Thesis Project Portfolio

Mountain Directed Energy Wayfinder (D.E.W.)

(Technical Report)

Robots in Schools: How Innovation Attempts to Solve Problems in Education

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis:

Technological Innovations in Education and their Implementations

The education system is sensitive to technological innovations, with the goal of each innovation to make learning easier, more efficient, and more engaging to students. However, the assumption that integrating technological innovations into the education system will improve it fails to capture the reality of the situation, that the impact a technological innovation will have on student learning is unknown at the time of implementation. The integration of robots in the education system and a laser pointing star gazer, which directs a laser towards a set of stars in the night sky, exemplify the intersection that exists between technological innovation and education. My STS research paper examines how technological innovation becomes integrated into the education system and the diverse perspectives that result from it, using the example of robots as a case study to examine technological innovation in education. Then, the laser pointing star gazer, named Mountain D.E.W., is exactly that, a technological innovation with the goal to better students' learning about the stars. The examination of robots as a case study provides a framework to analyze the possible implementation of Mountain D.E.W. in education curriculum.

One of my capstone professors came up with the idea that we should create some sort of laser pointing star gazer, as many current systems are expensive, prohibiting the exploration of the night sky by novice stargazers without significant investment. The main goal of our project attempts to decrease the cost of such systems, enabling educators in underfunded school programs and novice stargazers to purchase a cheaper alternative to the expensive systems while still providing the same experiential learning opportunity. Our system is made up of six distinct parts: the LCD display, the STM microcontroller, the GPS chip, the gimbal, the power system, and the laser. After the system has been powered on, it is calibrated by the user pointing the laser

to the north star. Then, the user can select from a set of pre-selected stars. Once the star has been selected, the motors in the gimbal will turn on and point the laser to the star. This can be repeated several times, until the users turn off the machine. A block diagram of our project can be found in Figure 1.

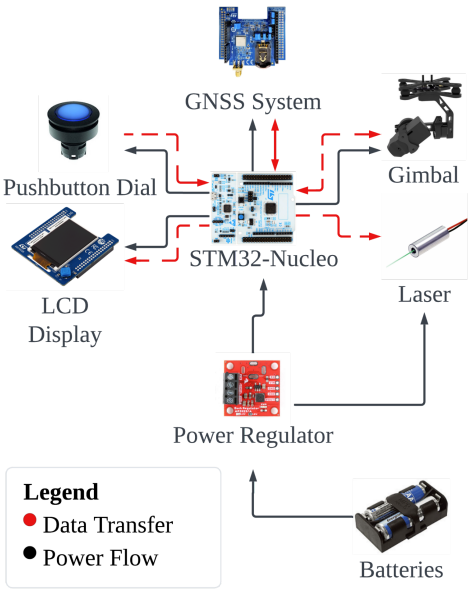

Figure 1: Block diagram of Mountain D.E.W.
(Created by Author)

The microcontroller performs all the calculations required to move the motors and retrieve user input from the display, providing real time experiential learning to students. This system provides a simple way for teachers to educate students about the stars without having prior knowledge on astronomy and star locations.

My STS research employs discourse theory to examine the implementation of robots in the education system. Through content analysis of educational media, including media coverage, government documents, and journal papers, my research uncovered the dominant discourses which inhibits the implementation of robots in education. The major discourse identified is the discourse surrounding technological solutions for education; meaning that possible solutions to

educational problems are usually based in technological innovation. In the context of educational robots, the problems that the current education system faces (i.e. lack of student engagement, increasing number of teachers leaving the field) are attempting to be solved with educational robots, ignoring policy-based solutions to the same problems. This finding can be applied to other systems, such as content management systems, where the goal of making teaching more organized and thus teachers more effective has not actually solved the problems within the education system. This conclusion informs policy makers and educators that policy solutions may provide greater relief to the problems that affect the education system,

These projects are both related to the field of education; one is a technological innovation related to education while the other examines a different technological innovation in the field of education. The conclusions derived from my STS research raise questions on the implementation of the star gazer; specifically, should the star gazer system be used instead of a knowledgeable guide? Does the development of this system actually improve the education that students receive when compared to an equal human instructor? The star gazer is a technological innovation attempting to instruct students about stars, something that a human could easily perform. Ultimately, policy makers, curriculum designers, and school systems must decide when to embrace or reject innovation, with the goal to maximize the improvements to student learning. Together, these projects tell a story about technological innovation, user-led design, and responsible implementation within the field of education.