

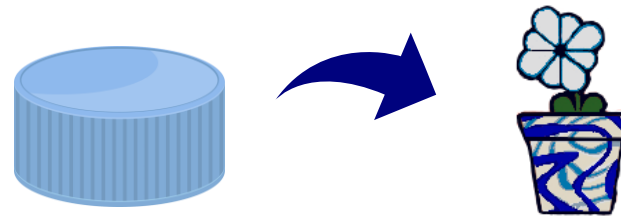
EXECUTIVE SUMMARY

Regenerative Plastics:

Case Study of Jesuit Social Services' Recycling Program

B Term
December 14, 2023
Melbourne Project Center

An Interactive Qualifying Project submitted to the Faculty of WORCESTER POLYTECHNIC INSTITUTE in partial fulfillment of the requirements for the degree of Bachelor of Science.



Community Partner:
Jesuit Social Services

WPI Research Team:
Carlos Jones
Marissa Burati
Sean Maguire
Troy Distaso

Faculty Advisors:
Jonathan Chee
Lorraine Higgins

This report represents the work of WPI undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on its website without editorial or peer review. For more information about the projects program at WPI, see <http://www.wpi.edu/Academics/Projects>.



Introduction

Across the globe, increases in production of single-use plastics result in high levels of plastic pollution (Walker et al., 2023). Plastics are light, durable, and inexpensive to produce, which explains why this material is often used in different manufacturing settings. A majority of these plastics are recyclable polymers known as thermoplastics; however, only about 9% of the plastic produced globally is recycled (Braun, 2023). The infrastructure, technology, knowledge of recycling policy, and community engagement in recycling needs to be expanded. This project documented the benefits of a program called Regenerative Plastics (RP), an initiative of Jesuit Social Services' (JSS) Ecological Justice Hub ("The Hub") in Melbourne Australia.

The RP program focuses on diverting plastic bottle caps from landfills by converting the caps into reusable products and educating community participants in hands-on plastics recycling. Small plastics, such as bottle caps, are unable to be recycled at many automated machine recycling facilities because their small sizes often clog machinery. Within Australia, most councils have determined that bottle caps must be separated from bottles before being recycled, and these caps are often placed in household trash (Mossuto, 2022). When these caps are washed into waterways or pile up in landfills, marine life and birds have difficulty differentiating between these caps and food, which can lead to fatal consequences for these animals (North Sea Foundation, 2017).

To combat this growing problem, JSS, a nonprofit dedicated to social change, has partnered with Precious Plastics Melbourne (PPM), and Lids4kids. PPM is a startup that builds and distributes machinery to shred and convert plastic bottle caps into a moldable resin. It also produces molds to create different products, such as plastic bricks and gardening tools, and runs micro workshops on how to operate the recycling equipment so other organizations can start their own recycling operations (Mossuto, 2022). After receiving a grant from Sustainability Victoria, JSS's Hub secured recycling equipment from PPM, and with the help of WPI students set up its own recycling assembly line (Figure 1). Lids4Kids is a national organization based in Canberra that organizes lid dropoff locations with local schools, businesses, and individuals (Mossuto, 2022). Lids4Kids designated The Hub as a drop off point for donated lids, which allows The Hub to obtain the bottle caps needed to create their reformed products.

While the regeneration of these bottle caps is important, so too is building community awareness and involvement in these processes. This is why The Hub, with the help of Worcester Polytechnic Institute students, has created demonstration workshops on plastic recycling in its facility for local community groups. The workshop contains a presentation on the larger problem of plastic pollution and hands-on involvement with the recycling process. As of October 5, 2023, 385 people from local businesses, schools, and other organizations had participated, and the State Minister for the Environment and a local federal politician had expressed interest in scaling up the project, but to further enhance the program, publicize it, and secure additional funding, the JSS needed to document and assess the various effects of the program.



Our Goal

The aim of this project was to develop a case study to inform the future expansion of the Regenerative Plastics Program.



To develop our case study, we relied on several objectives and methods as shown below.

Goal:

To develop a case study to inform the future expansion of the Regenerative Plastics Program.

Objective 1

Document the development of the program

Methods:

- Reviewed JSS and WPI reports and documents as well as news stories about the program
- Interviewed RP Program leaders and previous WPI project team to create a timeline of the development of the program and understand challenges they have faced
- Observed two recycling workshops to understand the process better

Objective 2

Assess the social and environmental impacts of the program

Methods:

- Surveyed participants at the beginning and end of workshops to determine individual social changes
- Analyzed feedback forms from past teacher participants to learn emotions reported and reactions after the workshop
- Interviewed RP Program leaders to create a map of program partners

Social Impact

Environmental Impact

- Interviewed program leaders to determine number of caps diverted from landfill
- Measured energy used to run recycling machinery

Objective 3

Recommend how the program can be enhanced and adapted

Methods:

- Interviewed a teacher and Head of Sustainability to gain insight on the interest and ability teachers and schools may have for integrating the program
- Interviewed RP Program leaders to determine challenges and lessons learned

Our research instruments and our methods described in more detail are included in our Supplemental Materials, which may be accessed at <https://digital.wpi.edu/> by typing the name of this study into the search bar.



Results

Case Study Overview

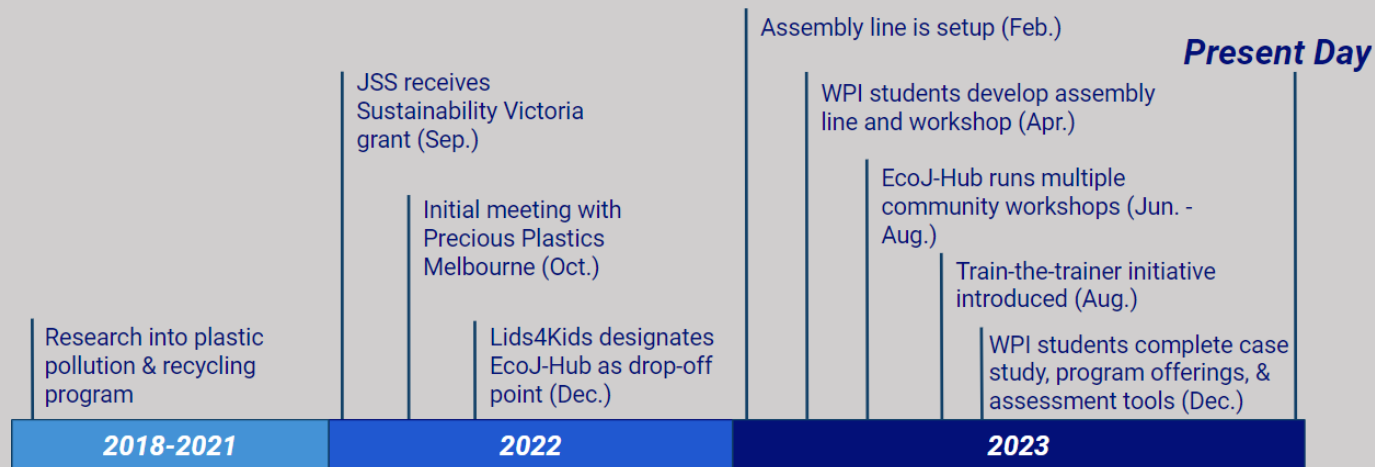
We developed a case study of the Regenerative Plastics Program that includes the following sections: Introduction, Development of the Program, Program Impact, Challenges, Next Steps, and Conclusion.

Introduction

We conducted research into the global plastic pollution problem and why bottle caps specifically are a major pollutant. We also note that individuals require both knowledge and skills to adopt and promote sustainable behaviors. In the case study, we use this research to introduce the program and its purpose.

Program Development

We constructed a comprehensive timeline of the program with information gained from interviews with program leaders, an interview with the past WPI team involved in its development, and documents created by these groups. This timeline spans from the program's conceptualization to its current state, offering a detailed account of its progression over time. This timeline includes major milestones including when the grant was received, when the assembly line was set up, and when the first community workshop took place. The program contains two aspects: an assembly line, and a hands-on workshop. We directly observed these components in order to describe them in the case study. This section also contains information on the types of products created with the assembly line and the packaging that was developed to show the story of how the products were made.





Partnerships

The Hub works with other organizations to extend the reach of this program and deepen community impact. An interview with program leaders allowed us to determine the many partners and the roles that they play. We mapped these groups of partners and their relationships with the Hub in terms of this program. The program has engaged 397 individuals as of December 14, 2023. Some participants took part in the full-length workshop, while others received presentations, demonstrations or outlines of the program.

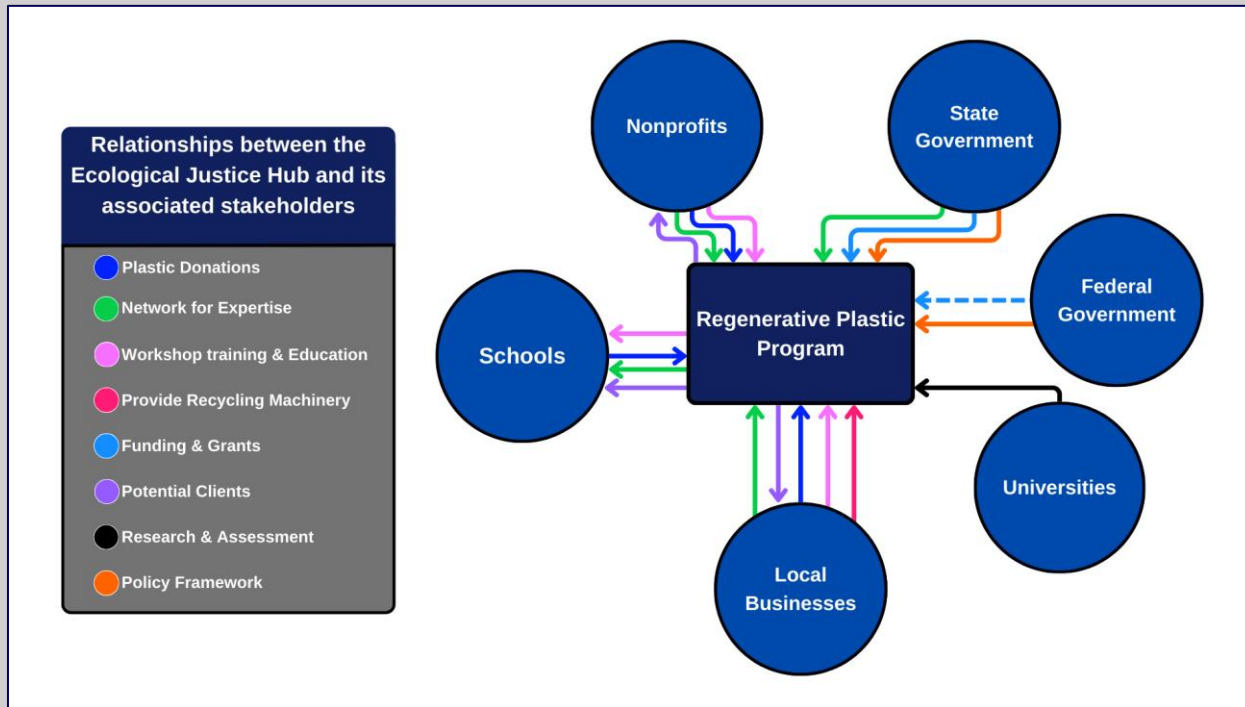
Impact on Workshop Participants

An open-ended survey was completed by 57 participants after a workshop. The questions gauged participants' general reactions and feelings after completing the RP workshop. The most common emotions reported after the workshop were “inspired” and “motivated”. The survey also shows that a majority of participants reported that they gained ideas, knowledge, and perspectives.

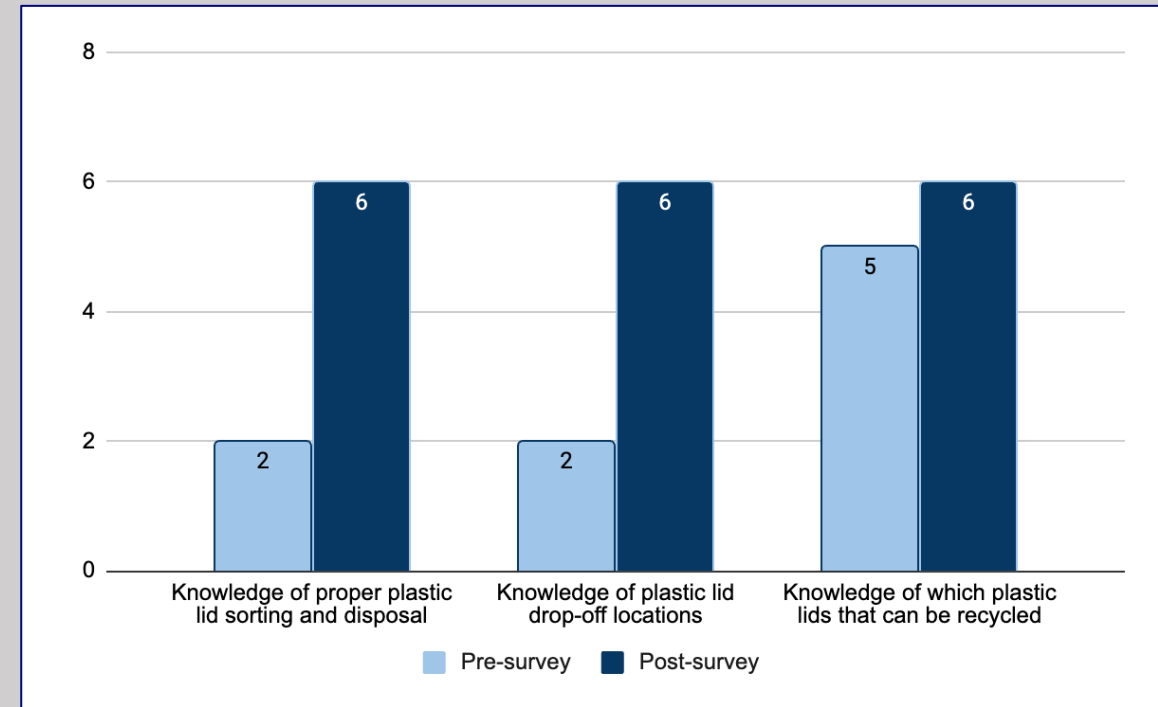
We piloted pre- and post-workshop surveys with 8 workshop participants, and the responses indicate that participants gain knowledge and intend to change behaviors regarding recycling and spreading knowledge of proper recycling.

Environmental Impact

The Hub acts as a drop-off point where individuals and communities can donate plastic caps to be recycled. We conducted interviews with the program leaders in order to gain information on the quantity of caps that have been donated into the Ecological Justice Hub to determine how much plastic has been diverted from landfills. Additionally, we utilized a power meter to measure the amount of energy it took to run the machinery used in the recycling process.



Map of relationship between the Ecological Justice Hub and its associated stakeholders for the Regenerative Plastic Program



Responses from pre- and post-workshop surveys highlight the benefit of utilizing these surveys to record impacts made on participants through the program.

Challenges

Throughout the development of the Regenerative Plastic Program, there were several barriers that needed to be overcome. During interviews with the program leaders, we discussed the various challenges that the Ecojustice Hub faced and how they were able to get past these barriers. Additionally, we discussed what lessons were learned through the development of the program, what current challenges have been presented, and what solutions the Hub intends to enact.

One of the primary challenges of the program was limited expertise surrounding the development of a plastic recycling assembly line and workshop. Collaboration with various groups allowed the Hub to gain the expertise that was needed for the workshop's progression.

Another challenge was that the assembly line was inefficient. The benchtop shredder is not able to process many caps at once and shreds them slowly. The Hub worked with a company that allowed them to use their granulator, which can process and shred caps at a faster rate. The Hub also fundraised to buy a granulator and other equipment to improve the assembly line.

To increase program reach, The Hub learned that developing a train-the-trainer program for teachers could allow the program to impact a larger audience. This enables the Regenerative Plastic Program to increase the awareness of plastic pollution and bottle cap recycling by training teachers that will educate their students who will then bring the education home to go on and educate their family and friends.

The final lesson learned through the development of the program was the importance of teaching individuals the skills and knowledge needed to act against plastic pollution. Many individuals are enthusiastic about making a positive difference in their community, but if the wrong steps are taken, then the efforts are not effective.

Conclusion and Next Steps

Following the assessment of the program's development, challenges, and impacts, our team outlined various recommendations to improve their reach and productivity. The first recommendation for the program would be to implement the surveys developed by our team, and to record the amount of bottle caps collected, to determine the social and environmental impacts of the program. The second recommendation would be to integrate parts of, or the entirety of, the workshop into schools by utilizing a set of program offerings to be given to interested schools. These offerings show different adaptations of the program that can fit the needs and funding for various schools. The final recommendation would be to hire a part-time administrator to help with program outreach, record keeping, assessment of the surveys for the impacts, and customer service for implementing the program into schools. Our case study will help inform the program leaders and interested parties of the development of this program. The case study also describes the steps the Hub can take in the future in order to expand and broaden their community impact.



Challenges

- Need for variety of expertise
- Inefficiencies in production
- Limitations in program reach

Lessons Learned

- Networks can provide access to a variety of expertise
- Training trainers can broaden impact
- Enthusiasm is not enough, skills and knowledge are also needed for sustainable behaviors