Sustainability Innovation

Comprehensive Approach In Promoting Sustainable In-school Garbage Classification

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Summary

Before our project, our school didn’ t have any means of garbage classification methods, though teachers and school management started to care this topic. Because of those factors, our project was totally new to our school and was widely supported by teachers.
During our first step in the project, we generated several solutions that we thought was most feasible. We noticed that a more functional trash can was required since the traditional cans have only one section. In addition, we realized that the supervision and teaching about trash was critical. Afterword, we did the questionnaires asking other students about the ways they thought that could efficiently promote classification and the problems about current situation about trash classification in school.
After analyzing those questionnaires, we found it similar to our ideas. Therefore, we decided to do several actions to promote trash classification in several aspects. Firstly, we decided to improve the trash cans after our first prototype which were three manmade trashcans that told us the result of using specialized trash cans. Secondly, we designed posters and brochures that have typical types of trash that students might generate (as pictures can be easily understand and remember). Thirdly, we arranged meetings regularly to each homeroom to provide them the idea of how important that the trash classification is and tell them the knowledge about trashes.
Unfortunately, the virus was spreading across so we were all in home—the prototype step was unable to proceed. The result is that the time for us to test the feasibility of the trash bin plan has to be shorten and the teaching session was not all successful because of internet and the tiredness of studying at home.
During the first time we went to school having offline study, we implement our first prototype which is three manmade cans. Ultimately, the result is quite good yet the time for us to test was short because the new virus case.
At September, we went to school again and we deploy many more formal trash cans that offered many feedbacks which is all listed in prototype section.
Currently, supervision is also a vital aspect of our success; we arranged a club to recruit group of students supervising others to classify trash properly. Students will also receive punishments or rewards if they classifiy wrongly or properly. The overall results are relatively positive because students and teachers have higher consciousness in garbage classification and most of them can follow the rules.
To conclude, we indeed solve some problems of garbage classification with the support from school, students and teachers. Further efforts are also required.

Identify the Challenges

The importance rank is from 1 (most important) to 6(least important to the project)
1.Public consciousness
Why the classify of garbage can’ t be promoted? It’ s because a lot of people tell us they don’ t know how to divide the garbage or no one is doing this. Some people think it’ s too troublesome, they are disinclined to do this. All these ideas reflect that people are lack of awareness of garbage classification and environmental protection. A lot of people don’ t know that if we don’ t classify garbage, the resources are waste and these garbage will occupy the land and lead to environmental pollution. For example, 4 billion plastic fast-food boxes, 500 to8 700 million instant noodles bowl and billion of pairs of disposable chopsticks are used in China every year. Between 30% to40% waste can be recycled. If people not sort them, these resources will be considered as garbage. What’ s more, a lot of waste that is not sorted also poses a threat of human heath. For instance, if battery are not be classified, they will release harmful substances which can even kill people. The environment issue is very serious. However, many people think it’ s far away to them, the resources are still a lot, they don’ t have to worry about this. If they don’ t do garbage classification, it’ s not a big problem, they think they just one in a million. Nevertheless, every single one has the same idea that they just a little part of the whole word, if they don’ t classify garbage, they probably wouldn’ t effect the word. When they get together, it’ s a big proportion, and have a hug impact to the whole environment. How can we really awake their awareness of garbage classification, give them more information about the negative consequences and touch them. We should remove the doubts and worries of people. Therefore, awake public consciousness is very difficult.

2.Supervision
We can’ t assure that everyone classifies the garbage and they classify it in a right way. It’ s because there are a lot of people in our school. In Japan, they have very detailed rules of garbage classification. For example, resource garbage is divided into mineral water bottles, glass bottles, paper, aluminium cans, iron cons, etc. In addition, each kind of garbage should be placed in the designated place at the specified time and there is an additional charge for discarding larger items. Garbage will be returned if it is not sorted or dumped at the right way, same as Germany and New Zealand. Maybe we can use the same approach, but surveillance camera can’ t catch everyone. This is because many people would cross trash can, and they may block the line of sight. Hence, it’ s hard to ensure everyone does garbage classification.

3.The arrangement of trash cans

In our school, we have garbage cans in every classroom and we have one at the entrance of public toilet. Besides, in the public lavatory, we also have one big trash can and many small trash cans in each toilet cubicles. There are a lot of trash cans, logically, the garbage should be enough for we to use. However, the current situation is the rubbish is piled up. This is because we produce many garbage during one day and we just throw away. I have seen many people who throw the garbage out of the trash can, they see this, but they don’ t pick it up, so more and more garbage are out of the trash can. It’ s definitely increase the job of cleaners. Moreover, the style of the trash bin in our school doesn't meets the needs of garbage classification, because there are no specific trash bins, for example, the trash bin for wasted paper, for plastic bottles. Thus, although we improve the public consciousness, we still will mix the garbage together. If we want to reduce this problem, we should rearrange the trash can. If we take away all the trash bin in each classroom, and just put 4 different kinds of trash can (recyclable waste, hazardous waste, other waste and kitchen waste), in the center of passage, many people may think this is not convenient. The 4 trash can may be not enough for so many people in our school. The situation that the rubbish is piled up would be more serve. If we put those 4 trash can in the end of the passage, some people may blame it’ s too far. Another problem is the beauty of the school. Four big trash can would take up a lot of space of the passage , so when we cross there, it may lead to congestion. Thus, what kind of arrangement is another challenge for us.

4.Subsequent processing of garbage

When the trash can is full. The cleaner would take them. There is a problem that if there have some garbage which are mix, like living garbage and garbage from toilet mixed. How can cleaner divide them or even discover them. We need to communicate with cleaners, tell them the rules of garbage classification. When they finish sorting, where the garbage are they going to send. Through survey, we know that cleaners will send them to Olympic Forest Park which is just behind our school. However, we need to know further garbage disposal in the park . Besides, it’ s difficult to find workers which can tell us this process. If we can have field visit, we will have deeply understanding of the garbage disposal. This can help us to find out which kind of garbage is the most difficult to dispose, so we reduce the produce of that kind of garbage. For example, plastic takes a long time to degrade, about 200 years. From our survey, we can conclude that plastic and paper takes a big proportion of garbage that we produce. However, now we can’ t find these workers and get more information from them.

5.School support

When we have the plan of garbage classification, we communicated with school leaders and have their promotions. The purchase of garbage and the resources for

publicity, such as mini televisions. We also discussed the policy of reward and punishments. For example, if some students don’ t follow the rules of garbage classification, we may post his or her picture on the billboard, so everyone can see and learn a lesson.

6.Pandemic

Due to the COVID-19, we forced to stuck in home, and many of our previous plan can't be implemented. For example, the time to test the feasibility of classified dustbin is shorten. It's hard for us to supervise the reaction of students and teachers toward garbage classification because we are all stay at home.

Identify a Root Cause

The root cause:
Not enough types of bin
There are only two types of bin, ‘recyclable’ and ‘unrecyclable’ in the campus which is not enough for efficient recycling the waste. Besides, there is only one trash can in every classroom. Those will cause all of the trash need to be manually classified by the cleaners which needs huge effort. *This will cause problems in the collection process and also lack of motivation.

After our actions, there are 2 trash cans in each classroom now but they are too small and some students will sort garbage wrongly. Which, indicates that we still have to improve the bin and educate the students.

Consequences of the root cause:
The collection process
Students are being asked to clean the classroom everyday including clear the trash can. All the trash in every classroom will be dropped in to several specific bin. The trash bin full up in a very short time, so students can only put the trash in other bins.

Lack of motivation
Because there is only one bin in every classroom and all kinds of trash are collected together, some students believe that their work is useless. Therefore, they won’t keen on to refuse classification.

Other causes of other garbage appear in the recyclable waste: following causes can be solved once there is a proper, functional trash can since students have the fundamental basis to classify trash.
Lack of knowledge
Some students throw the garbage in the wrong type of bin because they don’t know how the category was defined. Also, like the milk box, some trash are unrecyclable but it looks like recyclable which many students don’t know.
Various kinds of garbage.
There are too many categories of trash from takeout compared with school garbage, although the school had already banned students from eating in the teaching building, many food packaging still can been found in the trash bin.

Overall, from school facilities to software facilities, promoting the system of refuse classification is a tough job. It can only be done by working very hard on improving the facilities and educating the students.

Generate Solutions

All the members in our group brainstorm about the possible solutions for promoting classification. Then, we do the questionnaire asking other students about the ways they think can efficiently promoting classification and the problems about current situation about trash classification in school.

After analyzing those questionnaires, we decide to do several works to promote trash classification in many aspects.

Firstly, we decide to improve the trash can. As the result shown, most student is not classifying trash because of the trash can since it has no sections for different type of trash. Since the trash can doesn’ t have the ability to classify trash, students cannot classify them. In addition, the trash bins don’ t have a clear label to teel people what to throw, causing confusion and chaotic, eventually preventing the classification process. Thus, we decide to deploy trash cans with various function and deal with specific type of trash with labels on the side of each cans to let students. Moreover, the arrangement of those new trash can (discussed latter) may be a problem as the location of them determines how well people classify properly —students don’ t go too far to throw garbage as there are one trash can for different use near him.
Secondly, we think that the correct information given to student is critically important because student should know which garbage belongs to which type to throw them correctly. To solve this problem, we will firstly create posters and broachers that have typical types of trash that students may generate (as pictures can be easily understand and remember). Secondly, we will arrange meetings regularly to each homeroom to provide them the idea of how important that the trash classification is and tell them the knowledge about trashes. Also, during the meeting, we can use some practical examples to let students remember it deeper. Thirdly, we will arrange clubs and project for the whole high school especially for the 11th grade as they have both more time and more awareness to trash classification (because of government advertisement). In this club, student will have mainly two work: for one, they will teach the knowledge of trash classification and trash type to other students; for another, students will supervise their friends and classmate to classify trash correctly (more supervision methods will be introduced latter). Fourth, we decide to create videos about the purpose of classification, methods to classified garbage, and where would they go afterword. We can also promote students to involve actively in the project through the video. The video will

be a concise one with element students can remember easily and it will be projected on the television around campus.

The arrangement of those trash cans is a vital work to ensure the effectiveness of out project. We first come up the thoughts of arranging trash cans all around the campus. However, due to the time and cost problem, it is ultimately impossible for us to do. The second opinion is that arranging trash cans in the main building where most students have classes. Thirdly, due to the viruses, we decide to set several special trash cans for masks, which will help classify the most frequent used item at this period. Additionally, the trash bins we arrange will have a eye catching pictures together with the name of the trash can to let student understand the type of trash to throw in the trash cans.

For supervision, we have come up with many methods. For one, we arrange a club to recruit group of students supervising others to classify trash properly. For another, students will receive punishment or reward if the classify wrongly or properly. Also, we can ask for some volunteers and teachers to help us supervising the classification situation when they have time. Lastly, we randomly do researches and interview to see the effects of our advertising and classification method to prevent misunderstanding of information and to collect first-hand information about the effect of our advertising.

To conclude, we propose several methods in each phase, from trash can to final supervision. Before acting anything, we will go and present our ideas in the form of a complete project to school management, showing how feasible this project is and ask them to cooperate with us.

Identify the Criteria

*Ranking: from the most important criteria to the least
Criteria
1. Expected impact: The expected observable impact of the solution on improving the school’ s garbage classification. Classifying and recycling the garbage in our school is of the greatest importance and it is the primary goal of our project. This can be measured in terms of awareness and amount of trash correctly classified before and after the solution.
2. Extended impact: The impact of the solution has outside of school. How the solution will improve the student’ s trash classification habits at their homes or in local communities. How sustainable is habit created by the solution. This can be measured in terms of the student's knowledge of garbage classification before and after the solution.
3. Time cost: The time it takes to implement a solution. The time must be reasonably controlled so that we can fully implement the solution without running out of time, ensuring the effectiveness of the solution. This also ensures that we meet the deadline of our project without submitting a half-finished project.
4. Financial cost: The money it takes to implement a solution. This needs to be kept in check so that the solution is affordable and can be carried out. If this is too high and unaffordable, funding may need to be raised from various sources drastically increasing the time cost of our project.

Evaluate the Solutions

The solution ideas is broken down into a series of minor solutions which we rank from 1 to 8 based on the criteria. Solutions ranked below 4 are not considered in the implementation process. Solutions ranked 4 and above will be fully or partially implemented.

Solution: Put eye-catching picture on trashcans
rank: 1
Expected impact:
This is very important and is likely to have immediate effect because students will know what to put into each trashcan by the intuitive pictures.
Extended impact: Students will learn trash classification with the pictures, and will be able to do it without pictures as time goes on.
Financial Cost: There is low financial cost as only a few pictures needs to be printed.
Time Cost: The time cost for this activity is low as the pictures can be downloaded from the internet.

Solution: Establish club
rank: 2
Expected impact:
The club will help in organizing activities and communicating with local trash disposal companies. This gives an organized place for people who care about trash disposal and the environment to work together and improve trash classification for the school.
Extended impact: The peer pressure generated by such a club will make its group members realize the significance of trash classification outside of school. The group can organize activities to help the local community in trash classification if successful.
Financial Cost: There is no financial cost for this action, negotiation is needed for us to organize such club
Time Cost: The time cost is high as the club will last for a whole school year. The negotiations required to get the club started can also be lengthy.

Solution: Organize homeroom meetings
rank:3
Expected impact:
This gives students approximately 20 minutes of focused information on trash

classification where they will not be distracted.
Extended impact: The significance of trash classification talked about in the meeting can help them to be more aware of garbage classification out of school
Financial Cost: There is no financial cost for this action, negotiation is needed for us to organize such a meeting.
Time Cost: The time cost is medium as the presentation needs to be prepared and the meeting needs to be held for various homerooms.

Solution: interview students on trash classification
rank: 4
Expected impact:
The interview will give students a chance to show off their knowledge in trash classification and their care towards the environment. The interview will also prompt students to search up more relevant information on trash classification.
Extended impact: The interview will make the student actively search for trash classification related information, making it more memorable for them.
Financial Cost: There is medium financial cost for this action as recording equipment and interviewing room is needed.
Time Cost: The time cost for this activity is low as the interview can be conducted at lunchtime, not interfering with any activity.

Solution: Distribute promotional videos
rank: 5
Expected impact:
The promotional videos will tell students of the importance of trash classification. However, since there are only limited display screens to play the promotional video and phones are not allowed in the school, this will have a limited audience base.
Financial Cost: There is a medium financial cost to the solution as the video needs to be recorded and put onto electronic screens.
Time Cost: The time cost is medium-high as the recording of the video can take quite long if it is purely original.
Solution: Interview students to make sure they have correct trash classification knowledge

Solution: Ask Volunteers to supervise trash classification
rank: 6
Expected impact:
This could be very effective as many students can learn trash classification by having a volunteer guide them. This is also the policy being implemented in Chaoyang district. However, many students can find this uncomfortable and resolve to discard trash when there is no supervision.
Extended impact: This action is likely to have extended impact because it helps students form the habit of trash classification by being taught by a another student.

This can make sure they gain long-lasting trash classification skills.
Financial Cost: There can be no financial cost in doing this if there are sufficient volunteers but there will be medium financial cost if there are insufficient volunteers are financial incentives are needed.
Time Cost: The time cost is medium as recruiting the volunteers can take some time but the volunteer only has to supervise trash classification at times when the trashcan is most in use.

Solution: create posters and Brochures
Solution rank: 7
Expected impact:
Raise awareness of trash classification and make people understand what trash goes into which trashcan.
Extended impact: This teaches students knowledge of trash classification that are not unique to the school.
Financial Cost: The financial cost is low as posters and Brochures are relatively cheap and
Time Cost: The time cost is medium as the posters and Brochures needs to be designed

Solution: Punish/reward students based on their trash classification
rank: 8
Expected impact:
This will force students to do trash classification by making school policy punish them if they don’ t. However if students are simply forced to do trash classification without knowing why, they may find a way around it by not discarding trash in the trashcan or they may resent trash classification because they are punished because of it.
Extended impact: This is a action likely to have immediate but not extended impact. Forcing the students to do trash classification by punishment is unlikely to yield trash classification in the future when the punishments are removed.
Financial Cost: There is no financial cost in doing this action but the neogotiation with the school is needed to adjust the policy.
Time Cost: The time cost is high as the making the policy can take a long time and the implementation of the policy will last through the school year.

Make an Action Plan

The action plan

The disseminate

1.Use the screen of the school to show the video to teach students and teachers how to classify garbage.

2.Hold the house meeting and class meeting about the knowledge of classification of garbage.

3.Give a speech about the importance of garbage classification during national flag raising ceremony.

4.Poster for dissemination

5.Design some holiday homework about garbage classification

The experiment

Firstly, do some researches and questionnaires about the current consciousness of garbage classification. Then analyze the results and decide the set up of trash bin. We decide to put a trash bin that classify the garbage into two groups, one is recyclable waste and another one is other wastes in every classroom and every office. Also, we will put 4 specific trash bin in the passage. They are water bottle trash bin, wasted tissue trash bin, wasted mask trash bin and other wastes trash bin. Finally calculate the ration of mass of recycled rubbish/ the total mass and also do an interview about the students'views on the current school garbage classification.

Some policies to encourage students

We can give some demerits to students who do not do classification and we will also invite some volunteers to help to supervise the process of garbage classification, but we will find these volunteers from the cleaner team because their time are more available. Additionally, the supervisory camera will be set around those trash bins.

Prototype and Test

Prototype Design

Prototype:
We have deployed two prototypes because of the viruses and this special circumstances.

For the first one, we create three simple trash bins using cupboard boxes. We label them clearly and place them in the area where most student pass. They are labeled as: bottles, food container, and toilet paper.

For the second one, we buy some proper trash bins with two sections: recycling and non-recycling. They are places in several classroom

Feedbacks learnt from users

Feedback:

Our main target users are students and teachers in the campus because we are in a campus while students and teachers generate lot of garbage everyday. We randomly select several students and teachers to ask them about their feelings about the prototype we deploy.

The first prototype gives us a very positive feedback. Though we only open school for several days (less than 10 days), the result is quite good, most students classify the trash correctly. More than 90 percent of the garbage in the bins are matched with the label. We think this prototype is quite successful. The result of our random selection of testing is very positive, students find it much more useful than the original trash can since they can throw specific type of trash to a singe bin.

The second one meets some problems as they are deployed in classroom and they are greater in quantity. We found that the garbage in two sections are mixed and students rarely through them due to the label. The bins also become full quickly, not fulfill the need from students in classroom. As some of our interview's feedback: "the bins are too small to hold our trash, we can only throw garbage in the another

section" and "I don't know the exact classification type of certain garbage, I think I need more information".
We asked other students about their feelings about the new trash cans and we also randomly test their knowledge about trash classification; overall it inform us the result (feedback) talked above.
Feedback from teachers tells us that we need more supervision to assure that students are classifying trash properly. Teachers said that students are throwing garbage without the awareness of classification and some of them don’ t know the type of garbage they are throwing.

Improvement for next iteration

After the result of the prototype, we decide to have several improvements.

Firstly, the size of the trash can desperately need improvement. As the first picture shows, the trash can cannot hold enough garbage students produced.

Secondly, the function of the trash can require more development; the classification type is still not enough to meet the classification requirement. We should have more types like Non-recycle, Food, Bottles…

Thirdly, our advertising methods should be improved because students don’ t know enough knowledge about garbage. We should clip more eye-catching videos and arrange more meetings to teach other students.

Moreover, the supervision methods need more development to ensure most students are throwing their garbage in the correct can.

Lastly, we will cooperate with school more to find better methods to promote classification in campus since school management will help to both spread knowledge and supervise classification situation.

Current situation of the small trash can.

Team Credits

Wenye Zhou (Tim):

Tim contributed a lot in this project. From brainstorming initial ideas to coordinating and communicating with school management on garbage classification policies to giving presentations of garbage classification and writing the EVALUATE THE SOLUTION part of our final report. He also helped to edit the identifying the criteria part of the final report.
He actively participated in group meetings and many advertising activities we arranged throughout the school year.

Zhiyuan Chang (Lee):

Lee did a lot of works: checking the classification of garbage, prepare questionnaire, synthesize all the ideas from brainstorm to the solution in GENERATE SOLUTION part, help do the prototype and collect all opinions to write the PROTOTYPE AND TEST section. He also help to write SUMMARY, ROOT CAUSE, and he does the final check and overall corrections.
He also attended many teaching activities and check the overall report the group write. Moreover, he and Tim build the first prototype in school.

Chenye Wu:
She participated in many teaching sessions and created many questionnaires to gather data. She writes the SUMMARY and IDENTIFY CHALLENGE.
She helped to survey the feedback of our prototype and contributed many ideas when brainstorming.

Yuming Li:
She transferred to another school in USA and cut all communication from us, she primarily did the ACTION PLAN and propose several ideas in brainstorming step.

Xizi Wang:
She was involved in t4eaching session and she wrote the INDENTIFY ROOT CAUSES part and IDENTIFY THE CRITERIA section. She helped a lot in offering her personal experience about classification since her home was actively doing this. She also contributed her work during the prototype testing period.

Sizhe Zhang:
He contributed a lot, especially in analyzing data and searching materials about scientifically classification and papers about how to promote classification around campus. He did all data synthesizing work and listed all the feedbacks for other members to use. In addition, he helped a lot in arranging the position of out prototype since he knew the most about how to promote classification.

Judge Comments

" Review Comments: "I applaud the team for getting this project developed and actually producing some valid and usable results in the midst of a pandemic. The team was very systematic in analyzing the problem from different angles and generating solutions – you covered the infrastructure needs, the social/education angle and the maintenance/operations angle well in your analysis. I would consider including economics as a challenge – why is plastic waste so common, for instance? Most of the work done by the team focused on the downstream – how to FIX a problem after trash has been created. It would be useful to consider some upstream work to reduce the trash that is being generated as well (reduce single use items being used, bringing reusable water/soda cans, reduce printing unless necessary etc.) I really like that the criteria looks to assess long term impact and how the educational actions show long term benefits outside the school. Complexity of the classification system being designed would be another useful criteria to consider given the various types of products that get put into trash. One of the challenges recycling solutions across the world face is the challenge in telling a user how best to classify the various types of garbage that is being created – this is especially complex in the case of the various types of plastic products that we consume. I would also suggest that the team consider combining the various solutions they proposed into one integrated solution that feeds into each other. I hope the team takes this important work forward and works with the right partners in the school to develop, implement and measure success from a project like this." "