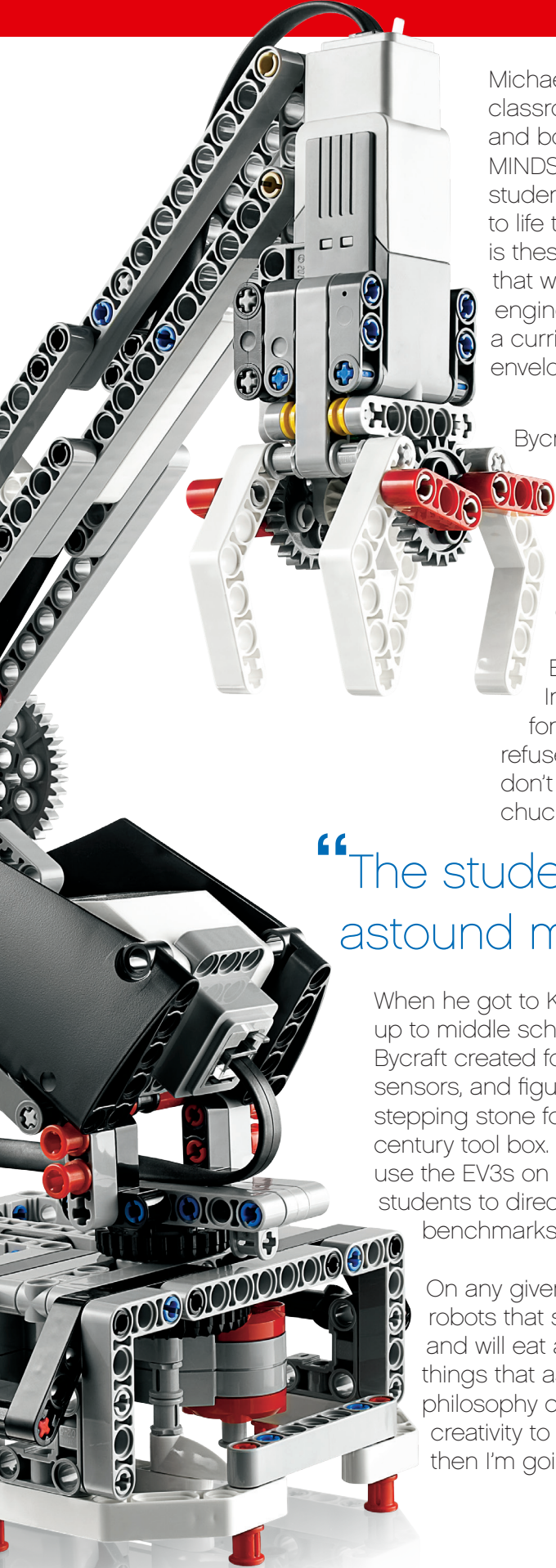


Students in Korea put the dynamic nature of LEGO® MINDSTORMS® EV3 on display



Michael Bycraft laughs, declaring, "I've made a terrible mistake!" His classroom at the Korea International School is a cacophony of beeps and boops thanks to the symphony his students created with LEGO® MINDSTORMS® Education EV3. It's a typical scene for Bycraft's class; students are smiling and enthusiastic, bringing outside-the-box-ideas to life through clever coding and hard work. What's more impressive is these students are just beginning a progression of skill development that will take them from music conductors to full blown robotics engineers. In the five years Bycraft has been in Korea, he's developed a curriculum around the EV3s that drives his students to push the envelope on a daily basis.

Bycraft and his wife came to Korea the old fashioned way—via Las Vegas, where he was teaching science. "one day a student asked him what he knew about robots. This introduced him to the world of competitive robotics, and Bycraft took to it right away. With limited funding available, he made himself into a grant writer and started forming teams. And his teams were good, finding success at both the state and national level. Building on his newfound interest in makerspaces and design, Bycraft sought a new opportunity and began applying to International Schools. Korea International School saw his passion for robotics and engineering and made him an offer he couldn't refuse. "They said, 'You do maker, you do design and robotics, why don't you come here and do whatever you want?'" says Bycraft chuckling.

“The students consistently do things that astound me!”

When he got to Korea they started him at the elementary level before moving up to middle school where things took off. Rover Robotics is a foundational class Bycraft created for students to become familiar with the kits, understand using sensors, and figure out how to get their robots to navigate mazes. It's a great stepping stone for students to hone their skills and start populating their 21st century tool box. But the real magic happens in Applied Robotics, where students use the EV3s on a whole different scale. It's a building block approach that allows students to direct the curriculum while also aligning with ISTE standards and benchmarks.

On any given day you can find his students working on everything from robots that solve Rubik's Cubes to a robotic fish that reacts to its environment and will eat a smaller fish right in front of you!. "The students consistently do things that astound me!" says Bycraft. Part of that is due to a teaching philosophy centered on students driving the learning and leveraging their creativity to meet challenges. "I'm going to facilitate., I'm going to help, but then I'm going to get out of the way," he says.



Bycraft says the durability of the LEGO® MINDSTORMS® EV3 gives him the confidence that he can indeed get out of the way. "Because they're solid and pretty much unbreakable, I can move around the room helping the kids who need it and trusting that the other kids are going to be fine with their kits." It's a natural fit in a setting that celebrates creative problem solving and the value of learning to be resilient in the face of failure. For Bycraft, LEGO is the perfect medium for teaching this concept. "It takes three seconds for them to take it apart and rebuild it, and that is so valuable to a student, the rapid prototyping over and over, getting results every time and seeing that progression. It's how you build

confidence." For a student population setting their sights on Ivy League colleges, confidence can be fragile, and Bycraft is focused on making his classroom a safe place for these kids to figure out that failure an opportunity to learn and get creative.

The students take that challenge to heart. When Bycraft developed a slope climbing challenge, thinking none of the robots would clear 60°, one group asked if they could build a grappling hook. "I was like, sure that's funny...and then it worked, and everyone wanted to build one." It's a terrific example of how this kind of hands on learning can so easily become interdisciplinary. In a matter of minutes his robotics class was transformed into an impromptu physics lesson on gravity and friction.

Bycraft's classes aren't just connecting disciplines, but they're also inspiring the next generation of robotics engineers. When he told his students to create a robotic zoo exhibit to help teach elementary students about animals and their environments, the results were definitely wild. The zoo featured everything from angry gorillas and scorpions, to things on the cuter end of the spectrum like walking dogs and flapping penguins. "It's what comes from stepping back and giving them that freedom, and a versatile tool like EV3."

When his students aren't finding innovative ways to meet Bycraft's challenges they're still thinking about how to create useful robots with practical applications. Sometimes there's even a personal connection. Bycraft, who was born with only one hand, shared video on his Twitter, @mabycraft of a robotic hand that his students created specifically for him. "They said, hey would you like a robot hand? And of course I said yeah build me a robot hand!" For Bycraft it's just more evidence of his students going above and beyond.



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