

# **Improving Single-Use Plastics Consumption at UBC Geering Up**

for  
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December 19, 2019

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**ABSTRACT**

Single-use plastics are renowned for their accessibility and popularity. In light of efforts in environmentalism this report was written and addressed to the manager in the goal helping UBC Geering Up, a non-profit engineering outreach organization reduce its plastic waste while helping lower expenditures.

This report includes background information on single-use plastics, analysis of views and opinions on single-use plastics at Geering Up, and suggestions for improving plastic consumption. Data was gathered from research articles, interviews with current staff, and surveys of staff and participants. Most are in favor of working towards choosing more sustainable materials to work with.

The report recommends alternative items to replace the top ten most used single-use plastic items in addition to raising more awareness on the role of plastics at the company as administrators and curriculum planners, and modifying activities to implement more reusable materials. If Geering Up successfully incorporates these suggestions into its short and long-term goals, then the organization will strive not only as a key player in STEM education, but also as an ambassador of sustainability.

## **INTRODUCTION**

### **A. Definition of single-use plastics**

The world has grown to depend on plastic products over the last three decades. Plastics are versatile, cheap, and convenient. They fall under two main categories: thermoplastics, which are most malleable and reversible, and thermosets, which undergo irreversible chemical change when heated. Conveniently, both types of plastics also have single-use applications. By definition, plastics that are intended to be discarded after one use, include a variety of packaging, bottles, bags, cutlery, and containers, are deemed “single-use plastics” (Giacovelli, 2018).

### **B. Introduction to Geering Up and its consumption of plastic products**

UBC Geering Up is an engineering outreach organization that focuses on using hands-on activities to engage students in Science, Technology, Engineering, and Math (STEM). In the past two years there has been significant growth in Geering Up’s programs, with an annual reach of over 24,000 students. However, its expansion also brings on the need for more materials, in particular those containing single-use plastics.

By reversing this trend, the company may produce a smaller carbon footprint while potentially decreasing its expenditures. Currently plastic products and adhesives that are seldom recycled and broken down contribute to the majority of the waste. In the last few years the organization has delivered thousands of workshops annually and has spent hundreds of thousands of dollars on single-use materials. Most workshops involve taken-home projects that are short-lived and materials that are disposed of at the end of each session. At the end of the Summer, copious amounts of plastic products are thrown away because they cannot be used again or are damaged.

### **C. Purpose of this report and intended audience**

The University of British Columbia is the leading university in Canada and the third in the world for sustainable cities and communities. As part of the university, Geering Up also plays a role in upholding similar values. In April 2020 UBC will be raising the cost for single-use plastic cups, which is a great opportunity for Geering Up to make a shift to using more reusable materials. Additionally this may decrease the cost of needing replenishing single-use materials frequently.

This report is intended for Jakob Manning, manager of Geering Up. Mr. Manning oversees all of the organization's programs, the budget, and coordinates with the faculty of Engineering, under which Geering Up runs. He has been involved with the company for over 6 years and is always looking for ways to expand our reach. As manager, everything must be approved by him first, including recommendations in his report.

### **D. Description of data sources**

To determine whether or not there is a need to reduce single-use plastic at Geering Up, this report considers primary sources of data which include interviews and surveys. Interviews were conducted on current staff, including the Materials Student Assistant, Teacher Pro-D Student Assistant, Local Events Student Assistant. Also, an anonymous survey was presented to current and past staff and participants.

## **DATA SECTION**

### **A. History and vision of Geering Up**

Geering Up started as capstone project by a mechanical engineering student in 1995 at the University of British Columbia. The organization introduced high school STEM programs in 1999, and shortly after, Indigenous programming in 2000. Geering Up always had a mission to make STEM accessible to kids and youth. A volunteering program was initiated in 2004 and an Integration Support role in 2005. Following these, many expansions were made in Surrey, White Rock, North Delta and North Vancouver. Geering Up's vision is to make STEM accessible to all, regardless of who they are. Evident in its efforts to be impactful and innovative as a part of UBC, currently certain staff are considering ways they could improve on the aspect of sustainability.

### **B. The role of plastics at Geering Up**

Geering Up runs the majority of its programming in the summer, which is comprised of workshops and camps for over 20000 children and youth. From May to August the Engineering Student Center and Engineering Design Center are filled with supplies from top to bottom. Much of those supplies are made of plastic and not reusable. On top of the supplies ordered for workshops, camps, and local events, there is a large reservoir of general supplies that include Ziploc bags, plastic bottles, plastic wrap, and adhesives. On the very last day of the Summer season, piled outside of the Engineering Student Center is a collection of plastic bins, plastic hangers, plastic waste and packaging (Figure 1). Similar heaps of trash to be thrown away are collected in two other locations.



Figure 1. Large pile of garbage to be thrown out on move-out day. The picture was taken in the morning, and represents about one sixth of the total trash thrown out. Photo taken by author.

### **a. Workshops**

Geering Up runs workshops for grades K - 12 students across the lower mainland and in northern BC. A majority of materials used for workshops are plastic-containing bottles, bags, containers, cups, straws, and food wrap. Various bottles are used to make take-home projects such as mini biodomes and thermometers. Containers and bags are used to transport materials. Cups and straws are mainly used for design challenges and take-home projects as well.

### **b. Camps**

Each curriculum planner is responsible for planning a camp that runs four to eight times in the Summer and ordering the materials for each participant with a budget of \$20 - \$30 per participant per week. The bulk of the budget goes to single-use items, especially plastic containing ones. For example, one of the 2019 high school camps spent \$1000 on PVC piping, Styrofoam balls, and bubble wrap.

### **c. Local Events**

Local events is another category of programming that reaches thousands of students and teachers each year. These events are similar to workshops but run during the school year instead of the Summer and the staff are mainly part-time rather than full-time. Similarly, the issue of single-use plastics is evident but in addition, new and part-time staff often opt for more convenient options

that may not be the most sustainable ones because they are more pressed for time than the summer staff.

### **C. Breaking Down Plastics**

One of the environment's biggest challenges is tackling plastic waste that often ends up in overflowing dumps, landfills, or the ocean. Though recycling plastics is one way to go, the truth is, plastics never fully go away. Instead, they photodegrade into smaller and smaller pieces of microplastic (Giacovelli, 2018). Certain products containing polystyrene foam such as plastic bags may take thousands of years to decompose, resulting in pieces of floating trash in the oceans harming marine life, or in overflowing dumps contaminating water and food sources.

Even biodegradable plastics made up of plant or bacteria byproducts usually require large amounts of heat to be broken down and likewise will not degrade naturally on their own (Giacovelli, 2018). During the process of breaking these plastics down, toxic chemicals may leach into the water or contaminate the air. Over the last decade, numerous bans have been set in the effort of putting a halt to the increasing trend of single-use plastic items. But still, single-use plastics remain one of the biggest contributors to plastic waste in the world.

### **D. Impact of plastics at Geering Up**

#### **a. Data from surveys**

Geering Up staff and participants were surveyed to determine the need for reducing single-use plastics. According to the data, most people support organizations that are environmentally friendly and recognize room for improvement at Geering Up.

The survey found that about three quarters of people surveyed find that Geering Up uses half or less than half of sustainable materials during workshops, camps and events. Only a small portion observed otherwise (Figure 2). In fact, the majority of staff and participants believe there to be alternative materials to plastic ones (Figure 3) and estimate a yearly spending of \$19, 563 on single-use plastic items (Figure 4). About half of the survey participants would opt for an organization if they were more environmentally friendly than Geering Up (Figure 6) but fortunately there is a lot of support for Geering Up prioritizing sustainability (Figure 5).



## Improving Single-Use Plastics Consumption at UBC Geering Up

Do you think Geering Up uses sustainable materials during workshops, camps, and events?

20 responses

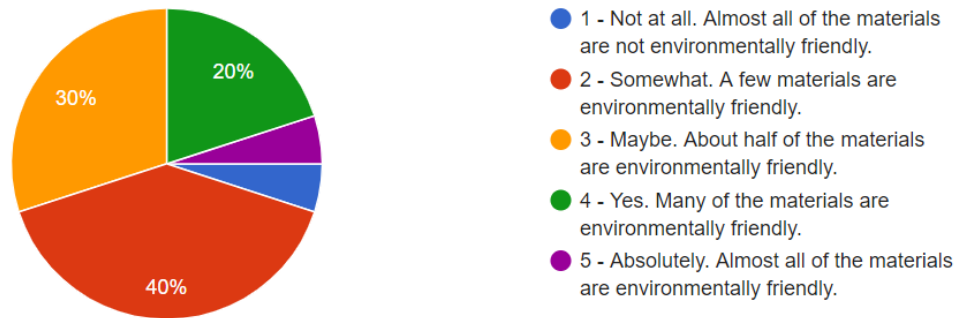


Figure 2. Survey responses for perception of sustainable materials at Geering Up.

Have you observed instances where Geering Up could use single-use plastic alternatives?

Please elaborate if possible.

20 responses

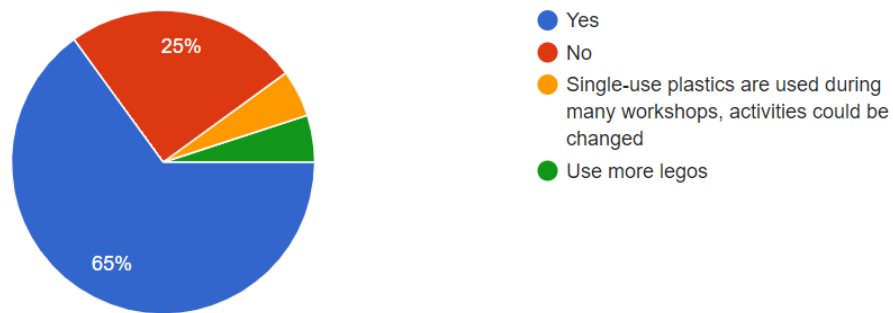


Figure 3. Survey responses for single-use plastic alternatives.

Estimate how much money was spent on single-use plastics in the 2018 - 19 school year.

20 responses

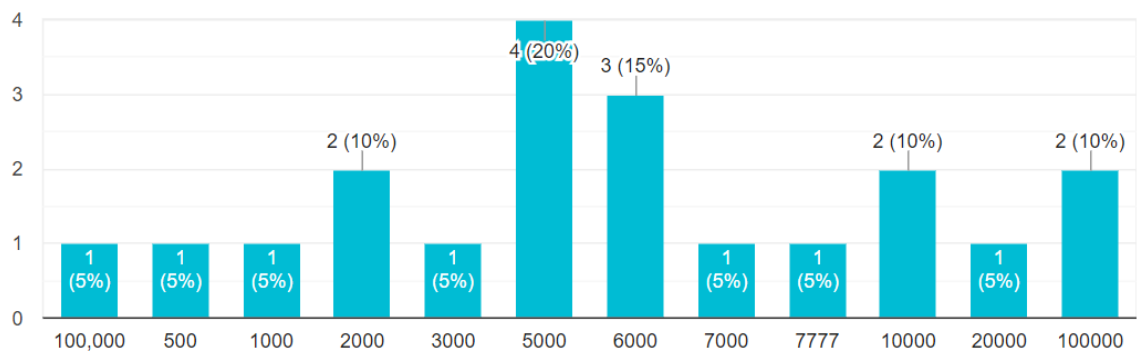


Figure 4. Survey responses for estimation of money spent on single-use plastics.

How important to you is Geering Up being an organization that cares for the environment?

20 responses

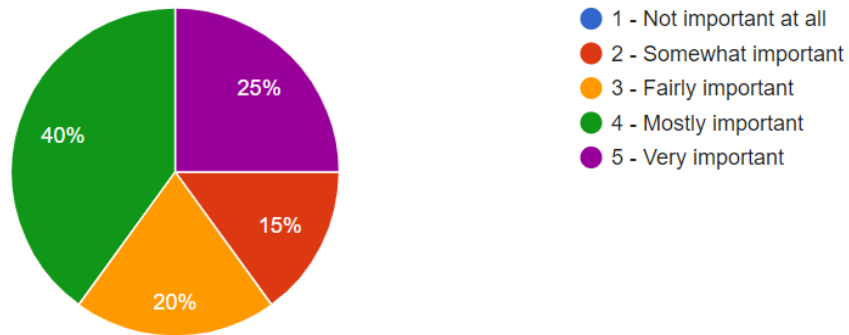


Figure 5. Survey responses for the importance of Geering Up being an environmentally-friendly organization.

Would you choose another organization over Geering Up if they were more environmentally friendly?

20 responses

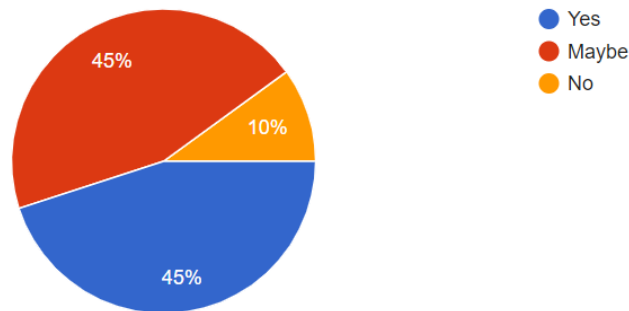


Figure 6. Survey responses for organization preferences in regards to sustainability.

### b. Data from interviews

Interviews were conducted with the Materials Student Assistant (MSA), the Teacher Pro-D Student Assistant (TPSA), and the Local Events Student Assistant (LESA). The data collected helped clarify the reasons why there is still so much plastic use at Geering Up and encourages

the organization to be more conscious of its actions. The main identified reason of rampant plastic use is because plastic is a very accessible resource. But once Geering Up switches to a greener mindset, replacing single-use plastics will become easier (LESA).

The interviewed staff recognize the need for a shift away from plastics, and are already taking measures such as purchasing reusable items, modifying curriculum to accommodate other materials, and getting rid of certain non-essential materials all in all. One specific example given by the LESA is to implement reusable materials during an ocean cleanup activity instead of the ones used, which included plastic bags and plastic cups, because the purpose of the activity should also be reflected in the materials used. Another opportunity to reduce plastic is eliminating plastic bottles in the “Thermal Theatrics” workshop and creating another take-home activity such as a candle or a solar powered device (TPSA). Lastly, the MSA who is in charge of 90% of materials ordered believes holding an hour-long session on sustainability of materials during training seasons will help drastically with reducing plastic waste.

### **E. Proposed solutions for plastic reduction**

#### **a. Plastic alternatives for the ten most common items**

In 2019 over \$100, 000 was spent on materials and about a third of the expenditures contributed to single-use plastic materials. The following shows roughly how much money was spent for the most common single-use plastic-containing items. The alternatives are just suggestions and can be modified to best suit the activity(s) they are to be purchased for. Ultimately eliminating or greatly reducing these products is most ideal as other materials can often be used to achieve the same purpose. Though the initial cost may be higher, the cost of replacing materials will decrease in the long run.

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Item	Estimated total cost from workshops and camps season 2019 (in CAD)	Alternative Products	Reasoning behind alternative products
Plastic cups	6000	Paper cups/mugs	Paper cups have the same function as plastic cups mostly. For beverages, reusable cups are more sustainable.
Disposable plastic containers	6000	Glass containers/ cardboard boxes	For activities, glass containers can have the same function as plastic ones. Cardboard boxes may be used for storage instead of plastic containers.
Duct tape	5000	Scotch tape/grafting tape/string/ elastic bands	Duct tape contains more plastic than the alternative tapes. In many cases, elastic bands are a great reusable substitute and are just as strong as duct tape.
Juice boxes - 200mL	5000	Larger bottles of juice	A larger volume to surface area ratio decreases the amount of material needed for the amount of juice contained.
Plastic Salbro bottles	4000	Recyclable beverage bottles	Using old beverage bottles that are washed out eliminates the need to purchase new single-use plastic bottles.
Ziploc bags	2000	Wax paper bags/cloth pouches	Ziploc bags are mostly used to transport materials, and therefore can be replaced with paper/cloth bags when transporting non-liquids.

Plastic spoons	2000	Wooden spoons/metal spoons/popsicle sticks	Wooden and metal spoons are more sustainable/reusable than plastic ones. Popsicle sticks often fulfills the purpose of scooping that a spoon does.
Plastic wrap	2000	Paper + elastic band	Paper and elastic bands may be used together to cover items.
Plastic straws	1000	Paper straws/Metal straws/Rolled-up cardstock	Paper and metal straws are more sustainable/reusable than plastic ones. For certain activities, rolled up pieces of cardstock may act as straws.
Styrofoam balls	750	Modelling clay/playdough	Styrofoam is usually used to make models and the alternatives work just as well, or even better.

Table 1. Ten most common single-use plastics, their alternatives, and reasons supporting the alternatives.

**b. General suggestions**

Given that Geering Up is an organization that strives to make a positive impact on education, there is also responsibility in modeling environmental sustainability to the thousands of people it reaches each year. To help Geering Up shift towards producing less single-use plastic waste here are some suggestions that could be implemented as early as the next camps season:

- **Raising awareness at the management level**
  - Reviewing sustainable development goals at Geering Up
  - Setting a good example for other employees by taking initiatives on reducing single-use plastics
  - During training of new employees, placing emphasis on being mindful of how much plastic is used

- **Making better decisions as Curriculum Planners**
  - Being environmentally-conscious while planning curriculum for workshops, camps, and local events
  - Being mindful of ordering materials and ordering materials in bulk quantities
  - Planning curriculum based off of available and sustainable material options
  - Reviewing the effectiveness of take-home activities to try to make them longer lasting
  - Capitalizing on the flexibility of design challenges to explore new and more sustainable materials
- **Planning activities and events that are more technology oriented.**
  - Incorporating technology in activities to increase reusability of items and decrease the need for single-use plastics
    - Examples of technology Geering Up already has: laptops, tablets, robots, microcontrollers, Arduinos, circuit sets

## **CONCLUSION**

The impact of reducing single-use plastic waste at Geering Up is a step towards being more environmentally conscious while decreasing financial expenditures. As a growing organization, this goal is something everyone can be a part of.

### **A. Summary and overall interpretation of findings**

Based on data collected from staff and participants at Geering Up, there is a strong urge to shift towards using more long-lasting materials for all events. The organization could potentially gain more people and save money by shifting away from plastic. Data from research papers also outlines the harm of single-use materials on the environment and living beings, further supporting Geering Up's move away from single-use plastics.

### **B. Recommendations**

To help Geering Up be more environmentally-friendly, this report mainly recommends changes centered around replacing currently used plastic items with options that are reusable or compostable and raising a culture of mindfulness around choice of materials. Suggestions for alternatives to the ten most popular single-use items would decrease waste production and decrease the amount of money spent on replacing these items frequently. Awareness at the manager and coordinator level on usage of plastic materials could lead to changing the way things are done at the instructor levels.

## REFERENCES

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## APPENDIX

### Interview questions to determine staff perception and suggestions for single-use plastics at Geering Up

- 1) Describe your role at Geering Up.
- 2) Do you find reducing plastic at Geering Up waste to be important?
- 3) What measures have you personally taken to reduce single-use plastic waste?
- 4) Which ways have been successful? Which have not?
- 5) How can we modify some activities to eliminate single-use plastic waste?
- 6) Do you think reducing the amount of plastic waste will make it harder for Geering Up's curriculum planners and instructors to come up with and deliver programming?

### Interview questions to determine staff and public perception and suggestions for single-use plastics at Geering Up

1. Do you think Geering Up uses sustainable materials during workshops, camps, and events?
  - 1 - Not at all. Almost all of the materials are not environmentally friendly.
  - 2 - Somewhat. A few materials are environmentally friendly.
  - 3 - Maybe. About half of the materials are environmentally friendly.
  - 4 - Yes. Many of the materials are environmentally friendly.
  - 5 - Absolutely. Almost all of the materials are environmentally friendly.
  
2. Have you observed instances where Geering Up could use single-use plastic alternatives? Please elaborate if possible.
  - Yes \_\_\_\_\_
  - No \_\_\_\_\_
  
3. Estimate how much money was spent on single-use plastics in the 2018 - 19 school year.  
\_\_\_\_\_
  
4. How important to you is Geering Up being an organization that cares for the environment?
  - 1 - Not important at all
  - 2 - Somewhat important
  - 3 - Fairly important
  - 4 - Mostly important
  - 5 - Very important

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5. Would you choose another organization over Geering Up if they were more environmentally friendly?

- Yes
- Maybe
- No

6. Do you have any suggestions for Geering Up on reducing plastic waste?

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7. Are you a Geering Up staff, or a participant of Geering Up's programs?

- Staff
- Participant