To engage students in STEM, engage them in the world

By **JOSÉ M. TORRES**

Encouraging teenagers to grapple with real local and global problems is the kind of challenge that can attract more to the study of STEM.

Over the coming years, the next generation of bright young minds will have to confront climate change, humanitarian crises, income inequality, and the other great challenges of our age. But for now, those challenges can provide them with great opportunities to learn. By bringing such topics into the classroom, teachers can tap into students' intrinsic motivation to grapple with authentic, real-world problems that truly matter, both at the local and global levels. Further, because these topics are so complex, they invite students to wrestle with ideas that reach across the academic content areas, requiring them to integrate their knowledge of science, technology, engineering, mathematics, history, law, and other subjects.

Recently, my institution, the Illinois Mathematics and Science Academy (IMSA),

JOSÉ M. TORRES (jtorres@imsa.edu, @JosemtorresM) is president of the Illinois Mathematics and Science Academy (IMSA), Aurora, Ill.

asked students to tackle a real-world problem in our local region: childhood exposure to lead. Over a weekend in January, IMSA joined with the Illinois Department of Public Health to host a Get the Lead Out hackathon, with participation by 11 student teams representing IMSA and six other local high schools. The event was supported also by a collection of 18 subject-matter experts, medical doctors, public health officials, epidemiologists, and nurses, who gave teams real-time information and feedback. (IMSA enrolls academically talented high school students in a tuition-free residential program with a deep focus on STEM learning.)

In what alternate world, you may wonder, does a group of 43 teenagers dedicate a weekend to learning about the dangers of lead exposure and seeking ways to increase early testing for children at risk of exposure? For the students who participated, it seemed perfectly normal. After a thorough introduction to the topic, they spent part of Friday evening and all day Saturday creating solutions to (i.e., "hacking") a set of pressing problems: how to increase awareness of the dangers of lead exposure, how to increase the number of children tested early for lead exposure, and how to accomplish both of those goals simultaneously.

Students learned about the effect of lead exposure on brain development, about related medical and societal costs, about the common sources of lead in the region, and about the most typical types of exposure. Further, they studied the association between lead exposure and certain zip codes and socio-economic conditions, and they even learned about the ways in which buildings are designated as historic, which can affect how lead pipes, fixtures, and paint are managed.

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Late Saturday evening, all 11 teams pitched their solutions, "Shark Tank" style, to a panel of expert judges, who selected the hackathon winners. The students' motivation to learn about lead, how children are exposed, and which populations are at highest risks was palpable. The winners included a team who proposed creating an app to alert residents if they lived in a location where there

could be a high probability of lead exposure, as well as encouraging them to visit a healthcare professional to get their children tested. Another winning team proposed placing infographics on diapers and other baby products to remind parents to get their children tested for lead exposure.

For teachers and staff at IMSA, this served as a powerful illustration of what can happen when we go beyond teaching to the test. By posing authentic questions about how best to solve a local problem, we can trigger in students a deep desire to learn and apply knowledge. Whether we introduce a local topic of interest (such as lead exposure) or one of the world's great challenges (such as alleviating poverty or ensuring access to clean water), we can give students meaningful reasons to learn STEM content while also building school partnerships with governmental and nongovernment agencies.

How do we increase engagement in STEM learning? We do it by inviting students to solve local or global problems, following in the grand tradition of John Dewey's progressive education model. As Dewey said, "Give the pupils something to do, not something to learn; and if the doing is of such a nature as to demand thinking; learning naturally results." **K**