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Inspiring the Next Generation of Engineers and Scientists

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Students are usually not excited about abstract concepts, and teachers struggle to inject “pizzazz” into many of their lessons. K-12 teachers need opportunities and the associated pedagogical training to bring meaningful and authentic learning to their students. The professional educator community needs to develop a learning environment which connects desired content knowledge with science and engineering practices that students need to be successful future technology leaders. Furthermore, this environment must foster student exploration and discovery by encouraging them to use their natural creativity with newly acquired technical skills to complete assigned projects. These practices are explicitly listed in the US “Next Generation Science Standards” document that is due for final publication in the very near future. Education in America must unleash students’ desires to create and make with their hands, using their intellect, and growing academic knowledge.

In this submission I will share various student projects that I have created and implemented for middle and high school. For each project, students were required to learn and implement engineering best practices while designing, building, and testing prototype models, according to pre-assigned teacher specifications. As in all real-world engineering projects, students were required to analyze test data, re-design their models accordingly, and iterate the design process several times to meet specifications. Another key component to successful projects is collaboration between student team members. All my students come to realize that nothing of major significance is ever accomplished alone, that is, without the support of a team.

I will highlight several projects that illustrate key engineering practices as well as lessons learned, for both student and teacher. Projects presented will include: magnetically levitated vehicles (maglev) races, solar-powered and mousetrap-powered cars and boats, Popsicle stick catapults and bridges, egg drop “lunar landers”, egg-passenger car crashes, cardboard boat races (with human passengers), and working roller coasters made with only paper and tape. Each project requires minimal, low-cost materials commonly found at home or in local stores. I will share the most common student misperceptions about inquiry and problem-solving I have observed while working alongside my students during these projects.