

★ **Christine Cunningham**, founder and director of the Engineering is Elementary project believes that engineering and technology should be taught to all school children as a fundamental part of their early education rather than being a subject reserved for older students or the gifted

Engineering as standard in early school education

Technology and engineering continue to grow in social and economic importance. Many people rely on technologies such as pens, spoons or phones in their everyday lives, while they are also an important source of entertainment and information. Despite this wide relevance many people remain unaware of the fundamental principles which underpin such technologies, a situation which has severe implications, particularly given current economic circumstances. The financial crisis is likely to place a premium on scientific and engineering expertise, and those nations that lack the capacity to develop innovative new products in line with emerging demands will quickly find themselves left behind. Against this backdrop the work of the Engineering is Elementary (EiE) project takes on real significance. EiE introduces engineering topics at elementary schools, work which project director Christine Cunningham says was prompted by trends higher up the educational ladder. “Educational standards in Massachusetts include engineering and technology,” she says. “There are engineering ideas in the science section of our standards, and the students are tested on them in the fifth grade. However, when we started talking to schools and districts we learned that, although the subject was on the exam syllabus, the teachers weren’t really teaching about it, and part of the reason they weren’t was because they didn’t really have any relevant educational materials.”

These words hint at one of the main issues which has, until now, hindered the introduction of engineering-related topics at elementary school level. A complex, technically demanding subject, elementary teachers often found the prospect of teaching engineering a daunting one, particularly given that they received

virtually no training. Cunningham says her project responded by developing highly accessible curricular units. Each of the 20 units has four lessons. The first lesson centers on an illustrated storybook in which a child character confronts a problem that he or she eventually solves using an engineering design process. The books introduce students to the field of engineering and the engineering challenge for the unit. And for the teachers, storybooks are a familiar and comfortable resource. “Our books are set in countries all around the world, and we did that for a number of different reasons,” she explains. “Initially the story was a way of setting a context for a particular engineering challenge, because we know from the educational literature that certain children – particularly girls and other groups under-represented in science – really want to know why they are doing a particular task and what the wider objective is. We

wanted to set-up a larger context and to have role models for the students that look like them. After reading the story, students learn more about the featured field of engineering in Lesson two and then design their own solution to the problem in Lessons three and four using the engineering design process that EiE has created for young children: Ask, Imagine, Plan, Create, Improve. Unit challenges include designing a water filter, windmill blade, plant pollinator, and solar oven.”

Integrating with the school curriculum

This focus on education ensures the widest possible impact for the project’s work, reaching almost a million children, even though it’s still in the development phase. The only way initiatives like EiE can reach every child – no matter their background – is through the public education system. Nevertheless, introducing a new topic into



Young children getting to grips with an engineering experiment

the school curriculum is not without difficulties, and so the project adopted a pragmatic approach to its work. “We looked to integrate engineering topics across different subjects,” explains Cunningham. “When we started the programme we found from teachers and science curriculum coordinators that virtually nobody was teaching anything about engineering in elementary schools. The resounding message we got from them was that it had to integrate with what they already do, so we had to think about ways in which we could get engineering into the classroom overlapping with subjects which are already being taught. We chose science and identified the twenty most commonly taught science topics in elementary school. Then we paired each of those with a field of engineering and then, along the way, because so much more time is spent on literacy in US elementary schools than on any other subject – we piggy-backed on that in terms of having a storybook to kick things off.”

technological or engineering literacy as a fundamental element of modern education. They will be interested in the world around them and will hence become better problem-solvers, and will approach problems in a more structured kind of way.”

Broad relevance

This latter point clearly illustrates the broad educational relevance of the EiE project, as well as its wider impact. Science and engineering are often seen as being the province of only the most intellectually gifted, and today many students quickly drop it in favour of less demanding topics; however, Cunningham says it is important that everybody develops a base level of knowledge, something in which her project is playing a key role. Indeed, although the US is suffering from a shortage of qualified engineers, the emphasis in EiE is firmly on introducing engineering issues and principles to all rather than training the elite-level engineers of tomorrow. “We haven’t designed our work with the idea

We firmly believe that it is extremely important to introduce our kids to this idea of technological or engineering literacy as a fundamental element of modern education

With science and engineering expertise being increasingly highly valued, this is work with wide social implications. An individual’s level of educational attainment is of course closely linked to their eventual job prospects, and certain groups are still bedevilled by a so-called ‘poverty of aspiration’, which often prevents children from fulfilling their potential. Education has a key role to play in boosting levels of social mobility, reinforcing Cunningham’s commitment to approaching science and engineering from a social justice perspective. “We know that 98 per cent of the time when you interact with things, you interact with human-made objects,” she stresses. “However, in our elementary, middle and high schools, our children traditionally haven’t studied any of that. So they know a lot about the physical world and the natural world – which is great – but most of our time is spent in this human-made world, about which there is a widespread lack of knowledge. We firmly believe that it is extremely important to introduce our kids to this idea of

that only the college-bound, or only the students who are going into science and mathematics should be getting access to it,” stresses Cunningham. “Everybody should have some base level of technical knowledge. There are some other projects – particularly at the middle school and high school level – that have a ‘developing a future pipeline’ kind of approach, but that’s not really our philosophy, we want every child to be involved. However, if some of our students get interested in the subject and decide that this is something they would like to do later on as a career, then all the better.”

Although the project was established in Massachusetts, it quickly became national in scope, because very early on in the development process people from other states started contacting the EiE. The organisers then set about securing money from the National Science Foundation (NSF) – and the result is that funding is now in place and is being directed at more than the needs of just a couple of states, but rather with a country-wide focus. ★

At a glance

Full Project Title

Engineering is Elementary (EiE)

Project Partners

There are several corporate partners who have provided funding.

One of the models for national dissemination is to develop a series of EiE Regional Hub Sites. Currently there are probably about 10-15 or so of these in universities, museums, and other organisation entities. EiE recently secured a grant to work with seven more and to formalise the process

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She is the founder and director of the Engineering is Elementary project. Her work focuses on making engineering and science more relevant, understandable, and accessible to everyone, especially marginalised populations such as women, underrepresented minorities, and people with disabilities. Christine received a joint BA and MA in Biology from Yale University and a PhD in Science Education from Cornell University.



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Museum of Science
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