds of learners.”

Quality education is a key to the success of children and the communities in which they live. This is particularly true as it relates to integrative STEM education. Integrative STEM education refers to engineering design-based learning approaches that intentionally integrate science and mathematics education with technology and engineering education (Sanders, 2009; Wells, 2013). Integrative STEM education may be enhanced through further integration with other

subjects such as language arts, social studies, art, etc. Integrative STEM education involves problem-based and project-based learning that allows learners to explore real-world problems, simultaneously developing cross-curriculum skills while working in small, collaborative groups.

GOOD FOR OUR CHILDREN

Integrative STEM education is good for children, particularly as it relates to educational engagement. Children now expect real-world connections to what they are learning, or else they disengage. As a means of learning, action-oriented, hands-on technology and engineering education can bring relevance into the classroom. Children’s lives are being enriched by the active study of STEM content, thus promoting the natural curiosity and innovation of students, who learn best by doing.

Integrative STEM education can also help young people become more confident in math and science. This approach to education makes school subjects personally meaningful, thus capturing students’ hearts and minds. Additionally, academically underprepared students can thrive through enriched, problem-based and project-based learning experiences and challenges. We can help elementary teachers engage creative minds and ignite young ideas. Because of the complexity of today’s technological processes, children need to learn early in their school experi-

I-STEM FOR CHILDREN/COMMUNITIES



Photo 1. Michael Daugherty (left) shares his insights on design with integrative STEM professional development workshop elementary school teacher participant.



Photo 2. Integrative STEM education professional development workshop participants on a field trip to BorgWarner (global leader in powertrain technologies that improve motor vehicle fuel economy, emissions, and performance).

ence to explore the differences in the human-made world and the natural world.

GOOD FOR OUR COMMUNITIES

Integrative STEM education is also good for communities. The ability of PreK-12 schools to foster children's learning in integrative STEM education is critical to the long-term economic health of the United States. The job market continues to demand greater numbers of employees with training or post-secondary degrees in STEM-related fields. For this and other reasons, STEM education continues to obtain momentum, and U.S. STEM education has rapidly become an emphasized part of the PreK-12 school experience.

Professional Development for PreK-12 Teachers

Educators in Anderson, Oconee, and Pickens (AOP) counties of South Carolina understand the importance of integrative STEM education to both students and communities. During the summer and fall of 2014, forty-eight (48) elementary school teachers from these counties took part in integrative STEM education professional development workshops. Kim Weaver, teacher and author of the book *Technology Starters*, and Michael Daugherty, teacher educator, led the sessions with a series of standards-based (ITEA/ITEEA, 2000/2002/2007) hands-on, problem-based activities aimed for replication in the classroom.

Held at the Bart Garrison Agricultural Museum of South Carolina and Tri-County Technical College, the workshops are equipping PreK-12 teachers to develop integrative STEM education activities that can be replicated in the classroom. The initiative is a collaborative effort among the AOP school districts, Pendleton Region Education Center, Tri-County Technical College, and



Photo 3. Integrative STEM education professional development workshop participants drilling holes in wood.

Clemson University's College of Health, Education, and Human Development as well as the Eugene T. Moore School of Education at Clemson University. Funding was made possible by Duke Energy's AdvanceSC.

Continued collaboration among elementary, secondary, high school, college, and university teachers and administrators, business and industry, and other interested people will con-



Photo 4. Integrative STEM education professional development workshop participant testing her Egbert Safe Racer Challenge vehicle (ITEEA, *Technology Starters*). Kim Weaver (center) and Michael Daugherty (right) observe the racer in action.



Photo 5. First and second grade teachers participating in A World in Motion © Jet Toy Challenge (Society of Automotive Engineers International).

tinue to strengthen integrative STEM education activities in the Upstate. By providing opportunities for our learners to identify problems, design solutions, do testing, and improve the designs, we can help them apply their math, science, and technology knowledge to solve problems (ITEA/ITEEA, 2000/2002/2007). Together, we can educate our students to be lifelong, creative learners who can thrive as individuals and strengthen the larger community. I think John Dewey would be proud!

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