2023 Waste Sorting Practice Project for Recycling

Plastic Bottles & Beverage Cans for Proper Waste Sorting and Recycling PICTOGRAM LABEL

Introduction

Today, many people use plastic bottles and canned products, which generates a large amount of waste. These products can be recycled if they are discarded in the right way. However, they can only be incinerated or reclaimed when disposed of improperly, causing environmental pollution.

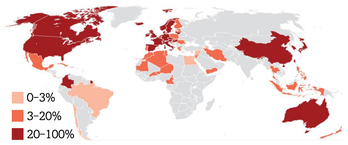
We observed students' consumption and disposal of various types of PET/canned products. Many PET/can products used in the cafeteria were not recycled properly. While looking for ways to solve this problem, we devised the idea of attaching a pictogram label to a product that indicates how to recycle the product properly.

In this study, we investigated how many 'pictogram labels' actually helped and if they were effective for proper recycling.

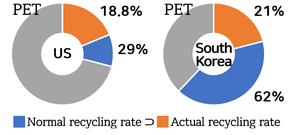
Background

Source : World Bank Group <2017 Atlas of Sustainable Development Goals> /NAPCOR <2018 PET Recycling Report> /World Economic Forum <The Climate Progress Survey Business & Consumer Worries & Hopes>

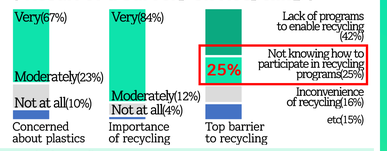
| The Recycling Rate of Each Country |



| Normal-Actual Recycling Rate |



| Result of a Survery on Recycling |



In the OECD's 2020 report, 25 of 32 major countries had recycling rates exceeding 20%, but this is based only on nominal recycling rates.
The nominal recycling rate refers to the amount of waste collected from a recycling company or facility. However, the actual recycling rate is the rate that was actually recycled through the recycling process. The actual recycling rate decreases if the waste is not recycled properly. As can be seen in the graph of US and South Korea, the nominal recycling rate is high, but the actual recycling rate is significantly lower.
In addition, according to the WEF survey results, most people felt the importance of plastic and recycling problems, and 'not knowing how to participate in recycling programs' was a big part of the question of barriers to recycling. So, recycling waste properly is essential.

How to Sort Waste for Recycling

Rinse & Remove the Substance and Discard.
Remove the plastic label and crush the bottle.
Close the lid and discard.

Empty the contents and squeeze. Reduce the volume and discard.

Source : https://www.korea.kr/main.do

Pictogram Label Idea

To increase the actual recycling rate!

Attaching Pictogram Labels

- **What is the Pictogram Label?**
  Pictogram Label is the label(or packaging) of the plastic bottles/beverage cans incorporating a picture of the proper recycling method.
- **How to Make a Pictogram Label?**
  It was made by creating icons about recycling and adding short phrases.
- **What is the Goal of the Pictogram Label?**
  Its goal is to inform the proper recycling method and increase the actual recycling rate.

| Pictogram Labeling Experiment; Plan |

Pictogram Labeling Experiment

Date : 5/23~5/27/2022
(Pre-Labeling Experiment)
5/30~6/3/2022
(Post-Labeling Experiment)

Target : Ulsan Science High School

Method
1) Attach pictogram labels to plastic bottles/canned products in the cafeteria
2) Analysis of PET bottles/canned garbage discarded in the recycling bin before and after attachment

Survey on the Proper Recycling

Date : 5/23~5/27/2022
(Pre-Experiment Survey)
5/30~6/3/2022
(Post-Experiment Survey)

Target : USHS Students

Method : Online Survey
(Google Forms)

Extended Experiment

- Check the long-term effectiveness of Pictogram Label
- Find out the optimal size of the Pictogram Label
- Test if the pictogram label works when the population is larger

Pre-Labeling Experiment

304(39.95%) of 761 bottles/canned products sold at the cafeteria were collected from the correct collection box during the period, and only 31 of them(4.07%) were properly recycled.

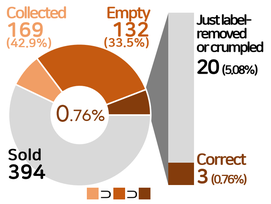
For plastic bottles, 169(42.89%) of 394 products sold during the period were collected from plastic recycling bins. 135(33.50%) were properly emptied, 20(5.08%) were only label-removed or crumpled, and only 3(0.76%) of them recycled properly. By classifying products by type (misclassified, label unremoved, uncrumpled, not emptied), the most common types were "label not removed" and "not crumpled" (159 and 179 out of 191), respectively.

For beverage cans, 135(36.78%) of the 367 products sold were collected from the can recycling bin. 127(34.60%) emptied, and 28(7.63%) were correctly recycled. By classifying products by type (misclassified, not crumpled, not emptied), the most common type was 'not emptied' (140 out of 183).

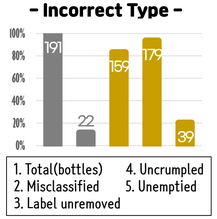
| Recycling Status of Plastic Bottles / Beverage Cans |

Recycled Correctly
31 (4.07%)

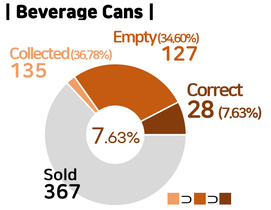
| Plastic Bottles |



- Incorrect Type -



| Beverage Cans |



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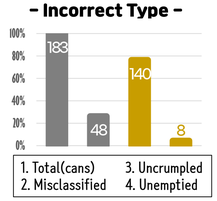
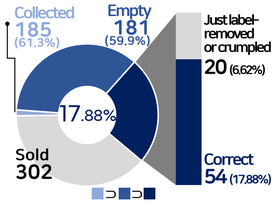


Post-Labeling Experiment

| Recycling Status of Plastic Bottles / Beverage Cans |

Recycled Correctly
172 (31.16%)

| Plastic Bottles |



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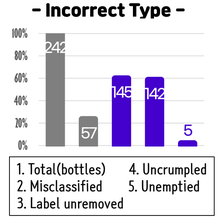
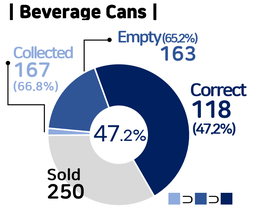
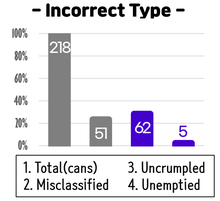


| Beverage Cans |



- Incorrect Type -



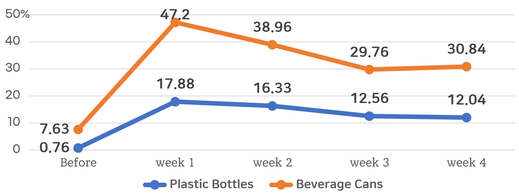
352(63.77%) of 552 bottles/canned products sold at the cafeteria were collected, and 172(31.16%) of them were properly recycled.

For plastic bottles, 185(61.26%) of 302 products sold during the period were collected from plastic recycling bins, 181(59.93%) were emptied properly, 20(6.62%) were only "label removed" or "crumpled", and 54 were properly recycled. By classifying products by type, ('label unremoved' and 'uncrumpled') (145 and 142 out of 242), the proportion of the total decreased significantly.

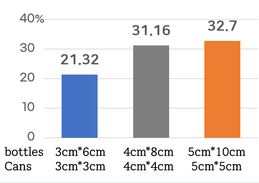
For beverage cans, 167(66.8%) of the 250 products sold within the period were collected from the can recycling bin, 163(65.2%) were properly emptied, and 118(47.2%) were properly recycled. By classifying incorrectly recycled products by type, 'uncrumpled' (62 out of 218) was the largest, but the proportion of the total decreased significantly.

Extended Experiment

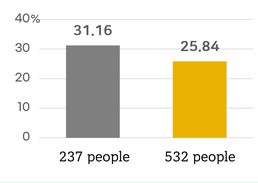
| Recycling Status over time |



| Size of Pictogram Label |



| Sample Group Size |



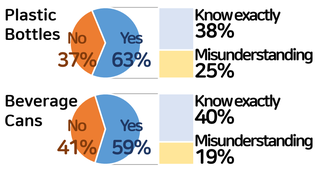
The recycling rate decreased over time when the experiment was conducted for 4 weeks. This result proves that pictogram labels are effective in the long term.

When we re-experimented with smaller and larger labels, the larger the label size, the higher the recycling rate. However, it did not increase significantly when the label size exceeded a specific size.

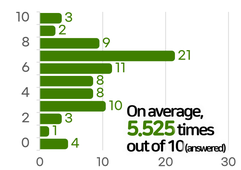
The recycling rate was a little lower in a larger group (dormitory school) with 532 people.

Pre-Experiment Survey

| Do you know how to recycle? |



| How well do you practice recycling? |



Before	Bottles	Cans
Sold	394	367
Correct	3	28

Actually...
0.407 times out of 10

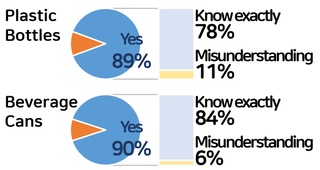
50 people(62.5%) said they knew how to recycle plastic bottles, but 20 of them(25%) wrote the wrong method. For beverage cans, 47 people(58.75%) knew how to recycle, but 15 (18.75%) did it improperly.

On average, the result of setting a degree of proper recycling on a scale of 0 ~10 times out of 10 is 5.525 times.

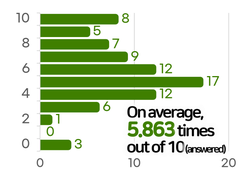
However, as a result of the pre-labeling experiment, only 31(4.07%) of 761 bottles/canned products sold were recycled properly. The experiment shows that students were not aware of the correct recycling method and practiced the wrong method.

Post-Experiment Survey

| Do you know how to recycle? |



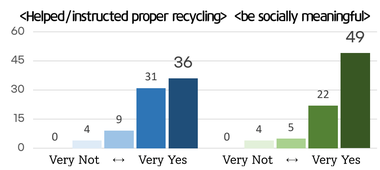
| How well do you practice recycling? |



After	Bottles	Cans
Sold	302	250
Correct	54	118

Actually,
3.116 times out of 10

| Did the pictogram label work? |



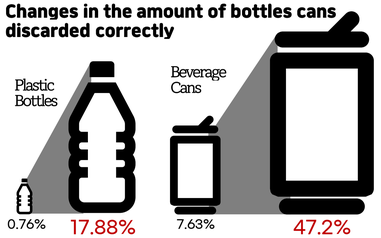
71 people(88.75%) said they knew how to recycle plastic bottles, and 62 of them(77.5%) wrote the exact method. For beverage cans, 72 people(90%) knew how to recycle, and 67 (83.75%) did it correctly.

On average, the result of setting a degree of proper recycling on a scale of 0 ~10 times out of 10 is 5.525 times. The results of the post-labeling experiment also showed that 172(31.16%) of 552 bottles/canned products sold were recycled properly, which was relatively similar to the answer compared to the pre-experiment survey. It shows that students were more aware of the proper recycling and practiced the proper method.

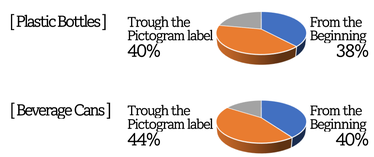
According to a survey of 'whether pictogram labels helped/instructed proper recycling', 67(83.75% / 'Very Yes'-36 and 'Yes'-31) were positive, with 'I don't know,' 'No' and 'Very Not' at 9, 4, and 0, respectively. In ' whether pictogram labels are socially meaningful in improving the status of proper recycling', 71(88.75% / 'very so'-49 and 'yes'-22) were positive. ('Don't know'- 5, 'No'- 4, 'Very Not'- 0)
Through this, pictogram labels directly help the correct recycling practice, and pictogram labels can play a significant role in socially improving the status of proper recycling.

Summary

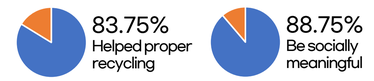
Changes in the amount of bottles cans discarded correctly



Change of correct recycling method cognitive rate



Perception of effectiveness



Conclusions & Suggestions

Prior to the experiment, students were less aware of proper recycling, but it was confirmed that students' awareness of recycling and actual recycling rate could be increased by attaching a pictogram label containing the proper recycling method.

It was also possible to see students misunderstanding the proper recycle method (how to recycle), but after the experiment, students' understanding of how to recycle was corrected, and it was observed that they put it into practice. Therefore, it can be seen that pictogram labels played a major role in increasing students' recycling rate.

Through this inquiry, it was found that pictogram labels contributed greatly to increasing the actual recycling rate of our school. If these pictograms are developed here and applied to actual products, it will be possible to increase the overall actual recycling rate by promoting people's proper practice of separate collection. In addition, it is expected to have a great social meaning that plays a role in environmental protection.