



Educator Case Study

INVENTEAM TEACHER'S SECRET TO SUCCESS: 'NO EXCUSES!' AND 'HIGH EXPECTATIONS'

InvenTeam teacher Joann Blumenfeld from Raleigh, North Carolina, is a rarity: a high school teacher credentialed to teach both high school science and special education. Her unique credentialing is bringing new learning opportunities to students with disabilities throughout North Carolina to address needs for a skilled workforce and to ensure her students have access to higher paying jobs in the field of science, technology, engineering and mathematics (STEM).

Blumenfeld argues that skills can help students from low-income families (especially those who have special needs) escape “a culture of poverty.” “You’re giving them a lifeline. Instead of being the kid that’s dependent, they can be the savior for their family,” she says.

Her inspiration came when she went to a Sustainable Forestry Teachers Academy at North Carolina State University about four years ago. There she learned that a local veneer factory was having trouble filling skilled jobs that paid more than \$25 an hour. Labor was being imported from Canada.

Blumenfeld realized that if she could provide high school students with disabilities the tools to learn

how to do these jobs through high-quality STEM instruction, she could help lift them out of poverty, while also giving them access to more interesting STEM careers that utilize their many talents.

Her first challenge: Flip the mindset about students with disabilities.

“ People look at kids with disabilities as the ones we have to help. I want people to look at them as the ones that can help us. ”

She believes students with disabilities make great engineers because “they have no fear of failure” and they are “inherently out-of-the-box thinkers.” Every day they must adapt to things. Engineering, she says, is a “hurry up and fail” environment – an environment in which students with special needs are used to.

In 2013, Blumenfeld developed the concept for the Catalyst program, a hands-on learning approach to building STEM skills for high school students with disabilities. She received funding from the Biogen Foundation to keep costs low for students’ families. The program launched in

2015 at the Science House at North Carolina State University. The program has attracted 24 students from across the state that meet on Saturdays during the school year as well as during summer sessions. This year, the students attended the Catalyst program from four counties and 22 high schools, and drove from as far as three hours away.

The Science House, a nonprofit government agency dedicated to STEM professional development and education, and NC State are the perfect partners, according to Blumenfeld. NC State offers more than 18 bachelor's degrees in engineering alone. She has adapted the Catalyst curriculum to take advantage of NC State resources, including departments and professors, collaborating on everything from climate to energy instruction. The Science House and NC State connections also have brought attention from media. The state's governors and senators have met with the Catalyst students, too.



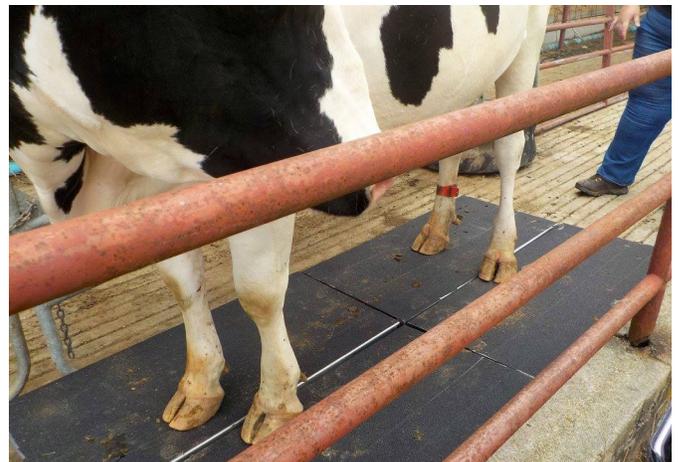
She considers science “a hands-on sport” so the Catalyst program – run in her spare time – consists mostly of labs and field research. Her students, she says, are rarely just sitting in a classroom. That much real-world learning requires a tremendous amount of creativity and time from Blumenfeld, who is also a full time teacher during the week. “There are only so many hours in a day, I typically work 60-70 hours a week to complete all the grant-writing, fundraising, and organization,” she

says. She does it because she loves working with these kids who are wonderful and deserve an opportunity to succeed in STEM.

A member of the National Science Teachers Association, Blumenfeld credits her “no excuses” approach to teaching to her relative newness to the field of education. She became a teacher in 2010 after working in an array of jobs, including for the Peace Corps and as a director for a national library and a science policy analyst. She discovered the big deficit of certified science and special education teachers in North Carolina.

“ And I noticed a lot of the way they teach science is text-based, which is really bad for kids, especially students who have poor reading comprehension or language issues but are great hands-on learners. It is also not so engaging and makes STEM boring for many kids. I wanted to change that. ”

“We are losing too many scientists and engineers in our leaky STEM pipeline who could increase our STEM workforce and ensure we do not lose the new discoveries of inventions that they could create,” she says.



Prototype sensor testing at North Carolina State University Dairy Farm

Her goal with Catalyst is to provide students with disabilities “the support” and “the experiences” they need. “A lot of kids don’t know what they don’t know. They never heard of nanotechnology or certain types of engineering,” she says. In their high schools, they are often in a large class



with teachers unskilled in special education. The teachers don't always think of them "as the kids they should be promoting," she finds, and, therefore, the field is losing a lot of great scientists. "We have more than 190,000 students with disabilities in the K-12 public schools [in the state] and only about 6% of them who attend college go on to STEM careers yet many of our most famous scientists from Einstein to Edison had disabilities.

Catalyst at the Science House received a Lemelson-MIT InvenTeam grant in 2016 to develop a prototype of their invention: a platform to detect lameness in dairy cattle. The students, mostly from urban settings, visited dairy farms and studied how the farms work, even walking through cow vacuums that vacuum off the cows' fleas.

The platform, which includes its own app, required the students to learn a range of skills, from soldering to coding in the Python programming language. Catalyst benefits from the resources and support of North Carolina State University, North Carolina Natural Science Museum, and other industry and government agencies. Blumenfeld drafted three doctoral students from NC State to assist with the project and she has made sure that the entire team knows all the technical skills associated with the invention.

"All the students had to go out of their comfort zones, even if they didn't want to," she says. "They all had to pull their weight." She was so adamant about this that when students said they were conflicted with finals and other high school responsibilities, she said "figure it out or you won't go to EurekaFest." The entire team figured it out and presented their prototype at the Lemelson-MIT Program's EurekaFest event at the Massachusetts Institute of Technology in

Cambridge, Mass. This also taught them "grit" which proves to be an indicator, more than IQ or other educational indicators, of a student's likeliness of success. Now Blumenfeld and the students aim to pursue a patent for the platform device, which will cost less than \$1,000 to manufacture. The closest competitive device on the market costs more than \$100,000.

" [Catalyst] has been their safe space. They come there and they are successful. They don't always feel that when they walk in the door of school. It has been a place where the kids will joyfully engage in learning for eight hours on a Saturday and also have no behavior issues. "

The Lemelson-MIT InvenTeam experience and Catalyst overall have convinced Blumenfeld she should work to ensure that the self-advocacy and invention skills the students learn don't go to waste when they graduate from her program. She aims to expand Catalyst across the state and help students get into four-year universities, internships (she's already lobbying NASA and the EPA for opportunities), and the skilled labor market. "It's attainable," she says. "Of our three graduating seniors, two are going on to engineering and one is going on to a community college." She wants people to know "students with disabilities have many gifts and talents and with supports and experiences, they can change the world and make a better place, one invention at a time."

ABOUT LEMELSON-MIT INVENTEAMS™

Lemelson-MIT InvenTeams are teams of high school students, educators, and mentors that receive grants up to \$10,000 each to invent technological solutions to real-world problems. The InvenTeam initiative is administered by the Lemelson-MIT Program, a sponsored program under the School of Engineering at the Massachusetts Institute of Technology. The Lemelson-MIT Program is funded by The Lemelson Foundation. Learn more at lemelson.mit.edu

