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# THE ENJOY SCIENCE NEWSLETTER

## THE ENGINEERING DESIGN ISSUE

“Anything can be an engineering process.  
It’s not just a set of skills, but a mindset  
that can be applied anywhere.”

ADRIAN MELIA,  
Engineering Design Challenges Program Manager

## Everybody is an Engineer

### A new initiative to encourage engineering design thinking for children lands in Thailand at the National Science and Technology Fair

After leaving school, students will enter a world full of complex problems in which there are no more teachers, clear instructions or even correct answers. They will then have to make do with their own critical thinking and problem-solving skills to address challenges in life and at work. At most, they will have their peers alongside them to share ideas with as they search for solutions.

This innovative and collaborative spirit is at the core of the engineering process. When inventing new machinery, there are no instruction manuals or textbooks, only teams dedicated to the continual improvement of a design. At the Enjoy Design Challenges booth at the National Science and Technology Fair 2018, students were presented with such an environment in which they, too, had to develop their own strategic approach to reach a desired outcome.

The Design Challenges activities, developed by the Museum of Science (MOS) Boston, were brought to Thailand by Chevron Enjoy Science in collaboration with the National Science Museum (NSM). As it becomes increasingly recognized that informal education spaces strengthen students’ passion and understanding of STEM both in and out of the classroom, Chevron Enjoy Science and the NSM have sought the most exciting and effective pedagogical tools from around the world to share with Thai students. It is widely accepted that, given the freedom to explore their interests, students become motivated to direct their own learning.

The Design Challenges debuted in Thailand at the Fair this year, which drew one million visitors. Excited by the opportunity to build something with their hands, 71,406 students embarked on the Design Challenges

throughout the week.

“Go down, go down, go down!” cheered a lower secondary student, as if his frantic flailing could motivate his satellite to float lower in the vertical air tube.

In the “Soaring Satellites” challenge, students were given an inventory of materials—paper cones, plastic cups, pipe cleaners, straws, various foam shapes and other miscellaneous items—and challenged to make a DIY satellite that could fly just right.



“Almost there,” chimed a ponytailed university student, the National Science Museum employee responsible for guiding students along the process, as a satellite hovered just above the target zone. The boy snatched his satellite back and shot back to the materials booth to revise his design.

“If something doesn’t go properly, that’s okay! You can use that as a learning experience and it doesn’t have to be a bad thing,” emphasized Devyn Curely, Engineering Education Associate at the Museum of Science Boston and one of the trainers for the activity. “The engineering design process focuses on how you use what would typically be a failure, and how you

learn from it.”

In the second challenge, “Echo Base Bobsleds,” students created bobsleds to slide down a 2.5-meter track with the objective of crafting the fastest or slowest bobsled. Choosing from a set of different fabrics, students decided to cover their cars with a combination of felt, fur, lace or coarse fabric.

“The first time, the texture was too rough, it didn’t even move,” said a boy as he checked the sturdiness of his new design. “So the second time I took the three heavy ones out and put the two together with only one clip, so that the weight is lighter.”

While laughing and having fun with friends, students were hypothesizing, prototyping, testing, iterating and redesigning — engaging in the same process that every engineer does to develop a new invention.

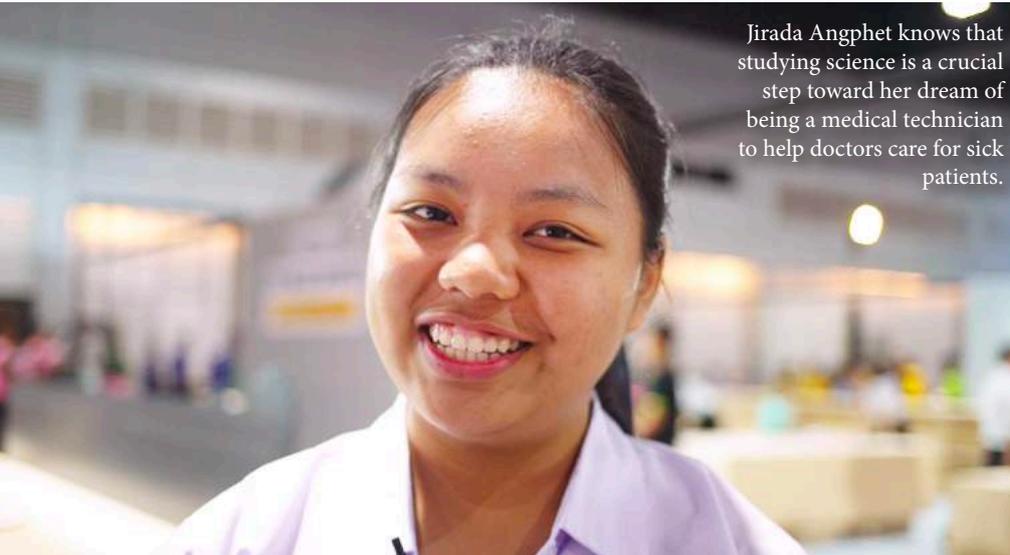
“Anything can be an engineering process,” said Adrian Melia, Engineering Design Challenges Program Manager. “It’s not just a set of skills that you’re learning, it’s also a mindset, a way of thinking that can be applied anywhere.”

What the Design Challenges teach is not how to complete the challenge itself, but how to engage with the design engineering process. Whether balancing a satellite, increasing friction in a bobsled, inventing a new technology, or addressing social problems, students must exercise critical thinking and creativity to address challenges.

The world that awaits the children will present obstacles of every kind. Whether or not each student becomes an engineer, by practicing the engineering design mindset, they are building the kinds of problem-solving skills that will help them face the world—and design a thriving future.

# "At first, I didn't think it would work, but then it flew..."

## Jirada from Nakhon Pathom finds excitement in STEM at Enjoy Design Challenges



Jirada Angphet knows that studying science is a crucial step toward her dream of being a medical technician to help doctors care for sick patients.

From the stack of materials, Jirada Angphet selected a plastic lid, paper cone, and three pieces of foam, then wrapped everything together with a pipe cleaner.

A student from Sri Wichai Wittaya School in Nakhon Pathom, Jirada was one of 71,406 Thai students who participated in Enjoy Design Challenges, a hands-on activity that challenges students to exercise their design engineering mindsets by building a satellite that can hover at a certain height.

"At first I didn't think I could do it, but I put it in and it actually flew," Jirada said. In fact, Jirada's satellite balanced perfectly in the target zone, meeting the challenge on her very first try.

However, it wasn't just beginner's luck; Jirada had been shrewdly observing the other students craft and test their satellites and learned from their mistakes. She noticed that a satellite with six foam pieces didn't fly, while a satellite with no foam pieces shot straight out of the top of the tube.

Jirada conjectured that a plastic cup would be too light if not well-weighted, and the shape of a paper cone would not generate enough lift if too heavy. In the end, she opted for the paper cone with a plastic lid to catch air, counterweighted by three pieces of foam. Spotting the weak points in existing designs, Jirada adapted their models to create a well-balanced satellite.

As she put the satellite in the tube, it hovered in the target area between two pieces of red tape, swiveling slightly. "One, two, three, four... five!" the National Science Museum employee remarked. "Very good!"

It was Jirada's first time attending the National Science and Technology Fair, Thailand's largest annual celebration of

science and technology. "I'm excited to be here," said Jirada, "I want to learn about science and what can come out of it."

Jirada already had an idea of how well-designed technology can improve people's lives. When Jirada was young, she was frequently ill. "I went to the hospital and saw how hard medical doctors worked, long hours to help the sick." Her eyes glisten with admiration. "If I want to be a doctor, I might not get accepted, but if I choose the medical technician field, I can really help doctors."

"I know that science is a basic knowledge requirement for that work," Jirada said, noting that while her marks weren't stellar, she was driven to gain a sophisticated understanding of science in order to pursue her dream career.

"This [kind of activity] is better because in the classroom we only read from the book, take notes and listen to the lecture," Jirada said. "We don't have the chance to do experiments like this." In an informal learning environment, where students like Jirada can apply their creativity to explore their own interests, they can learn to love science.

"The Challenges help students understand the science because they need to apply it to improve their designs and reach their success," added Devyn Curely, Engineering Education Associate at the Museum of Science Boston.

No longer was the field of physics mere equations on a blackboard, but forces of motion Jirada had to control and balance in order to balance her satellite. Gauging forces like weight and lift, Jirada and her classmates observed the effects of their designs and adjusted toward the desired outcome.

In the process of observing, designing and iterating toward their goals, Jirada and



# 71,406

STUDENTS PARTICIPATED IN THE ENJOY DESIGN CHALLENGES AT THE NATIONAL SCIENCE AND TECHNOLOGY FAIR 2018

# 1 MILLION

STUDENTS AND PUBLIC VISITED THE NATIONAL SCIENCE AND TECHNOLOGY FAIR 2018

her classmates built not just an airborne contraption, but an understanding of STEM concepts that they could take back to their classrooms and beyond. And perhaps, like Jirada, they would carry with them the surprise and wonder of watching their creations soar.



Students watch as their handmade satellites capture lift from upward rising air, aiming to build a satellite that can balance in the marked zone.