



LEMELSON-MIT PROFESSIONAL DEVELOPMENT INSPIRES A CULTURE OF INVENTION EDUCATION

BY LIZA GOLDSTEIN

The 2021 Ridgewood High School InvenTeam from Ridgewood, New Jersey exemplifies the pillars of high quality invention education: teamwork, dedication, perseverance and above all else, a curiosity and ambition to solve both local and worldwide challenges through invention. A 2019 Lemelson-MIT Program (LMIT) workshop for educators served as a catalyst for one enthusiastic teacher at Ridgewood High, inspiring her and her colleague to challenge their diverse students to identify a problem of their own choosing, build an invention that solves that problem, and apply for an LMIT InvenTeam grant. With deep support from their community, the team secured the grant and their work culminated in the creation of a successful prototype and a promising invention education legacy for the school.

The Ridgewood InvenTeam's journey started with a unique pair of STEM educators at Ridgewood High School, who both share immigrant stories that helped shape their career directions. Hsuan Lillian Labowsky, a veteran chemistry and physics teacher, was born in Taiwan to parents who escaped the Chinese Revolution of 1949. During a college entrance exam, Labowsky was selected to pursue chemical engineering, which began her STEM pathway. In the 1970s, Lillian left Taiwan to pursue

graduate school at Yale University on a research fellowship. Her father gave her his blessing by saying, "I heard of Yale; you may go!" At Yale, Lillian was fortunate to have the world-renowned scientist Professor John B. Fenn as her thesis advisor. There, Lillian witnessed the initial development of Fenn's Electrospray Mass Spectrometry (ESMS) technology which became a standard tool for identifying proteins in medical and biomedical research, and later lead him to win the 2002 Nobel Prize in Chemistry. Lillian had the once-in-lifetime honor to be invited to the Nobel Prize Ceremony by Professor Fenn. Soon after, Professor Fenn suggested that Lillian teach at the high school level to inspire students, just as his chemistry teacher had done previously for him. She accepted his challenge and has been teaching at Ridgewood High School for the last 15 years. Every year, Lillian shares the inspiring story about attending the Nobel Prize Ceremony with her students on the first day of school.

John Wohner, the second advisor to the Ridgewood InvenTeam, is a certified career and technical education (CTE) teacher at Ridgewood High School, who oversees the fabrication shop and makerspace equipment. John's parents are Hungarian immigrants who built a successful decorative arts company in

the U.S., and taught him the importance of a strong work ethic. John learned the woodworking trade from his parents and spearheaded the business side of his family operation before deciding to switch to teaching. The impulse came from doing volunteer work after Hurricane Sandy to restore properties and observing first-hand the lack of hands-on technology experience among the younger generation. After completing his teacher certification, John found that Ridgewood High School was an ideal fit, as leadership had already invested in top notch makerspace equipment and labs that supported hands-on learning.

Despite both educators' impressive backgrounds, invention education was a new concept for them. In the summer of 2019, Lillian came across the Lemelson-MIT Program while searching online for professional development opportunities. Drawn to the summer Creative Problem Solving and Inventing workshop for educators, she applied for an Excite Award, which awards 25 K-14 educators across the United States annually for their exemplary work facilitating project-based programs in their schools, by offering the professional development opportunity at no cost. After submitting her application, Lillian was notified that she was a winner by Leigh Estabrooks, the Invention Education Officer for the Lemelson-MIT Program. In the summer of 2019, Lillian attended the workshop and gained valuable insights, resources and advice from LMIT and MIT staff, as well as other professionals in the invention education sector.

LMIT's emphasis on empathy and community engagement as the initial components of invention education struck a chord with Lillian and reflected the lifelong learning strategies at her school. She was eager to integrate invention education into her chemistry classes and the Applied Engineering Club after attending the LMIT workshop. "Although I did not have all the needed skills, I had no hesitancy to implement the Lemelson-MIT invention education because I was confident that we would not be alone

and would receive full support from LMIT staff, our school, and the community," says Lillian.

Indeed, during the 2019-2020 school year, Lillian continually received advice from LMIT's Anthony Perry and Leigh Estabrooks. With John on board, the inventive thinking flourished at Ridgewood High School through weekly meetings. In fact, their invention concept for a Solar Aqua Tech (SAT) water bottle came out of discussions between Lillian's chemistry students and Yale University's Professor Shu Hu via his National Science Foundation (NSF) outreach program.



Although community mentors, educators, and students at Ridgewood were ready to work on their water bottle project, the world was rapidly changing with the onset and spread of COVID-19. The shift from face-to-face meetings to conversations over Zoom was the new reality. Despite the challenges of working remotely, the SAT team entered a virtual Thomas Edison Pitch Contest and took home first prize. The prize was a 3D printer that would later be used during the Lemelson-MIT grant

period for prototyping.

In the spring of 2020, the SAT team gained the confidence and skills to begin the initial application for the Lemelson-MIT InvenTeam grant. The InvenTeam grant initiative is an annual, year-long program where high school teams of students, educators, and mentors receive up to \$10,000 to invent technological solutions to real-world problems. During the summer of 2020, John joined forces with Lillian as the team's assistant teacher and expanded the team from four students (two female and two male) to 11 students (five female and six male), some with disabilities. The team had a diverse set of skills, backgrounds and interests ranging from business, chemistry, engineering and communications expertise. The racial diversity of the team even surpassed the racial makeup of the school as a whole. By the end of the summer, the team was able to submit their final InvenTeam application. [Continued on page 3].

In October of 2020, the Ridgewood Solar Aqua team was awarded a Lemelson-MIT InvenTeam grant and set forth on a year of inventing and improvising with COVID restrictions in place. Collaboration over Zoom prevailed and the team even met with proper protective equipment in the high school parking lot under a popup tent that they borrowed from the local Boy Scout troop. The team was able to find a way for their solar aqua tech reusable water bottle to sanitize water by producing hydrogen peroxide. Community partners such as Ridgewood Water allowed the team to test water samples and the team practiced public speaking through presentations at town council meetings and other local events. By June 2021, their 3-in-1 SAT prototype was complete and tested successfully at the nearby Diamond Brook. Although the team could not present at a traditional in-person EurekaFest (Lemelson-MIT's annual invention celebration), they presented their project at a well-attended virtual EurekaFest.

As if this achievement was not enough, the community-wide enthusiasm for the Ridgewood High School InvenTeam contributed to a substantial donation of \$635K from the Dave & Cheryl Duffield Foundation to fund science, technology, engineering, arts, and mathematics (STEAM) education at the high school. Dave Duffield is a 1958 Ridgewood High School graduate who is heavily interested in STEAM initiatives.

The Ridgewood InvenTeam's positive experience and subsequent Duffield grant demonstrates how schools can develop a robust community of inventive thinking and hands-on learning, while teaching empathy. Through the invention process, students learn to recognize needs in an increasingly challenged world and realize they have the skills to solve them. One of the team members, Matthew de Meulder, expressed his experience through these words: "I would never have considered myself an

inventor. However, this experience has opened my eyes to other career and life paths that I would not have expected." Lillian and John's students, under their tremendous guidance, acquired skills in areas such as 3D printing, soldering, circuit design, social media, public speaking, and perseverance. Eight of the 11 members of the team have expressed a desire to major in STEM at college.

The inventive culture at Ridgewood will continue to expand with the funding from the Duffield grant and the passing of the torch to other educators. In June of 2021, Suzanne Zilvetti, an eighth grade science teacher at the George Washington Middle School in Ridgewood, received an Excite Award grant to attend the Lemelson-MIT summer workshop, just as Lillian did in 2019. Lillian's only wish, after reflecting upon her InvenTeam experience, is for InvenTeams and other invention opportunities to be integrated into the regular school day with academic credit offered to students. Lillian says, "I adopted the Lemelson-MIT invention program as the pathway to instill our school's learning strategies in critical thinking, creativity, resiliency, and empathy, desperately needed capabilities for students." With dedicated educators like Lillian and John, as well as generous gifts like the Duffield's, and strong support from the school community and district, invention education is likely to thrive at Ridgewood High School well into the future.

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—Lillian Labowsky