Leadership in Action Report

Vishweswar Eswaran, Electrical Engineering, University of Toronto

Introduction

In the heart of Tamil Nadu, nestled in the remote village of Ramanathpuram, a unique journey began—a journey aimed at transforming the lives of young minds through the magic of electronics and innovation. As part of the Laidlaw Fellowship Leadership in Action (LiA) program, I traveled from Canada filled with anticipation and hope, eager to engage with a group of children who had little exposure to design thinking and hands-on learning. This report outlines the Funtronics workshop I conducted over several weeks, where we harnessed the power of electronics as a tool for problem-solving and creativity.

The village, vibrant yet challenged by limited resources, provided a rich backdrop for exploration and learning. With the cooperation of local leaders and the enthusiastic participation of the children, we set out to tackle real-world issues that impacted their daily lives. Together, we embarked on a journey of ideation and innovation, ultimately **designing a glowing shoe** to enhance night time navigation—a solution born from their own experiences and aspirations.

Through interactive sessions, hands-on projects, and collaborative brainstorming, we not only built prototypes but also ignited a passion for STEM education in these young innovators. This report details the week-by-week progression of the workshop, highlighting the milestones we achieved, the challenges we faced, and the invaluable lessons learned along the way.

I1: Students with their design notebook during our design session

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Specific Work, and Impact

Throughout the Funtronics workshop, I was responsible for designing and implementing a curriculum that introduced basic electronics concepts and practical problem-solving skills to the children of Ramanathpuram. My work involved several key components:

1. **Curriculum Development:** I crafted a hands-on, interactive curriculum that utilized local materials and focused on real-world applications of electronics. This included projects like the glowing shoe, which addressed the community's challenge of nighttime navigation.
2. **Workshop Facilitation:** I led weekly workshops that engaged the children in collaborative learning. By using storytelling, demonstrations, and group activities, I fostered an environment where children could explore, ask questions, and express their creativity.
3. **Community Engagement:** I worked closely with local leaders and the cooperative society to ensure the workshop aligned with the community's needs. This collaboration facilitated access to resources and support, making the workshops more impactful.

Impact

The impact of the Funtronics workshop was multifaceted:

1. **Skill Development:** The children gained foundational knowledge in electronics, design thinking, and problem-solving. They learned to work with components like light-dependent resistors (LDRs) and microcontrollers, empowering them to create their own projects.
2. **Increased Confidence:** By participating in hands-on activities and successfully building prototypes, the children developed confidence in their abilities. This newfound self-assurance proved crucial for their future academic and personal endeavors.
3. **Community Awareness:** The project heightened awareness of the importance of STEM education within the village. We went from 2 to 20 participants. By solving a local issue through innovation, the workshop inspired discussions about technology and its potential to improve quality of life.

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The Three SMART Goals to Apply Leadership Attributes

Goal 1: Facilitate Hands-On STEM Education for Rural Children (Specific, Measurable, Achievable)

I aimed to introduce STEM concepts through a series of interactive workshops for children in Ramanathpuram. This goal was specific to teaching electronics and problem-solving via practical projects, measurable by the children's engagement and completion of various hands-on activities. The workshops were designed to be achievable by utilizing locally available materials and simple technology (e.g., light-dependent resistors and microcontrollers).

Goal 2: Build a Community-Based Prototype to Address a Local Issue (Relevant, Time-Bound)

The second goal was to involve the children in identifying a local problem and collectively building a functional prototype to address it. This was a relevant goal as it directly aligned with the village's needs and the children's lived experiences. The solution they developed—a glowing shoe for safer navigation during power cuts—was selected through a community-led process, and the project was completed within the five-week timeframe of the workshop.

Goal 3: Create a Sustainable Learning Framework for Continued Engagement (Measurable, Time-Bound)

The final goal was to ensure that the learning did not stop after the workshops concluded. This was measured by the distribution of design books to all participants and the training of local facilitators who could carry on the workshops after my departure. The framework was set in place by the end of the workshop period to ensure continuity and community ownership.

These goals allowed me to apply the leadership attributes of teamwork, problem-solving, and adaptive thinking that were emphasized during the Laidlaw Fellowship training.

I2: Students working with LDR and performing circuit analysis

Working With/For an Underserved Community

The Funtronics project was centered on engaging with a rural and underserved community in Tamil Nadu, India. The children I worked with had minimal exposure to design thinking, electronics, and problem-solving techniques, largely due to the limited resources available in their village. These workshops provided an opportunity for them to explore new concepts, work with technology, and see how innovation can directly improve their lives.

This experience also involved engaging the broader community. I collaborated with village leaders and local institutions like the cooperative society to secure teaching space and resources, ensuring that the project was deeply rooted in the village's context. The workshops aimed to give the children tools they could use long after my departure, thus addressing the educational gap in a sustainable and meaningful way.

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Different Perspectives Gained in a New and Challenging Environment

Being immersed in the rural environment of Ramanathpuram offered a unique and challenging experience. Coming from a background where access to technology and educational resources is abundant, it was eye-opening to witness the creativity and resilience of children with much more limited resources. The challenge of working in an area with power cuts, limited infrastructure, and a language barrier pushed me to think differently about teaching, communication, and problem-solving. I also gained a new perspective on the role of education in community development. The children were eager to learn, and their engagement in the workshops revealed the potential of using STEM education as a tool for empowerment. This experience taught me the importance of adaptability, cultural sensitivity, and the power of co-creation in leadership.

Our journey begins

Week 1 (5/7/2024 - 5/13/2024)

- 5/7/2024: Arrived in Ramanathpuram, Tamil Nadu, and began acclimatizing to the village. I connected with the local community and started assessing the children's level of knowledge about electronics and problem-solving.
- 5/8/2024: Met with local officials to secure permission to conduct workshops in the village. I also gathered logistics like seating arrangements, teaching space (a cowshed on a farm), and electricity.
- 5/9/2024: Prepared the workshop space and started organizing the materials for the upcoming activities. The setting was informal but practical for interactive workshops.
- 5/10/2024: My first interaction with two curious children, who mistook my equipment for toys, set the tone for building interest and engagement with the larger group.
- 5/11/2024: Scouted the village for local resources and found materials like old rubber tires, scrap wires, and sandals, which sparked an idea for a hands-on project the children could replicate later on their own.

I3: Design book provided to the students

Week 2 (5/14/2024 - 5/20/2024)

- 5/14/2024: Kicked off the first workshop, introducing the children to the concept of robots in agriculture—a topic that resonated with their daily lives. The idea of building something similar captured their imaginations.
- 5/16/2024: Distributed design books to the children, outlining the upcoming five-week plan. Each child was tasked with identifying a problem in their neighborhood, and as a group, we would vote on one to solve through an electronics project.
- 5/19/2024: Held a problem diagnosis session where the children shared various challenges they faced in the village, such as dirty roads, stray dogs, and well cleaning. However, the most pressing issue identified was navigating the village at night during frequent power cuts, which was dangerous due to the presence of snakes and scorpions.
- 5/20/2024: The ideation phase started. We explored several solutions like street lights and campfires but eventually decided to design **glowing shoes**, a wearable device that would provide flexibility and ease of use for nighttime navigation.

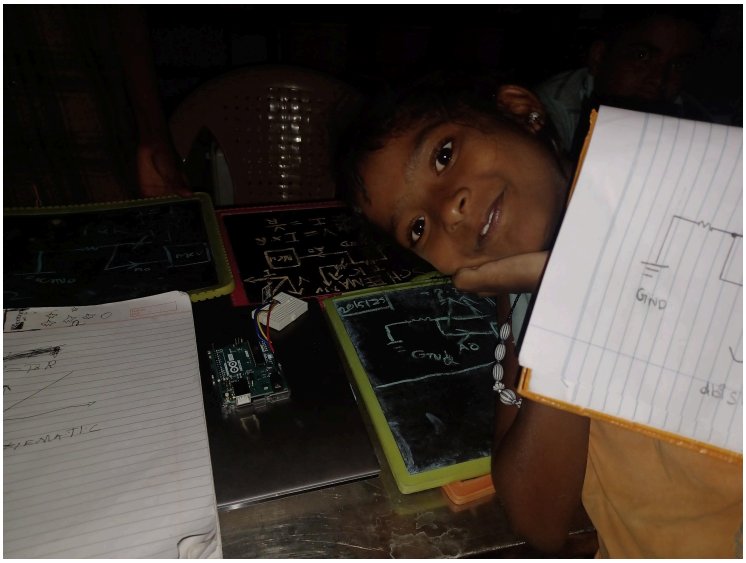

I4: Ideation session

Week 3 (5/21/2024 - 5/27/2024)

- 5/22/2024 & 5/23/2024: Workshops were canceled due to heavy rain.
- 5/24/2024: Introduced the concept of LDR (Light Dependent Resistor) sensors. The children were excited to learn how sensors react to light, and I provided them with simple examples of how they could use this knowledge in their project.
- 5/25/2024: Taught atomic structure in an engaging way. The children were divided into groups representing protons, neutrons, and electrons, with electrons running around the nucleus to simulate atomic orbits. This helped them understand the basic concept of electricity.
- 5/27/2024: Introduced the concepts of voltage and current. We used a physical activity where children acted as electrons and resistors to visualize the flow of current and the resistance's effect on slowing it down.

Week 4 (5/28/2024 - 6/3/2024)

- 5/28/2024: Continued the lesson on voltage and current, reinforcing the electron flow concept. The children also learned about resistors through a playful yet informative exercise.
- 5/29/2024: Built a small project using an LDR, which demonstrated how photons could knock off electrons, creating a current. This introduced the children to the idea of sensors, particularly how light can control electronics.
- 5/30/2024 & 5/31/2024: We connected the LDR to a microcontroller (MCU) and programmed it to control a NeoPixel pattern. During this process, the children learned soldering and basic MCU programming, using analogies like the brain (MCU), sensors (senses), and actuators (muscles) to explain how electronics work together.
- 6/2/2024: Introduced the concept of electric fields and capacitors using a tug-of-war game. This illustrated how two oppositely charged objects create a force that pulls them together, giving the children a hands-on understanding of electric forces.

I5: Fundamentals of Electronics

Week 5 (6/4/2024 - 6/10/2024)

- 6/4/2024 & 6/5/2024: The children built a pressure sensor from old rubber tires, metal washers, and wires. This simple yet functional sensor cost just a few cents and was a great way to teach them about capacitive coupling and pressure sensing.
- 6/6/2024: Pre-success celebration: Held a small party to motivate the children for the final project push. It was an informal gathering to celebrate their progress and dedication.
- 6/7/2024: We brainstormed ideas on how to integrate the pressure sensors into the shoes. The children were actively engaged in refining the design, deciding where to place the sensors to maximize functionality.
- 6/8/2024: The children began assembling the glowing shoes by placing the pressure sensors into the soles and connecting them to the MCU. I guided them through the process of wiring and programming.
- 6/9/2024: Shoe testing day! The children put on the shoes, which were equipped with pressure sensors that controlled the NeoPixel lights, lighting up the side of the path based on pressure. The project was a huge success, with the kids enjoying the interactive and functional shoes, even using them to create dance moves.

I3: Glowing show prototype

Week 6 (6/11/2024 - 6/15/2024)

- 6/11/2024: Reviewed the entire process with the children, ensuring they understood the electronics and programming principles behind the glowing shoes. We also discussed how they could apply these skills to other problems in their community.
- 6/12/2024 - 6/15/2024: Final reflection and celebration. We reflected on what we had achieved together and how the children could continue building projects independently. I handed out prototyping materials to continue experimenting at home. A final celebration was held to wrap up the six-week workshop.

Conclusion

The six-week journey with the children of Ramanathapuram was a transformative experience, not just for them, but for me as well. We started with simple concepts of electronics and slowly built up to an impactful project—the glowing shoes, which addressed a real challenge the community faced: safe navigation at night. Through a mix of hands-on learning, creativity, and local resourcefulness, the children discovered how to apply STEM knowledge to solve practical problems.

The project highlighted the importance of making technology accessible to underserved communities. By using affordable, locally sourced materials and breaking down complex ideas into digestible parts, the children gained confidence in their ability to innovate. Moreover, the collaborative spirit fostered through group work and problem-solving encouraged them to see themselves as active contributors to their community's well-being.

The glowing shoes project was not just an educational exercise but a lasting solution that can be expanded upon. The kids now possess the fundamental skills and tools to iterate on the design and come up with new innovations. Sustainability will be ensured as they continue to experiment with the materials and knowledge they've gained, making them self-reliant problem solvers in the future.

This experience underscored the potential of gamified education to democratize STEM learning and empower young minds to take charge of their surroundings. As a Laidlaw Scholar, this project gave me invaluable lessons in leadership, especially in working within a community in need and understanding the importance of sustainable, locally-driven development. It reaffirmed my belief that impactful change begins at the grassroots level, with each small, meaningful step toward solving a larger problem.