Building STEAM With Model Railroads

Are you a science, technology, engineering, arts, and math (STEAM) teacher seeking a new way to interest students in these subjects? While model railroading is not a new hobby, STEAM teachers can accomplish learning goals while introducing it to a new generation of students.

“Over the last 25 years, model railroading has been going through a significant change from relatively simple analog electronics to more complex digital electronics,” says Greg Maas, a member of the Amherst Railway Society in Palmer, Massachusetts. “Now trains can run independently of [one another] because of the microprocessors installed in the locomotives. And those microprocessors have to be programmed and fine-tuned, which brings mathematics into the arena. Digital electronics has added the whole world of sound to model railroading. LED lighting has brought even more realism to the hobby. Wireless communications and internet technology have made it possible to run trains with a smartphone.”

Maas also points to “the shift to building model railroads in sections that conform to track and electrical specifications (modules).” Then modules can be combined to form a working model railroad.” Model railroad modules, he contends, “are ideal for high schools and middle schools where space is limited. It is relatively easy to take modules apart and store them in limited space. Yet in building modules, students are learning and using all the model railroad skill sets.”

Many model railroaders believe “it is important to include the A (Arts) in STEM education. Scenery planning, design, and execution are an important part of model railroading that often takes a back seat to the technology. It shouldn’t,” Maas maintains.

Julia McMeans, director of education for the San Diego (California) Model Railroad Museum, has developed preK–8 STEAM programs for the museum. As a former elementary and middle school teacher and K–12 curriculum writer, McMeans notes that while model railroading is not part of content standards, it has “meaningful connections with content standards,” the Common Core and the Next Generation Science Standards. She says her programs “are designed to support and enrich and extend what teachers are doing in school,” providing “standards-aligned experiences for students” that many teachers can’t do because of a lack of time and resources.

In the Working With Scale program, for example, students in grades 6–8 build scale models “to address the math that rail modelers would use,” McMeans explains. Students measure their scale models “and use math to scale real-life objects up and down. For example, we scale the Statue of Liberty down to a factor of 1:1. They can see the real-world implications of how scale would be used,” she asserts.

Students in grades 3–8 in The Able Arch and the Trusty Truss program learn about the physical science and history of arch and truss bridges and what makes arches and triangles so strong, “why those shapes are attractive to civil engineers,” McMeans relates. K–2 students in Communities Then and Now: Making a 3-D Model explore model train layouts of the past and present to learn about science topics like friction, the shape and stability of structures, and properties of matter, along with social studies and history. “They build an actual 3-D model of their community,” she notes.

The museum has free resources at http://bit.ly/2HHNtmM that teachers can use in conjunction with a museum visit or as a supplement in their classrooms.

More Curriculum Connections

Stacey Walthers Naffah, president of Milwaukee, Wisconsin, model railroad supply company Walthers, suggests other STEAM topics students can learn through model railroading. “Electrical currents make trains move, something that kids can actually see. Speed can regulate movement in a miniature world just as it can in the real world,” and students can control it “through a digital controller…People can run their railroad like a real one. Wiring a layout for operations helps to create a truly great model railroad.”

Model railroading teaches students about how things work, such as gears in a locomotive or steam engines versus diesel engines. “Students can see things in miniature and take things apart to see how they work,” says Walthers Naffah.

To make a scene look realistic, knowledge of depth of field is required. “It gives the illusion you can see far off in the distance because you don’t have unlimited space [in a train layout],” Walthers Naffah relates.

Students also learn about city planning. “Discovery World [Science and Technology Center in Milwaukee] developed a curriculum for a summer camp called Design Your City…In one week, kids designed and created a small city,” as model railroaders do for their layouts, Walthers Naffah reports. Creating scenery brings in art, “which is a very valuable skill,” she asserts, and the teamwork and collaboration the children experienced while working on the city helped develop those soft skills.

In addition, students learn about “the economics of our country and how railroads are a part of it, moving people across the country and moving food and other goods. There’s a lot to learn about how things are moved around, and the importance of railroads in connecting our country,” Walthers Naffah contends.

She suggests teachers visit the website http://wgh.trains.com from the World’s Greatest Hobby, which features free resources on model train basics.

Blaine Holbrook, treasurer of the Salt Lake City Northern Utah Division and Rocky Mountain Region Director of the National Model Railroad Association, runs the Pizza Box Model Railroad Group for children and their families. “We give kids extruded foam and a track, and they can use their