

# Wizard of recycling lures kids to science

**At the Mama Tierra workshop in Mexico City, a kid's wistful 'I want a remote-control boat' is a plan, not a dream.**

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**MEXICO CITY** - As a child, Carlos Macias made a hobby out of inventing his own toys. A self-described bookworm, he quickly exhausted the family supply of books and became something of a young scientist.

"I preferred [inventing] to playing or swimming," he says of a childhood full of the explosions, splatters, and sparks of invention.

On one family outing to a city park, the young boy decided that he wanted to catch bugs in a murky pond. After finding a stick, a piece of string, and a plastic bag, he made his own fishing rod. Seeing him using the new invention, some other children came over and asked to buy it. When the young inventor offered instead to show them how to make it, they insisted he sell it to them, but, Macias refused, saying they should make it themselves.

While his ethic hasn't made him rich, it has made him a minor celebrity among kids who consider him a modern-day wizard.

Mama Tierra, the science workshop he founded in 1992, helps make dreams come true. The wistful "I want to make a remote-control boat with passengers and a moving radar detector" becomes a plan, not a wish.

His mission is twofold: To introduce kids of all ages to recycling and environmental technologies like solar energy and to teach them to experience creativity firsthand, to reach for solutions rather than expect easy answers.

If a child can describe it, Macias usually can help bring an idea to reality from his cluttered jumble of cables, tools, and dusty model boats and spaceships. He'll discuss an idea with a child until they come up with a plan for construction.

One little girl who wants to make a mechanical caterpillar is given egg containers to get started, and Macias checks in periodically on her progress.

Kids work on picnic tables under a white tent outside the workshop, developing their inventions while they chat and laugh with their friends.

Many of the gadgets that young inventors make at Mama Tierra yield ecological lessons – from toys with recycled parts to machines that run on renewable energy. "We try to encourage energies that don't pollute, that are recyclable, that are renewable, so that the kids will see that they are options," Macias says.

In addition to letting kids follow their imaginations, he offers classes on ecological technologies that are easy to put into practice, like solar ovens and water heaters, both of which can be made using recycled materials.

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Just after lunch on a recent weekday, two high school girls stop by, saying that they need to make a model of the effects of acid rain.

"Would you like to start it now, as if it were a model of a city? We'll make factories that are spewing out dust," he says, after consulting them on their time frame. But the girls say they need to highlight the consequences of acid rain. "We could put in a river, we can put in an ocean – we can even put in the houses, the trees, the birds," he answers.

As the girls decide what to do, Macias says the project is probably for a class on environmental education. He'll help the students make a model that will attract the attention of their classmates with moving parts or flashing lights, or even falling water, and that will highlight a solution to the problem of acid rain.

"At times the solution is right there," he says.

Some of his work is more complicated. One challenge for more advanced students is making a hydrogen engine, which to Macias is a perfect way to combine science education and environmental consciousness. "It's one of the most abundant elements in the universe, so what could be better than developing this type of energy?" he says.

Some projects he won't do: a model of a nuclear plant, for instance, which he feels would promote a dangerous type of energy. Others, like a remote-control submarine, require too much time and concentration for the modern child. "I've realized that for this generation of children, everything needs to be faster. They don't have the patience to do things kids did 30 or 40 years ago," he observes.

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Macias's interest in science began with observing everyday objects. Magnets, with their inexplicable attraction and repulsion, and the light-bending capacity of simple eyeglasses made him want to understand.

"These things always seemed magical to me," he says. Inspiration aside, the boy's inventions didn't always go as planned – at age 9, he decided to make a formula to take out ink spots, but instead he stained the floor. "That was the invention of the indelible spot," he says mischievously. His mother ended up finding out about the spot after reading his notebook, where he recorded each day's work.

Another time, he filled his house with smoke by mistakenly lighting the entire contents of a bomb he made from ingredients bought at the local pharmacy.

He didn't exactly have a cheerleader for his inventions, he says, but his grandfather's work operating radio telegraphs on oceangoing ships sparked his curiosity. Macias would ask him for tools, and the man would hand over what he needed or explain how a process worked.

Later, at Mexico's Del Valle University, Macias studied accounting and philosophy, far removed from the scientific workshop he would found in his 30s. But during that time, he fed his inventiveness by making rockets equipped with parachutes and selling them to an model airplane store.

But these days, Macias guides kids toward safer projects than he undertook as a child.

"Here the kids do absolutely nothing dangerous," he says, noting that they're "dying to do" fireworks, which is not in the workshop repertoire.

Mainly, he tries to invoke the same curiosity in children that he felt as a child. Many examples of his success are enrolled in science tracks at some of the country's top universities.

Tabare Arrua, now 23, has known Macias since he took a summer class at Mama Tierra at age 8. Mr. Arrua's first project was a mini-motor boat, and he later made tiny solar cars and even attempted a remote-control airplane.

"It's a really fun way to learn and grow," he says. At 15, Arrua became a summer assistant at Mama Tierra and worked there when able to during the school year. He's now a student of engineering at Mexico's National Autonomous University, and says of Macias, "He helped me to keep on the path of science."

The relationship continues – recently Arrua went to Macias for help on a university project. Together they made a Van de Graaff generator, which accumulates electrostatic charges in a metallic sphere. "Even now, at the university level, in this workshop where grade-schoolers go, he's helping me," Arrua says.

Dinah Colin, an assistant at Mama Tierra, came a different way. As a first-year computational engineering student at the National Autonomous University, she was helping her little sister with homework – a science project using solar energy. Friends told Ms. Colin to head for Mama Tierra. "It was really crazy because I had never seen a place like that," she says.

She made a boat with a solar-powered, rotating radar tower. And the workshop opened new horizons, including her creation, the "Brother alarm." She has two little brothers, who sparked the idea for the motion-detecting device that, when placed in her bedroom, throws a little ball at entering offenders. "They are things that you imagine as a child but you never thought you could make," she says.

Her sister's boat project went so well that Macias hired Colin to work for him.

A fast-talker by nature, she gets even more animated when asked to describe Macias: "He's like those guys in the cartoons, like a mad scientist. He gets energized about everything he sees, as if he were seeing it for the first time."