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## INTRODUCTION/ABSTRACT

3D printing is an ever-expanding method of manufacturing. It is used on a wide scale, from an individual hobbyist to industries such as aerospace manufacturing, biomedical devices, mechanical engineering, and more. Since 3D printing is already used so commonly and is continuing to grow, we need to analyze how waste can be cut down. 3D printing with plastic filament tends to create a lot of plastic waste that often gets thrown out. This contributes to a widespread problem of general waste, with plastic being particularly harmful to the environment. Currently, 3D printing projects result in excess material waste, which can be from supports, failed prints, prototypes that did not work, or a host of other reasons. Numerous types of material can be used in a 3D print, but we are focusing on plastic-based filament. This type tends to be the most widely used. Our research investigates the environmental impact of current 3D printing waste and waste disposal methods. We were able to find strategies to help maintain 3D printing waste by interviewing Cleveland State University's MakerSpace manager and casting a survey on campus. We also used online resources to help find out how individuals reduce and dispose of filament waste. This research works towards more sustainable options for plastic FDM filament waste.

## OBJECTIVES

- Spread awareness about the lack of recycling and amounts of waste being produced
- Reduce the environmental impact of printing industry
- Inform users on proper waste management techniques

## METHODS

- Interviewed the Dan T. Moore MakerSpace Manager, Matthew Johnson, to find out the recycling system at Cleveland State University when it comes to 3D FDM filament.
- Created a focus group for students to discuss what they do with their 3D printing filament waste and how they think waste should be handled.

## RESULTS

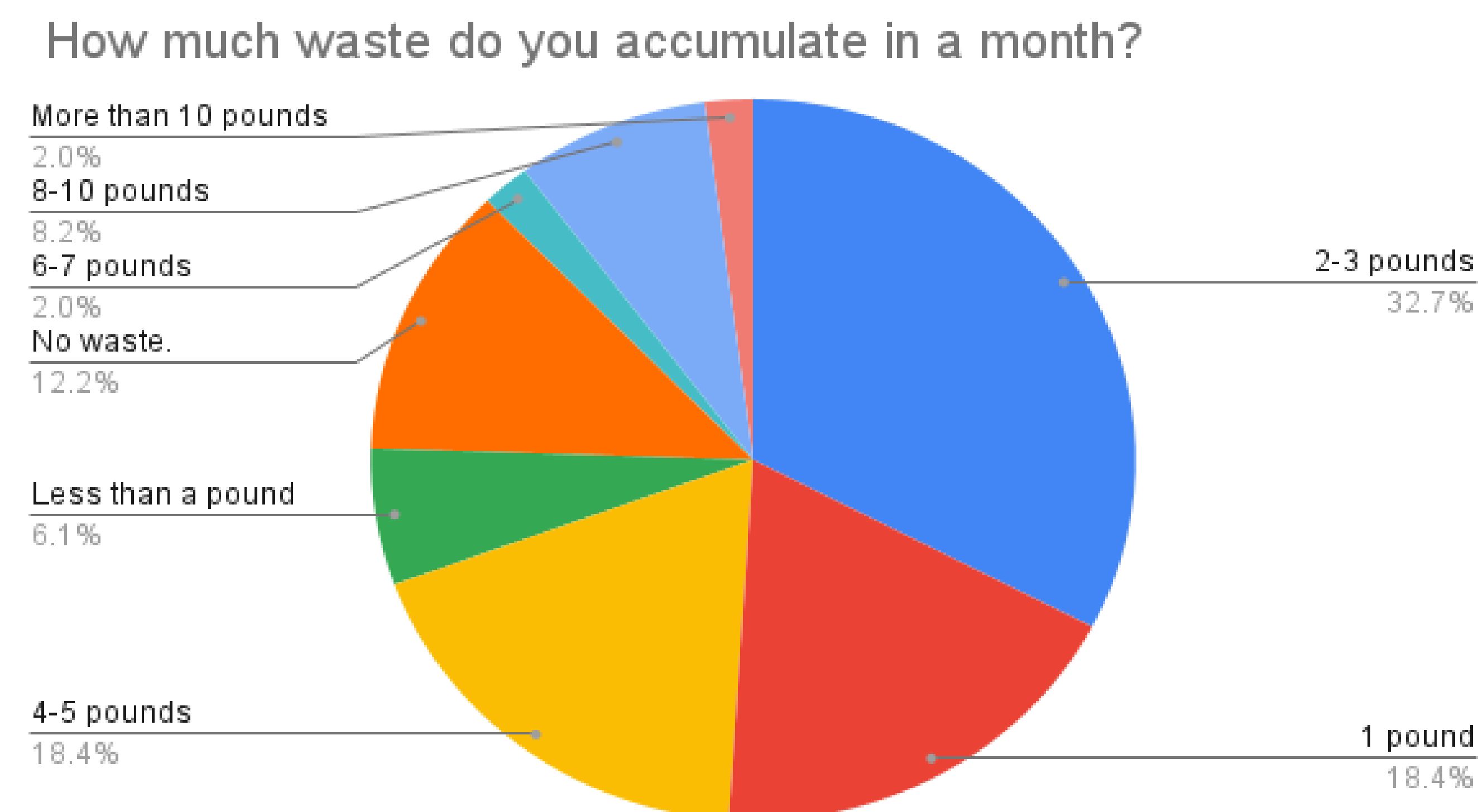


Figure 1. Campus Focus Group Results for 3D filament waste.

- In figure 1, the focus groups results show that the average waste amount is 2-3 pounds. Which is not a lot but as month passes those pounds will add up.
- In the interview with Makerspace manager, there are some steps being taken to limit the amount of waste produced on campus.
  - “Students are limited to the amount of material (in grams) they can print. This keeps students from unnecessarily printing” (Johnson).
- In figure 2, the focus group results show how the average user does not have recycling methods established.
- The majority of students surveyed threw away their accumulated filament waste.

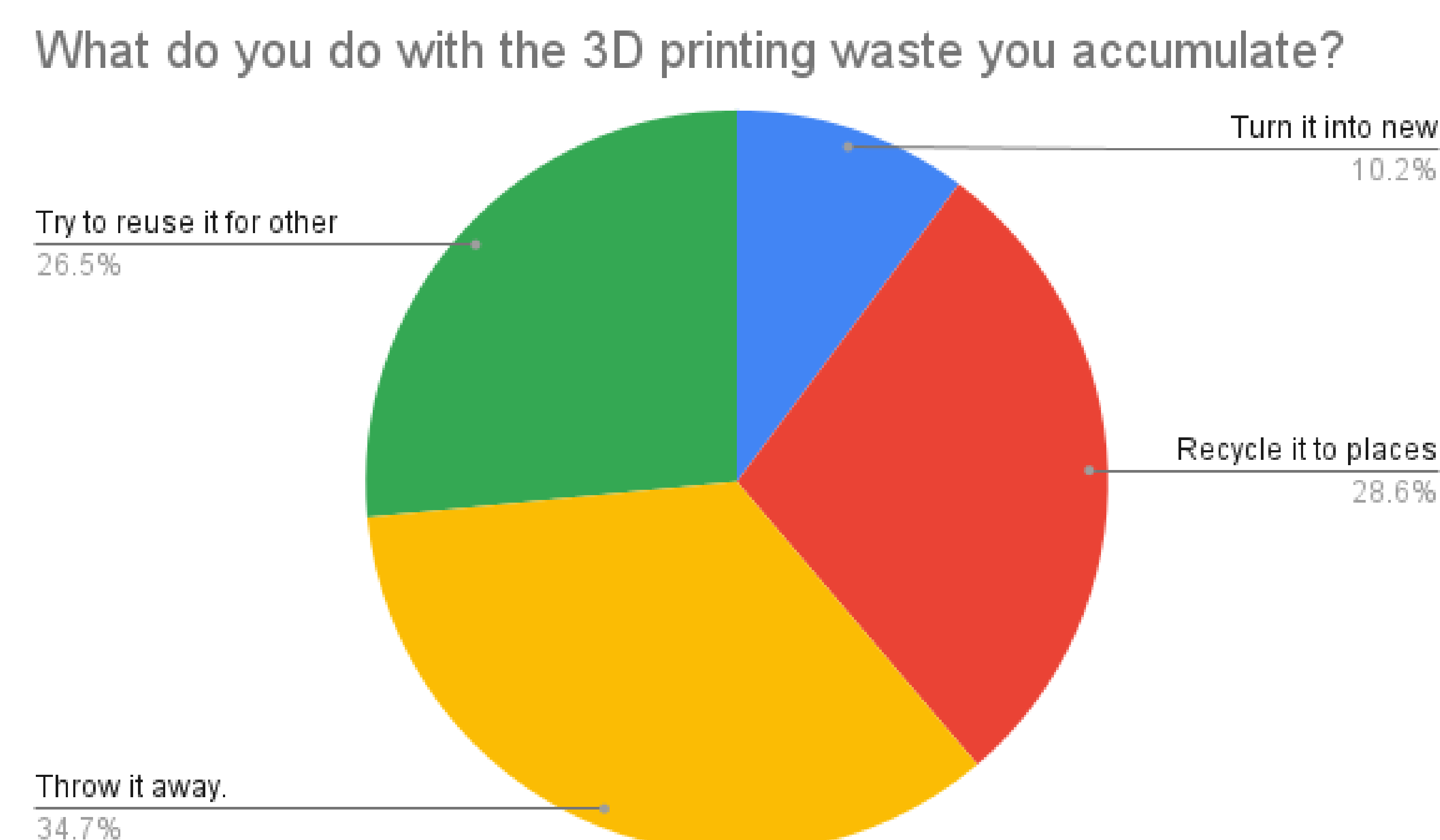


Figure 2. Campus Focus Group Results for accumulated filament waste.

## FUTURE WORK

Future work would include reaching out to printing companies and other universities in Northeast Ohio such as Case Western, who have their own printing workspaces, to learn more about their practices. After collecting these practices, they would be consolidated to work with current techniques on Cleveland States campus. Our focus group would then compare new practices to establish their efficiency.

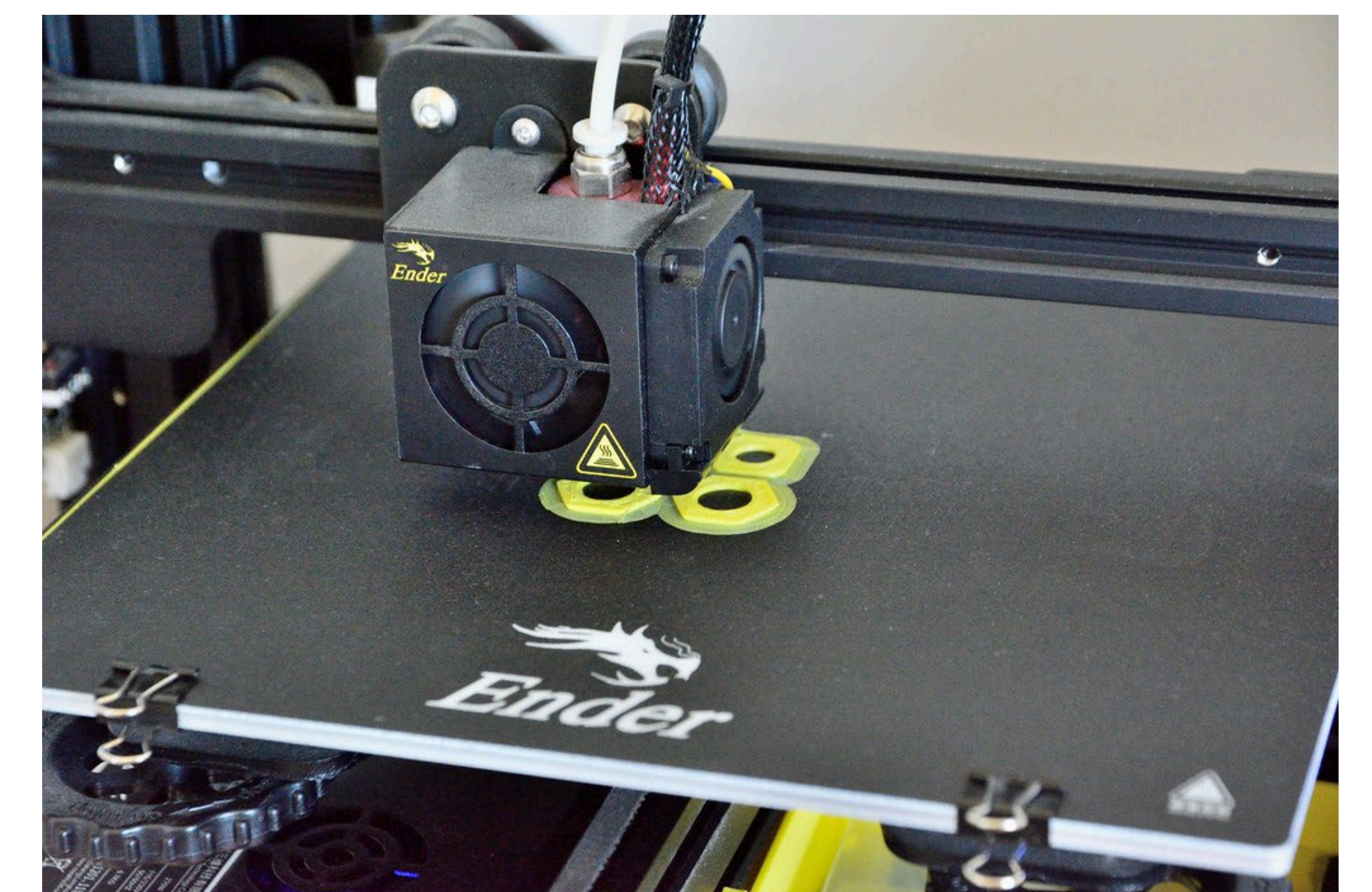


Figure 3: Example of an FDM printer (Creality Ender 3) in action

## CONCLUSIONS

Overall, on average, students waste about 1-5 pounds of filament. Cleveland State University has been making progress towards reducing 3D printing waste. Some ways to reduce waste is to have 3D printer stations in which printers can give scrap to have it repurposed or ensure that printers know that there are more options when it comes to getting rid of their scrap. Students have reported that making easy access points for recycling or finding a way to combine wasted filament would be the best ways to reduce waste.

## References

All3dp.com. All3DP. (n.d.). <https://all3dp.com/>

## Acknowledgments

Matthew Johnson – Faculty Advisor