School Science Students Developing and Mobilizing Eco-Just Engineering Products

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Abstract:

In many contexts worldwide, educators are encouraged to integrate aspects of the traditionally-isolated disciplines, science, technology, engineering and mathematics (STEM). Among variants of STEM education, promotion of engineering design and consciousness of engineering processes, products and services seem particularly prevalent. Innovations/inventions from STEM are said, for instance, to improve people's lives and to contribute to jurisdictional economic competitiveness. While there are numerous defenders of such foci, several scholars suggest that many STEM education initiatives minimize or alter students' consciousness of harms to living and nonliving things associated with influences of powerful people (e.g., financiers) and groups (corporations, think tanks, trade organizations, etc.) on fields of science and technology and on

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many other entities. Accordingly, we report findings from action research involving a secondary school science teacher's efforts to educate students about such problematic relationships and, for areas of their concern, and to encourage them to design and implement STEM-based engineering products that perform intended functions and also addressed matters of social and/or ecological justice. Students developed, for example, a candle recycling device made from waste material, 3D-printed athletic shoes made from biodegradable material and 3D-printed parralletes supports (also biodegradable) for calisthenics training. At the same time, work still seems necessary to help students with abstract concepts like immutable mobiles and techniques for mobilizing such more eco-just technologies across multiple context to perhaps generate an assemblage of co-supportive living, nonliving and symbolic actants. Claims from Science and Technology Studies, such as sociotechnical imaginaries, show great promise in this regard.

Keywords: science education; engineering design; sociopolitical activism

Biographical Note

Larry Bencze is an Emeritus Associate Professor in Science Education at the University of Toronto. His research emphasizes critical analyses of science and technology, explicit teaching about problematic power relations and student-led, research-informed, sociopolitical actions to overcome social and environmental harms associated with fields of science and technology.

Dave Del Gobbo is a secondary science and special education teacher in Mississauga, Ontario, Canada. In addition to his teaching career, Dave has worked as an instructional technology consultant for the Peel District School board. Now that he is back in the classroom, he works with his students to explore coding, 3D printing, technological design and how they intersect with Science, Technology, Societies and Environments (STSE) issues.

Sarah El Halwany is a PhD candidate at the Ontario Institute for Studies in Education (OISE), University of Toronto. Her research looks at how science education is affectively enacted and embodied. She is also interested in pedagogical approaches that connect Science, Technology, Societies and Environments (STSE).

Minja Milanovic is currently a Science Lab Technician, Teaching Assistant and Research Internship Co-ordinator at The Bishop Strachan School. As a member of the STEPWISE team she has participated in creating teaching and learning resources, organizing teacher PD workshops, action research projects and publications in science education.

Majd Zouda is a Ph.D. candidate in Science Education at the Ontario Institute for Studies in Education(OISE), University of Toronto. Her doctoral dissertation focuses on STEM programs in elite schools in Canada, and she has received the SSHRC doctoral fellowship for her doctoral research. Majd has been involved in publications regarding socioscientific issues, STEM education and student activism.