

The Complex Problem Solving Project: A Guide to Improving Our Own Community (Student Guidebook)

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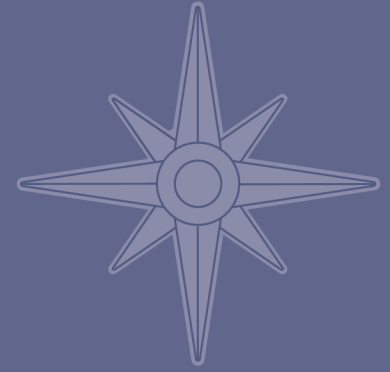
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The Complex Problem Solving Project

A GUIDE TO IMPROVING
OUR OWN COMMUNITY

Enhancing Critical Thinking and Creativity Skills



The Complex Problem Solving Project

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The Complex
Problem Solving Project

A Guide to Improving Our Own Community
Teaching and Learning Lab, Kyushu University Faculty of Design



Teaching and Learning Lab, Kyushu University Faculty of Design
<https://life-green-peace.org>

This resource package is an educational prototype produced by the Teaching and Learning Lab. We are hoping to understand the usefulness of these materials and how we can improve them to make them better for educators and learners. At the same time, through the feedback, we also hope to create new resources for educators and learning through research and development. If you have used these materials, please share your feedback with us in this survey.



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Acknowledgement

Leading towards the creation of these resources, our lab has visited secondary and high schools in Oceania and Asia to understand the common approaches teachers use in their teaching subjects to teach students to solve complex problems. At the same time, through the sharing by the teachers, we were able to catch a glimpse of the challenges faced by the teachers when facilitating and teaching complex problem solving. The generous insights from the teachers have contributed to the motivation and ideas for these resources.

We would like to express our appreciation to all the staff, teachers, and professors for their help in coordinating the school visits in their countries.

In addition, we would like to thank the following faculty members at Kyushu University for their valuable insights and advice in this project.

Dr. Melanie SARANTOU Professor

Dr. Yanfang ZHANG Associate Professor

Dr. Moe SHIMOMURA Associate Professor

Dr. Noriko TAKANO Researcher

Preface

There is no doubt that complex problem solving is one of the most important competencies that our students should possess to navigate the rapidly changing and uncertain future. Why is it so? Doing a search on the World Wide Web, we will be able to find many books, resources, and information that explain what complex problem solving is, its importance, and how to develop complex problem solving skills. National curricula in many countries have also been designed to systematically develop complex problem solving skills in students. Through solving complex problems, students develop important attributes necessary for the 21st century.

Complex problems can be associated with ill-defined problems. Ill-defined problems are like the real-world problems that we face daily. During my research journey, I often found students learning how to solve complex problems in subjects such as Design and Technology; in some countries, the subject is called Technology. In Design and Technology, students are taught how to use the design process to solve real-world problems. Besides Design and Technology, school curricula in some countries consist of a dedicated subject for students to be engaged in project work. During project work, also known as complex problem solving projects, students are often taught to use design-based approaches to solving real-world problems. While some teachers are trained to facilitate complex problem solving projects using design-based approaches, many are not. Some teachers may be trained in teaching a specific subject area; some are beginning teachers with less experience than others. For this reason, our team in the Teaching and Learning Lab at Kyushu University started to conceptualize this project that aims to develop a set of resources as a “starter kit” for teachers to embark on facilitating and teaching complex problem solving in their classrooms.

Our set of resources is designed to enable teachers to initiate a complex problem solving project in their classrooms. In this project, students will explore real-world problems within their communities, with the overarching goal of contributing to a sustainable world by achieving the Sustainable Development Goals (SDGs) through their creative solutions. The general approach to solving real-world problems in this project is adapted from the design process used by design practitioners and academics. While the design process can be defined in various ways, our team has attempted to articulate it through a story, providing teachers and students with a more general approach to solving real-world problems.

Through solving real-world problems in this project, students will develop various competencies. Firstly, students will need to integrate knowledge and skills learned in different subjects to understand the problem and create suitable solutions to solve the problem. Through understanding the problem, students may better understand

their communities and connect with their cultures, history, societies, etc. Secondly, through solving real-world problems, students will also need to exercise critical thinking to make good decisions, creativity to create original ideas, social-emotional learning to empathize with the issues faced by others, communication skills to connect with stakeholders, and many more.

This set of resources is mainly written with the following users and learners in mind.

- a. Beginning teachers (secondary/high school teachers)
- b. Teachers unfamiliar with facilitating and conducting complex problem solving project
- c. Secondary and high school students

While we admit that there are many strategies to conduct and facilitate complex problem solving projects, our team hopes these resources will serve as a starting point for some teachers and be useful for them and their students. Teachers may also adapt the content of the resources to implement the project in a way that suits their classroom and students best.

Leon LOH

The Complex Problem Solving Project Package

This package consists of four items designed to be used hand in hand with each other. Main items in this package:

- Lesson Plans
- Guidebook
- Workbook
- Worksheets

This project is planned as a short curriculum for teaching complex problem solving. The curriculum is planned for 18 Lessons. Each lesson is suggested to be 100 minutes. Activities planned in each lesson include individual and group work.

This complex problem solving project is designed for upper secondary/high school students. Students in the class are suggested to work in groups. The recommended size of each group is about four.

How to use the resources?

1. The lesson plans consist of the following content to suggest how teachers can conduct each lesson in the project.
 - Learning objectives
 - Detailed plans, including the purpose of the content/activities, teaching strategies, materials needed and time allocation
 - Facilitation notes which pre-empt teachers of possible issues that may happen, suggestions of what they can do, what they can prepare beforehand, etc.
 - Suggested references and resources for further reading
2. The guidebook provides concise content information, examples, and references for further reading that students will need for the project.
3. The workbook provides activities to facilitate students' learning, and it serves as a journal in which students record all their learning, research, and thoughts during the project.
4. The worksheets are designed in A3 size for individual work and group discussion.
5. Teachers can use the resources in the following ways.
 - Use as it is
 - Extract relevant activities and materials to adapt to your curriculum
 - References to design your curriculum and materials

Introduction

The 21st-century world that we live in is complex and changes rapidly, fueled by globalization and digital revolution. Globalization and the digital revolution brought about a flattened global economy, changing work demands, and expanded consumption of products and natural resources. These resulted in

1. Unprecedented global migration led to increasingly diverse neighborhoods, identities, and citizenship, and new issues surfacing due to societal stereotypes and biases, a lack of understanding of cultural differences, social injustice, etc.;
2. Changes in job types. Some jobs became obsolete. Some people lost their jobs, and some were not equipped for the new types of jobs;
3. Poverty due to inequitable;
4. Depletion of natural resources due to overproduction and food waste;
5. Climate instability due to high carbon emissions, loss of biodiversity, etc.;

and many more...

Are you aware of these issues that the world is facing now? Are you aware of the changes in your community in the past, say 5 years? Do you know the issues that your community is facing? Do you know why this awareness might matter to you, the people around you and the world?

The world we live in may not have a future if these issues are not addressed. Everyone needs and can play a part in creating a better future.

How can we envision and achieve a sustainable world together, with society's well-being as a shared goal?

Project Task

In this project, you will identify a *real-world problem* related to achieving the Sustainable Development Goals (SDGs) within your community and solve it creatively and feasibly through a *real-world problem solving process*.

Before embarking on the project, let's try to understand the meaning of the keywords in italics in the project task.

Real-World Problems

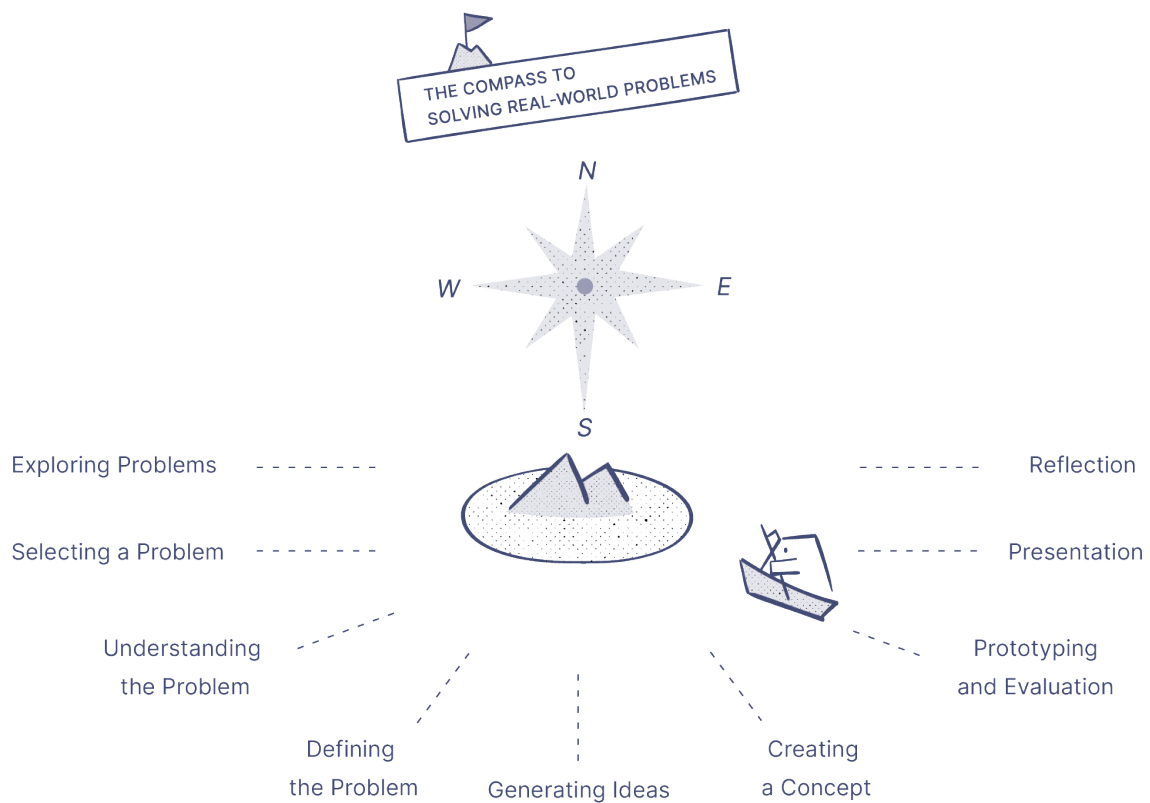
Problems around us can be called real-world problems, and they are not easily solved. This is because real-world problems are not well-defined or described clearly. Well-defined problems are those where all information required to solve the problem is known. The solutions for well-defined problems are finite, such as mathematical problems. Meaning that there is a correct answer or at least some convergent answers for well-defined problems. For problems that are not well-defined, much of the information required to solve real-world problems is often unknown. Research activities are required to gather information so that real-world problems can be understood and solved. Integrating knowledge and skills from different disciplines is required to solve real-world problems. This is because there can be many ways to solve a real-world problem. Sometimes, there is no solution to a real-world problem when no consensus agreements can be reached on any solutions presented. The evaluation criteria to evaluate solutions for real-world problems can be multiple and varied. Sometimes, the ways to solve real-world problems can be influenced by personal beliefs or opinions. Although real-world problems are not easily solved, any one of us can make a small but meaningful impact by using the processes that we are sharing in this resource to solve real-world problems. The processes we share in this resource are mostly adopted and adapted from the design process that design practitioners and educators use when engaging design problems in the real world.

Process to Solving Real-World Problems

Firstly, solving real-world problems requires us to know what problems exist around us. We need to be observant to explore what problems people face. While exploring different kinds of problems people face, some problems will be particularly interesting to us. This can be due to our beliefs, experiences, personal goals, etc. It is not possible for us to solve many problems at one time. Often, we select a problem that is the most important to us to solve first before the others. Instead of jumping right into thinking of a solution to solve the problem, we need to understand the problem deeply so that an appropriate solution can be proposed. To understand the problem, we need to conduct research to understand the needs of the people involved, the causes of the problems, and many other information. Once the problem can be understood to a certain extent, we can explore different new solutions to solve the problem. However, not all solutions can solve the problem well. So, we need to decide how to evaluate the solutions and then select one that is the most appropriate. However, when we cannot reach a consensus on an appropriate solution due to our lack of understanding of the problem, we may be required to conduct more research to understand the problem and then once again think of creative solutions to solve the problem. To determine how well our solutions can solve the problem, we must test

them by making prototypes. After testing our solutions and getting feedback, we can consider ways to improve them to solve the problem better. Then, we can present our solutions to the related users, organizations or government bodies for feedback and possible implementation. The process described above may seem unfamiliar to you.

Fear not! It can be explained through the story of a brave explorer whose journey included the stages of exploration, discovery, analysis, and invention.





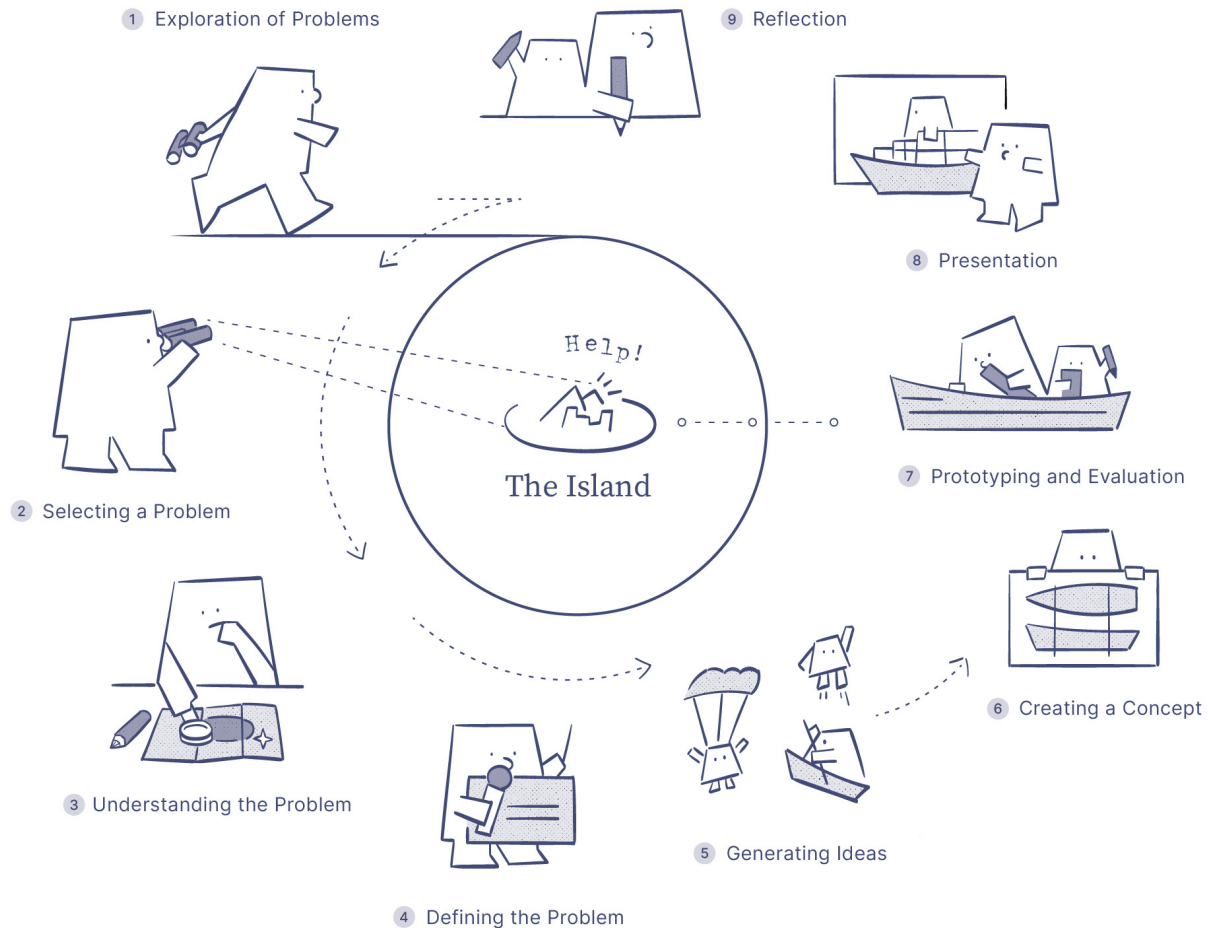
The Explorer's Journey

Imagine yourself as a brave explorer, standing on an island in the middle of an ocean surrounded by scattered islands.

You're looking through a telescope, wondering what all the islands are like, and you suddenly notice a strange movement in one of the islands. Trees are swaying as if a gale is blowing, smoke is billowing out from the mountains, and you can see people bustling around. The island village looks like it's in need of help compared to the others. However, from what others have said, the sea conditions around that island are so bad that no one can get to them. Your journey to help the villagers isolated on this island will start from now on, but your first task is to get closer to them. After that, you can find out what has been happening on the island. What situations and obstacles would you encounter? Though everything seems uncertain at the moment, how can you take your first step to making an impact?

The Explorer's Journey

Process to Solving Real-World Problems



You pull out a map and start planning the route to the island. You ask some of the people nearby questions. They might know the sea very well. The flow of the currents, the speed of the wind, the mysterious incidents that happened at sea in the past, success cases in other situations, and perhaps even the problems the villagers are facing! At this point, investigate deeper, gather information about the surroundings, and confirm the available resources that you have.

When you're done investigating and organizing your information, share your analysis with the public. Though you may have felt scared of the complex

challenge, the more opinions you gather and the deeper you learn, the more it will become clearer, and you will become less fearful and more confident in achieving a solution.

Then, think of the specific ways to reach the island whether it's building a small boat or devising a way to fly to the island. Don't hesitate to come up with ideas and jot down thoughts and sketches that come to your mind! Decide on the best solution and add details to it. How can you overcome the strong wind and the high waves? What supplies and resources might be needed to help the villagers?

Finally, don't just keep your strategy as a concept. Make it a reality, and put in the energy and time to build a model, test if it works, and ask others for opinions. Present your strategies to make your intention known and encourage people to assist you in crossing the ocean.

Sometimes, plans don't work out the way you think they will. The experts around may tell you that your model cannot withstand the waves, which can be higher than what you expected. The winds may be too strong, and other things that you don't know! When that happens, go back to the drawing board, look for new clues, revise your plan, and make a new model.

When you finally have a good solution, present it to the public and call for action and support. Your courage may spark something in the hearts of people, and unexpected help may come along. Together, you can all build something sturdy, put the brilliant idea into action, and brave the harsh weather to get to the island. Sharing your story can be the first step toward helping the islanders receive more support.

Reflecting on your journey, you recognize that each expedition is a lesson. Landing on the island is not the end but the beginning of a new chapter. You are ready to make use of your knowledge and supplies for the villagers and go on tackling the next challenge that lies ahead.

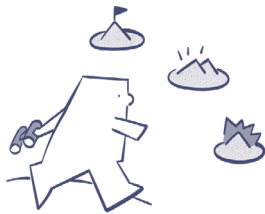
The adventure continues, and with every step, you learn and grow.



In this Complex Problem Solving Project, you will follow the explorer's journey throughout to solve the challenge.

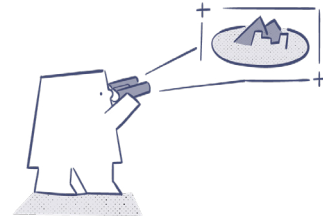
Sometimes, you will work as an individual explorer, and other times, you will work with your teammates to go on to the next level.

During the project, whenever you feel lost, trace back the journey of the explorer in his quest to help the Islanders. It may help you to figure out which stage you are at and what step you should be heading for.



1. Exploration of Problems

The explorer gazes at the *different islands and villages*.
(Different real-world problems and social issues in the communities)



2. Selecting a Problem

The explorer peers closely through a *telescope* (problem selection tool) and focuses on one island village in need of help. *What makes it difficult to get to the island?* (problem situation)



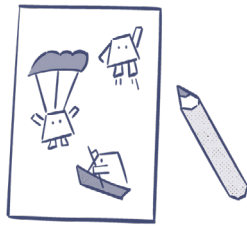
3. Understanding the Problem

No one can reach them due to the harsh sea conditions. *The explorer hears from the people around to understand more about the island* (interviews and surveys). The explorer studies the *maritime map and past cases* (research) to see how to tackle the strong wind and high waves.



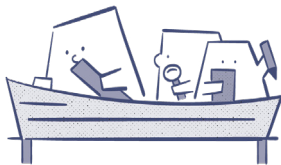
4. Defining the Problem

The explorer makes an *announcement* (problem statement) to the public based on a deeper understanding of the situation. "The people on the island need help. They have been isolated from the outside world for a long time due to the storms and high waves, which have made it difficult for anyone to get to the island. I want to find a way to help these people."



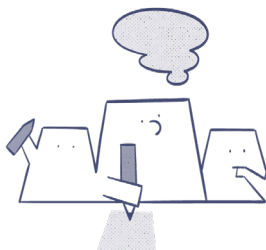
5. Generating Ideas

The explorer questions, “*How might I cross the ocean?*” (How-Might-We questions) *Design a boat? Fly with a parachute? How might we transport supplies and resources to the villagers? Catapult?”* and begins sketching. (Brainstorming)



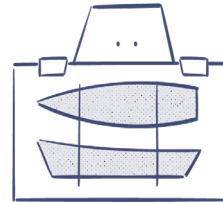
7. Prototyping and Evaluation

With a small piece of wood, the explorer makes a *model boat* (prototype) according to the dimensions. A friend of the explorer said, “*Isn't the bottom of the boat too thin to load heavy supplies for the island villagers? Should the joints of the boat be reinforced with steel plates to counter the force of the waves?*” (evaluation) The explorer modifies the boat based on the feedback gathered.



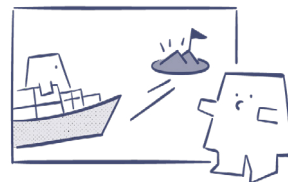
9. Reflection

After the presentation, the explorer reflects on the whole journey through questions. *What has been learned through the investigation, challenges, and failures? How can these learnings help after reaching the island safely before starting the rescue mission there?* (Reflection)



6. Creating a Concept

The explorer questions details about the idea of constructing a boat. “How can the boat withstand the force of the waves? What material should be used to make the boat? What supplies and resources to bring along? Who else should come along?” After much thinking and discussion on the questions, the *design of the boat* is finalized (design concept) with a detailed sketch.



8. Presentation

The explorer presented his purpose of helping the islanders and his boat to a group of people to garner support to build the boat and volunteers to go on this journey.

Last Note

We are all in the position of ‘rookie explorers’, who can look closely at our surroundings, tackle problems and limits, and envision a meaningful impact on our community. It may be a challenging journey, but we can do it!

The Sustainable Development Goals (SDGs)

“The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth –all while tackling climate change and working to preserve our oceans and forests.” - Extracted from [the United Nations, The Sustainable Development Goals](#)

To address the rapid changes of this century and the new and urgent issues that have surfaced, the SDGs are goals that require a concerted global effort from every country and everyone to play a part in bettering our lives. The situation in each country is different. In some countries, poverty, and basic needs such as having clean water to drink, clean air to breathe, shelter over their heads, vaccination against diseases, etc., are more urgent issues that need to be tackled. In other countries, there is a tendency for overconsumption of natural resources, overproduction and wastage of materials and food, a high carbon footprint that leads to climate issues, etc. Hence, there is an urgent need for all countries to evaluate their status and come up with solutions to tackle the issues and achieve sustainability. These issues must be tackled at different levels – global, national, prefecture, organization, community, and individual. Each of us has a role to play, and if you click on each goal on the [UN website](#), the sub-targets will show the different goals set for countries with different needs.

Globalization, the process by which ideas, knowledge, information, goods, and services spread globally, has transformed the world's economy.

The digital revolution has further accelerated this transformation, leading to the interconnectedness and interdependence among countries. Consumers worldwide can purchase products with the aid of high-speed internet communication, lower import tariffs, and government incentives for foreign investments. Food and products can be produced and transported from any part of the world. People can work in any part of the world. However, we have not fully grasped the implications of such rapid globalization on our society and environment. We now face issues such as excessive greenhouse gas emissions due to the transportation of goods and people, erosion of unique cultural identities and languages, and the increasing risk of pandemics like COVID-19. This underscores the need for countries to collaborate on mutually beneficial agreements and solutions for sustainability.

In all countries, the government needs to examine and develop effective strategies and policies, garnering support from various stakeholders to address the nation's issues holistically at the national level. At present, the countries are trying to do their part. Their strategies and policies for SDGs are on the [Voluntary National Reviews](#) of the UN website.

Different provinces or cities in huge countries have different issues, and they need to evaluate their own issues and derive effective solutions. For example, Surabaya City in Indonesia has set many goals to address SDG issues pertaining to their city, such as improving public health, building an educated and knowledgeable society, etc. In the area of public health, they aim to achieve Open Defecation Free, Zero Stunting, etc., and their strategies have been successful and on the path to reaching their aims.

At organizational levels, companies such as [Toyota](#), [Starbucks](#), etc., are responding to the government's sustainability directives and even forming their own partnerships to champion SDG efforts, such as the

🔗 [New Zealand Winegrowers](#). There are also start-ups, such as Flashfood Inc., Glass Half Full, Rugsal Trading, etc., that aim to address environmental issues.

In most countries, within close proximity to home, there are community groups formed. For example, in Japan, there are 🔗 [neighbourhood associations and community associations](#), which are community development organizations made up of local residents. Both groups engage in various activities to deepen interactions among residents and solve local issues, such as creating events to encourage interaction, community clean up, etc., which are related to achieving the SDGs. There are many initiatives at all levels to tackle the issues we are facing now. However, there is a lot more that we can and must do.

What have been done for SDGs?

Do you know what has been done for SDGs by the different groups of people all over the world? Do you know what people of your age have done? It is important to look at what others have done and what has not been done and ask yourself what you can do to contribute to the SDGs. We are all part of this earth. We can start by making little changes to our lives and taking little actions within our community to achieve a better world.

What can you do to make your community a better place to live?

You can start by reading the articles and watching the videos of your interest in the 🔗 [SDGs Resources](#). For each of the resources, there are reflection questions to help you consider how you can contribute.

Be inspired to make a difference. Each small effort, when added up, can make a huge difference.

What can you do for SDGs?

Exploration of Problems in the Community

There are many ways to achieve the SDGs. For starters, you can start small and think big. You can start by addressing SDG issues within your community to make it a better place for everyone to live and then expand this effort to reach out to bigger groups or address deeper problems. Community can be defined as a place where a group of people live, like your neighbourhood, town, city, country, etc.

Do you know what you have or who are the people in your community? Do you know the problems in your community? How can you make improvements to your community to benefit people?

You can start by being observant and curious, just like a detective, and having an interest in and caring for others. Question the things you see every day, the behaviors of people, their actions, etc. Wonder about those you have heard about but don't see often, how they spend each day, whether they are happy or sad, what their challenges are, etc.

To help you explore the problems in your community, you can use a mind map to help you think widely and think deeper about what you see or know with questions.

Think wide with the mind map **METHOD**

A **mind map** is a tool that captures the thinking that goes on inside our heads. It helps us think, collect knowledge, remember, explore options and create ideas. Most importantly, it will likely help us be better thinkers.

You can use a mind map to help you recall and explore the different places, facilities, people, objects, etc., in your community. If you are unfamiliar with mind maps, you can refer to the 4 examples on pg 23-26. Examples 1 to 3 used different first-level associations to kick-start the exploration. You can use one of these to start your mind map or develop your own first-level association. As you create your mind map, you can also refer to what you have read or watched through the resources provided earlier or search on the

internet for information. You can note down words or short phrases in the mind map to help you create it faster.

If you find that you cannot expand the mind map anymore, you can add a different first-level association. If, amid expansion, something that comes to mind does not fit the first-level association, you can branch out to another first-level association. There are no rules concerning mind maps. It is a tool to help you think. You can refer to Example 4.

The examples provided a reference for using mind maps to help you think of problems, but they are incomplete because they did not identify many problems. Your role is to create a completed mind map that is comprehensive and identifies many problems.

The mind map will help you recall and explore the different places, facilities, people, objects, etc., in your community. However, how can you think deeply to uncover problems or inconveniences that people face?

Think deep with questions **METHOD**

Questions can arouse curiosity, develop observational skills, and provoke responses that allow thinking to be deepened, extended, or challenged. It can help you discover many interesting and new insights and issues that need to be resolved to improve your daily lives.

You can think using the following considerations and questions, then draw connections to similar situations to explore possible problems in your community.

EXAMPLE

1. Purpose of the place, facilities or objects:

All places or things serve a function.

- Consider their purpose and the users who will use them.
- Consider if the purpose is still valid or needs to be reviewed with time.
- What if the purpose is no longer valid? How to repurpose them or prevent the loss of purpose?



SCENE 1

A pack of raw chicken wings with the expiration date the same as the day indicated on the calendar.

- What happens if no one buys this chicken?
- What happened to all expired raw meat?
- What about the fresh vegetables that are going to spoil?
- What would happen if this happened at home? What did my mother do with it?

EXAMPLE

2. Users

You need to be observant, curious and caring for people.

- Recall and observe every little detail the moment they step into the place/facility.
- Note down how they move around, where they go, and what they do.
- Observe their actions and behaviors and wonder why they are doing that or behaving that way.
- Is there something lacking, uncomfortable, inconvenient, awkward, etc., that affects the users' experiences in the place?
- How can the flow of movement and things in the place be improved to make it more comfortable, efficient, and sustainable for the users' needs?



SCENE 2

An old man sitting alone with a sad look.

- Why did he look so sad?
- Is he lonely or staying alone?
- How did he pass his time?
- Is there anything suitable for him to do in the park?

EXAMPLE

3. Achieve SDGs

Achieving SDGs is the key task of this project. You need to think about what you have learned earlier about SDGs as you observe people and the environment.

- How can the consumption of resources be reduced?
- How can the well-being of people be improved, or people be happier?
- How can the quality of education be improved or designed to be inclusive or accessible to all?
- How can the environment be improved for the good of people or natural habitats?
- How can minority groups of people, like the handicapped, foreigners, vegans, Muslims, etc., be taken care of?
- What can your country's critical problems, such as the ageing population, pollution, etc., be addressed?
- How can your community be more aware of the different issues if most people are unaware of them or don't care much about them?



SCENE 3

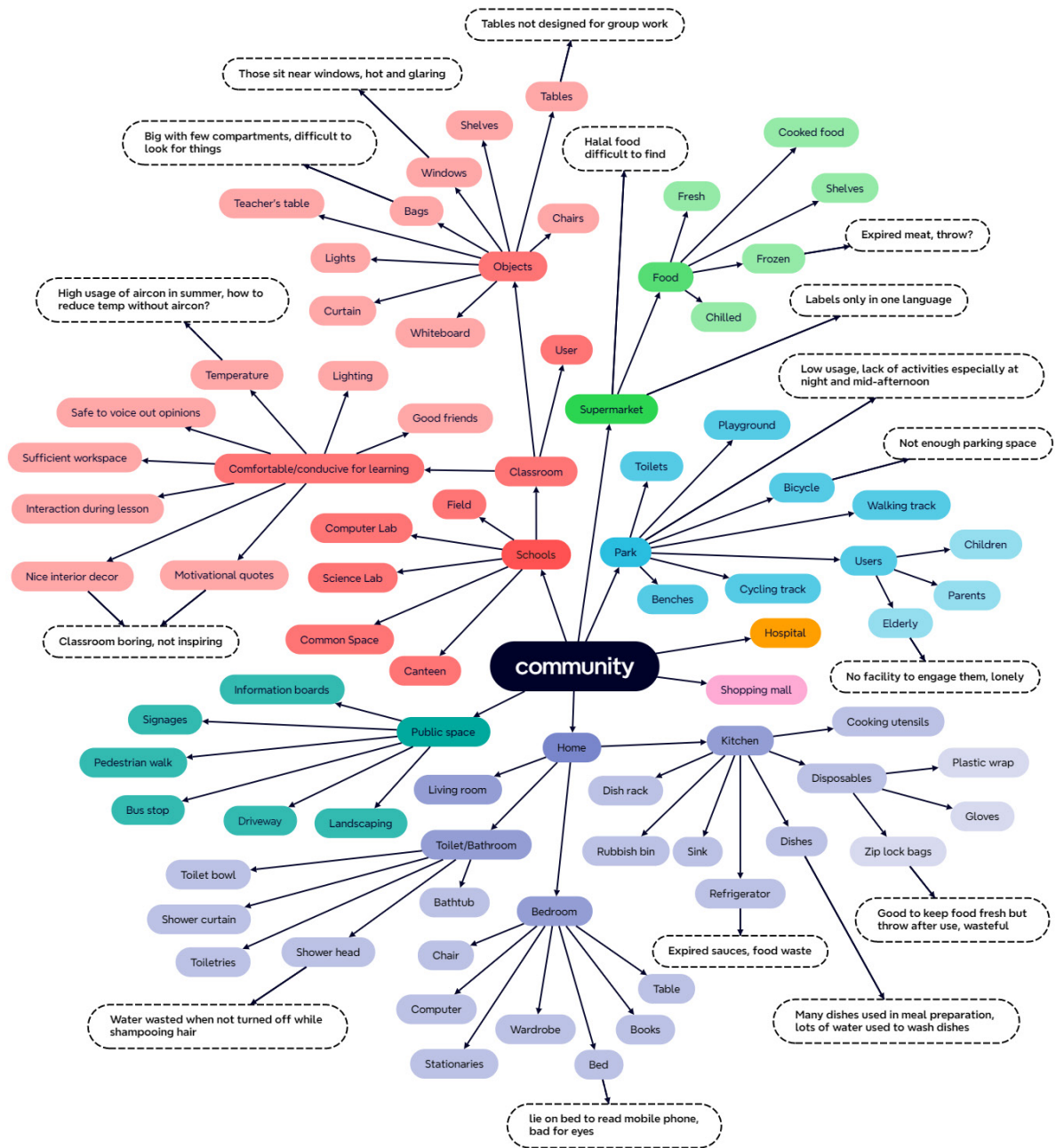
A shower head in the bathroom.

- Did I waste water when I bathe?
- The shower head drips water occasionally. How can I prevent it?
- Where else did I waste water at home?
- How can I reduce the amount of water used at home?

EXAMPLE 1

Places

It started with “Places” as the first-level association to explore the venues and objects within these places and then identify possible problems related to the venues and objects.

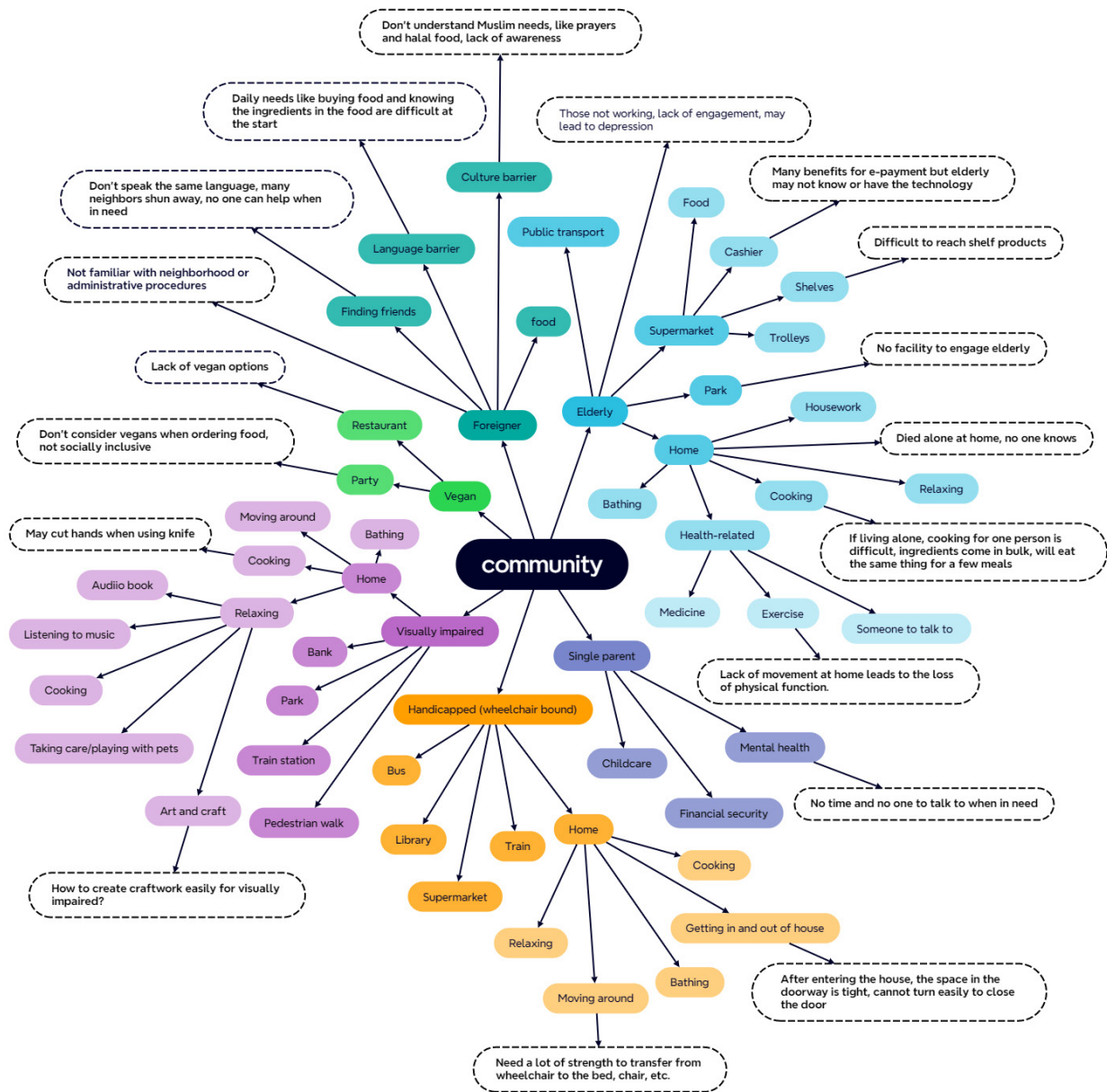


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EXAMPLE 2

Different groups of people

It started with “Different groups of people” to explore the places/activities/events they participated in and how they got there to identify possible problems.

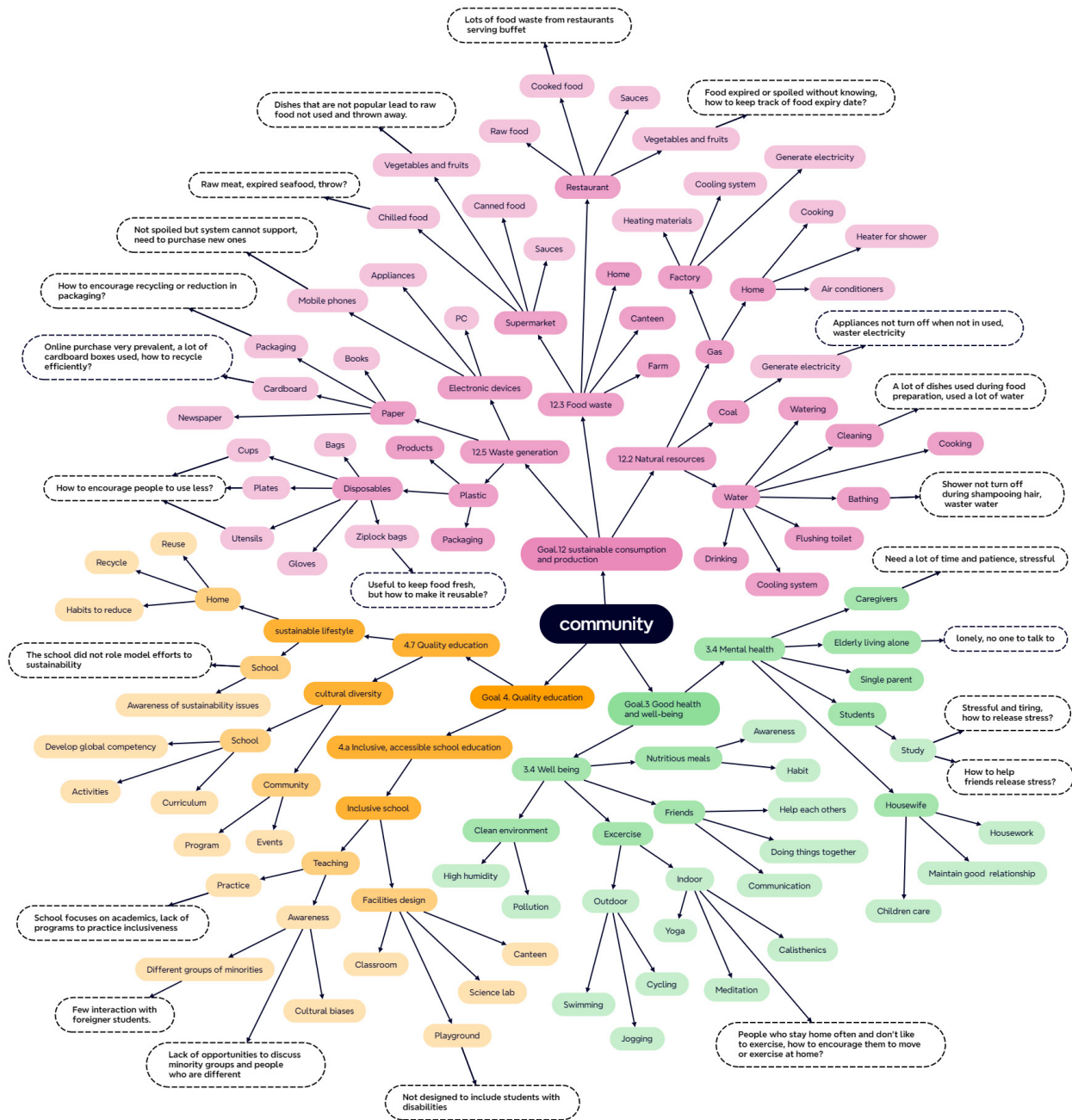


Presented with xmind

EXAMPLE 3

SDGs and its sub-target

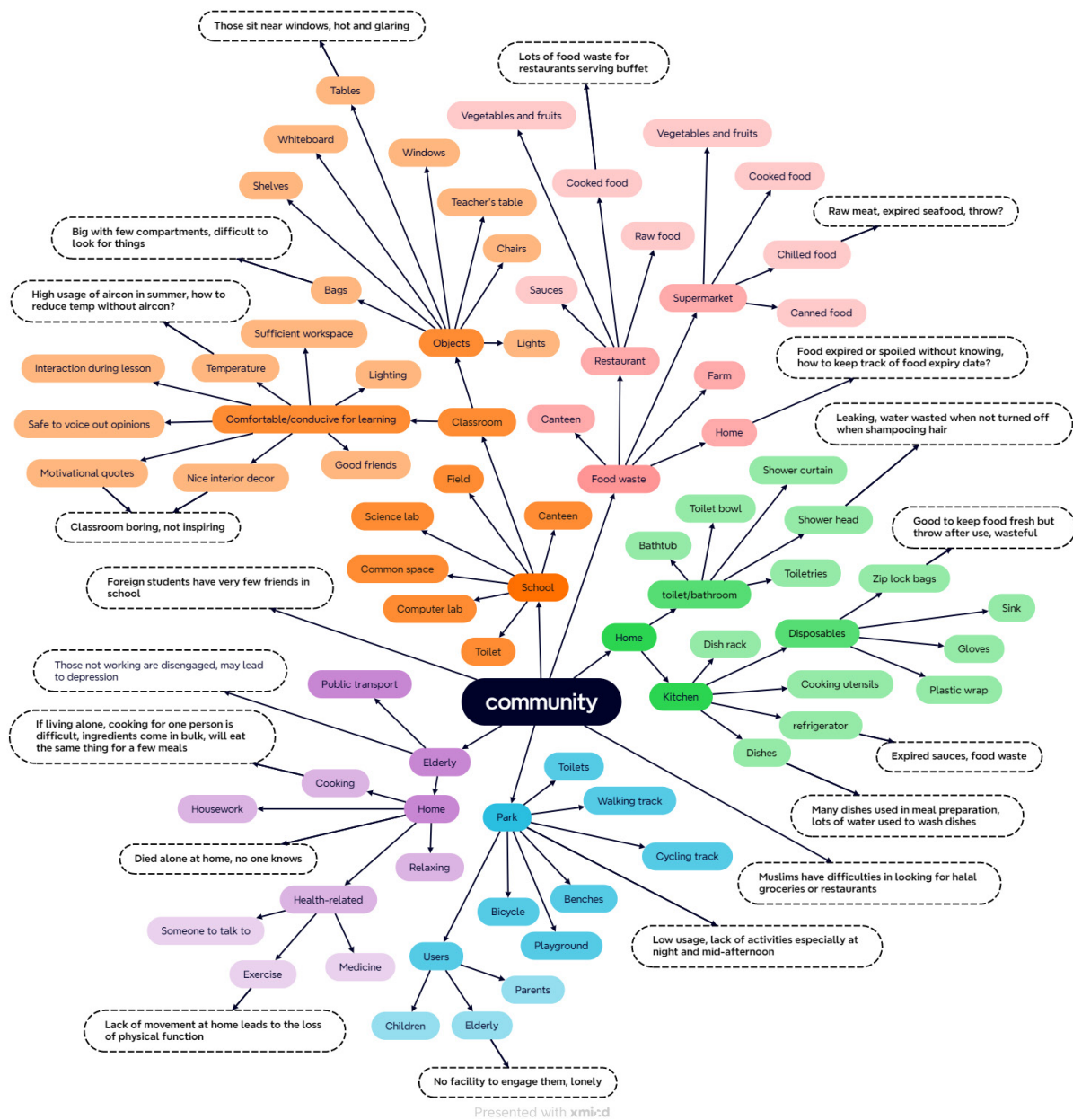
It started with “SDGs and its sub-target” to explore the keywords used in the sub-target descriptors to explore the places, people, events, objects, and resources and then identify problems or areas for improvements.



Presented with xmi:d

EXAMPLE 4

This example shows a combination of different first-level associations and some random thoughts.



Presented with xmi:cd

Writing Problems with Details

The mind map consists mainly of short phrases or words. Hence, it is important to write the problem clearly in sentences. Writing out the problem will help you articulate your thinking and make it easy for others to understand.

To write the problem clearly, you need to include the place where it happened, the people involved, what happened, and how and why it happened.

EXAMPLE

1. The supermarkets throw a lot of raw meat after it passes the expiry date which leads to food waste.
2. There are many elderly people who are living alone, and they don't have many friends. They are not engaged and don't go out much. As such, some of them suffer from depression.
3. Although the SDGs have been set since 2017, there are not many efforts done by the students in our school because they don't know much about them.
4. Our school bag is big and useful for us. However, it was difficult for us to find the things we needed in the bags, and we took a very long time to find what we wanted.

Deciding a Problem

After exploring different problems, how do you decide which problem to select? Do you select a problem based on feelings and emotions? Yes, to a small extent, you can base it on your feelings. However, that is insufficient. We need to apply our logical and critical thinking to make the decision.

To do that, we need first to set **criteria** for the decision-making.

What are criteria?

Criteria are standards for judging something. In this case, they are used to decide which problem to select. There is no right or wrong criteria or the

best problem to select. Every problem is important, as the SDGs aim to be inclusive. It would be best if everyone could do their part in different ways to solve all SDG problems. Hence, we need to think about our criteria to decide on a problem. You can refer to the list of criteria below.

- Number of people impacted: Solving the problem will impact or benefit more people. It addresses the problem faced by most people.
- Minority groups of people: Solving the problems will address the needs of minority groups, such as handicaps, special needs, etc., which are often neglected.
- Urgency: There is an urgent need to solve this problem as many people are suffering from this problem.
- Importance: Solving this problem is fundamental to addressing a bigger issue.
- Time required: Can the problem be solved within the given time for the project?
- Technology required: Can we solve the problem with the currently available technology?
- Availability of solutions: Are there solutions or many solutions to address this problem? If not, there is a need to solve this problem.
- Accessibility to the target group: Is it easy to find information on this group of people so that we can understand the problem well and design a suitable solution?

What are the methods to decide a problem?

There are many methods to help us make decisions. You will use two methods – Decision Axis and Decision Matrix, to help you decide on a problem.

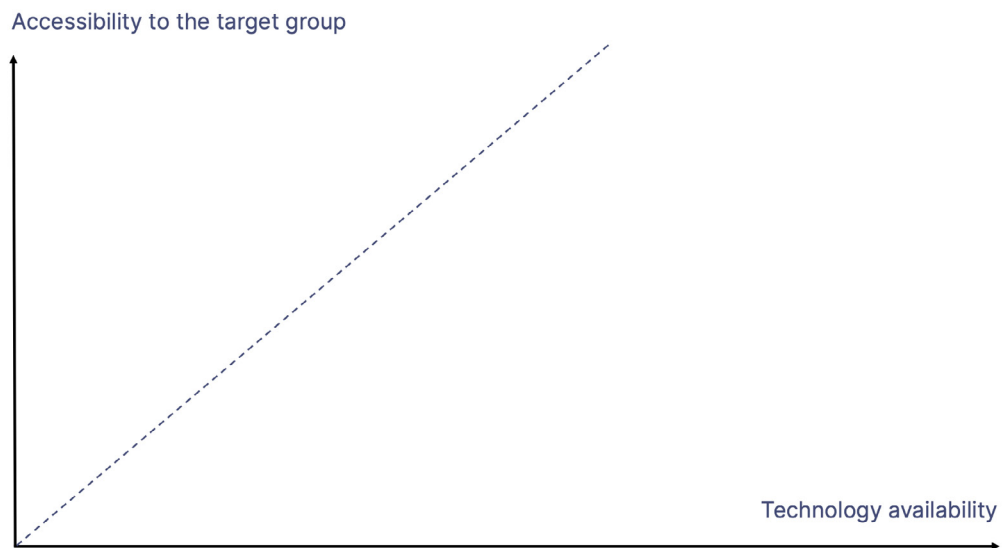
Decision Axis **METHOD**

The **Decision Axis** method will help you eliminate problems based on the two most important criteria.

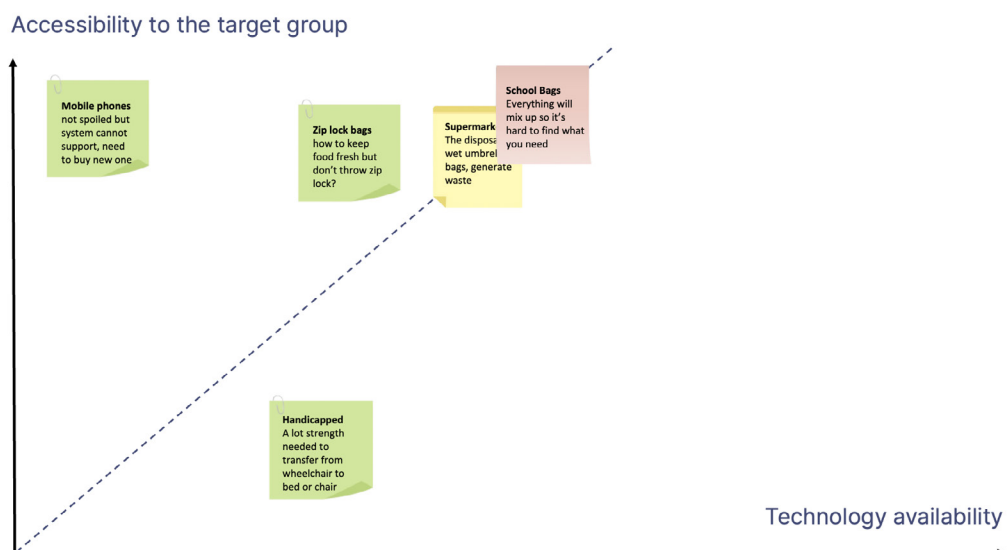
As a group, you need to decide on the top two important criteria from the list.



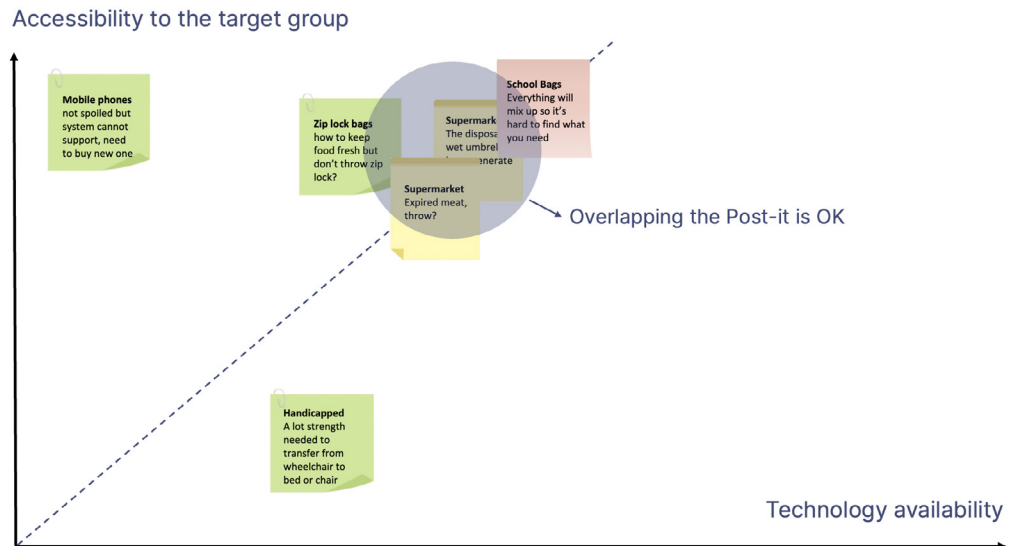
- 1 Create the axes on a large piece of paper and write the two chosen criteria at the end of each axis, as shown below.



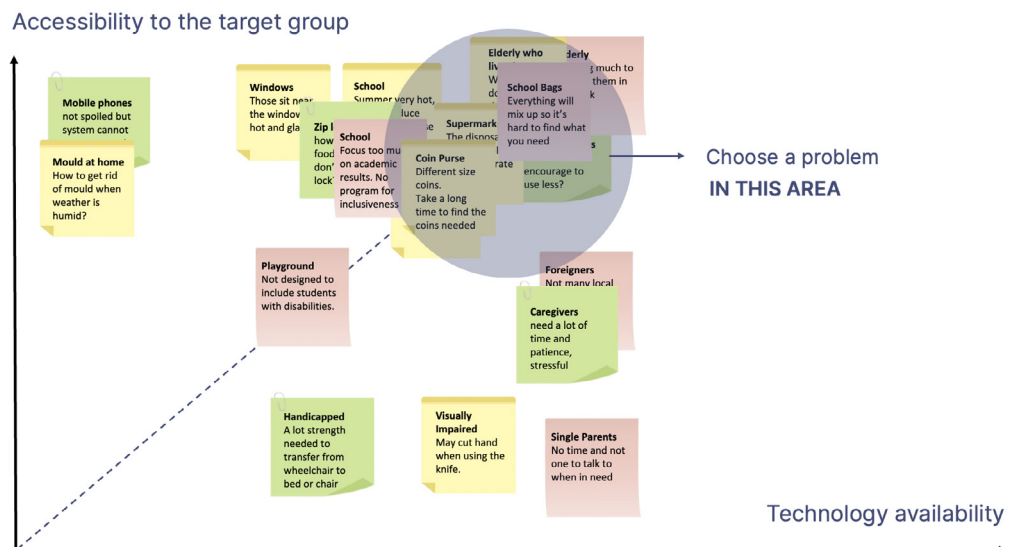
- 2 Evaluate each problem based on the two criteria and paste the post-it with the problem on the paper.



- 3 If some problems are similar, you can consider them as one problem. You can overlap the post-it on the paper.



- 4 The problems that meet the two criteria will likely fall in the shaded portion.



- 5 Choose 5 problems from this shaded portion. This shaded portion showed problems that scored high on both criteria.

Decision Matrix **METHOD**

The **Decision Matrix** is a decision-making table that allows you to evaluate different problems systematically and logically based on given criteria.

STEPS

- 1 Paste the five selected problems on the top row of the A3 size worksheet and list the remaining criteria from the List of Criteria on the left column.
- 2 Based on the five selected problems, evaluate the problems against the criteria. Pick a tick on the box if the problem meets the criteria.
- 3 Total up the number of ticks in the bottom row. The highest score problem will be the chosen problem.
- 4 If there is more than one problem with the same highest score, you can decide which to choose with good reasons.

EXAMPLE

	School Bags Everything will mix up so it's hard to find what you need	Coin Purse Different size coins. Take a long time to find the coins needed	Supermarket The disposable wet umbrella bags, generate waste	Students Don't know much about SDGs. How can we help them?	Elderly who live alone What can we do to prevent the elderly from getting depression?
CRITERIA					
Urgency			✓	✓	✓
Importance	✓		✓	✓	✓
Time required	✓	✓	✓	✓	✓
No. of people impacted		✓			
Availability of solutions	✓		✓	✓	✓
TOTAL SCORE	3	2	4	4	4

Understanding the Problem

What you see and what you hear, does that make it real?

We often think that what we see and hear is the truth. However, our thinking is mostly based on our assumptions and perspectives, which may be inaccurate because we did not experience the situation. What we see is the surface of the problem, and we don't fully understand the problem or its root cause. Hence, our thinking could be biased, inaccurate, uninformed, unfair, etc.

For example, some people say that most foreigners in their countries work in convenience stores or low-level jobs such as cleaners, rubbish collectors, etc. Foreigner workers are poor and resort to crime, which is why their countries' crime rates have increased.

Is what is said true? Are they supported by the statistics published and confirmed by the Ministry of Foreign Affairs and the National Policy Agency? If not, such statements could be inaccurate, uninformed, unfair, and biased.

If we believe this statement is true without supporting it with evidence, we may try to address the issue of an increased crime rate by reducing the number of foreigners working in these countries. If this statement turns out to be untrue, do you think the solution will effectively reduce the crime rate?

Hence, understanding the problem is very important. It is the key to coming up with good solutions. We can never derive an effective solution if we do not understand the problem well.

Do you understand the problem?

Is the problem that you have written accurate and true?

You can do a quick self-assessment using the questions below.

QUESTIONS

- Is the problem based on my own assumptions?
- Do I have evidence to support that the problem is accurate?
- Is the problem only from my perspective?
- Have I asked anyone else for their opinion?
- Did I ask relevant people for their opinions?
- Did I ask many of the people involved?

How can you understand the problem?

To understand a problem, you need to research for accurate information as evidence to justify the problem. You also need to understand the current situation to gain insights into what has been done, whether the solutions are effective, and the advantages and disadvantages. You can conduct site visits and surveys or interview relevant people to understand the problems. A good understanding of the situation and currently available solutions will help you come up with good ideas for solving the problem.

Research Plan

Before you embark on research, it is important to develop a **research plan** to justify the chosen problem.

What do you need to consider?

You need to consider the following when drafting the plan:

- What evidence should we collect?
- How do we find this evidence?
- Who else should we seek an opinion from to make a fair judgement?
- What are the current solutions and related information?

EXAMPLE 1

Problem The supermarkets throw away a lot of raw meat after it passes the expiry date which leads to food waste.

What evidence should we collect?	How?	Where? Who?
① Do supermarkets really throw away raw meat after it has passed the expiry date?	Internet	Government agencies, organizations that promote food waste reduction, general search.
	Interview Site visit	Supermarket staff, staff of the government agencies, environmentalists, etc.
② How much raw meat did they throw away?	Internet	Government agencies, organizations that promote food waste reduction, general search.
	Interview Site visit	Supermarket staff, staff of the government agencies, environmentalists, etc.
③ What else did they throw away?	Internet	Government agencies, organizations that promote food waste reduction, general search.
	Interview Site visit	Supermarket staff, staff of the government agencies, environmentalists, etc.
④ How did they minimize throwing away the raw meat and others (if any)?	Internet	Government agencies, organizations that promote food waste reduction, general search.
	Interview Site visit	Supermarket staff, staff of the government agencies, environmentalists, etc.
⑤ Are there any ways to use the raw meat instead of throwing it away?	Internet	Government agencies, organizations that promote food waste reduction, general search.
	Interview Site visit	Supermarket staff, staff of the government agencies, environmentalists, etc.

NOTE Although the target group is the supermarket, it is possible to interview other groups of people who are related or connected. For example, for ways to use raw meat instead of throwing it away, people such as parents or restaurant chefs may also face the same situation and have their own solutions to this problem that the supermarkets can learn from.

EXAMPLE 2

Problem There are many elderly people who are living alone, and they don't have many friends. They are not engaged and don't go out much. As such, some of them suffer from depression.

What evidence should we collect?	How?	Where? Who?
① Are there many elderly people who are living alone?	Internet Publication	Government agencies, elderly care associations, newspapers, community centers, general search.
② If they are living alone, are they not engaged, don't go out much, and don't have many friends?	Internet Publication	Government agencies, elderly care associations, newspapers, community centers, general search.
③ Did they suffer from depression because they are living alone, do not have many friends, are not engaged, and don't go out much?	Internet Publication	Government agencies, elderly care associations, newspapers, community centers, general search.
④ What are the challenges faced by the elderly?	Internet Publication	Government agencies, elderly care associations, newspapers, community centers, general search.
	Interview Site visit	Grandparent who is staying alone, any elderly person you know who is living alone, caregivers or nurses, staff from government agencies or elderly care associations, etc.
⑤ What has been done to engage the elderly?	Internet	Government agencies, elderly care associations, newspapers, community centers, general search.
	Interview Site visit	Grandparent who is staying alone, any elderly person you know who is living alone, caregivers or nurses, staff from government agencies or elderly care associations, etc.
⑥ Are there elderly people who stay alone and are happy and not lonely? If yes, why?	Internet	Government agencies, elderly care associations, newspapers, community centers, general search.
	Interview Site visit	Grandparent who is staying alone, any elderly person you know who is living alone, caregivers or nurses, staff from government agencies or elderly care associations, etc.

NOTE The scope of this problem is big. Elderly people face very different challenges in their sixties and eighties, whether they are mobile or not, whether they are healthy or have medical conditions, etc. After or during research, it is important to scope the problem, focusing on a particular group of elderly people. Otherwise, in the ideation stage, the ideas generated may target different groups and issues. Thus, it will be difficult to evaluate ideas and decide on the best probable idea that can solve the problem.

EXAMPLE 3

Problem Although the SDGs have been set since 2017, there are not many efforts done by the students in our school because they don't know much about them.

What evidence should we collect?	How?	Where? Who?
① How much do the students know about SDGs?	Survey Interview	Students in the school
② Where did the students learn about SDGs?	Survey Interview	Students in the school
③ What have the students done to achieve SDGs?	Survey Interview	Students in the school
④ If students have done something for SDGs, why did they do it?	Survey Interview	Students in the school
⑤ If students have not done anything for SDGs, why did they not do it?	Survey Interview	Students in the school
⑥ What did the school do to create awareness of SDGs and encourage students to achieve SDGs?	Survey Interview	Students and teachers in the school
⑦ How did other schools create awareness of SDGs and encourage their students to achieve SDGs?	Internet Interview School Visit	General search Teachers in other schools Schools active in SDGs
⑧ What have students from other schools or other countries done for SDGs?	Internet Interview	General search Friends in other schools

NOTE The scope of this problem may be manageable, depending on the research outcomes. In this case, there may be two perspectives: how the school can implement strategies to achieve SDGs that involve whole-school efforts (top-down) or how to encourage students to take initiatives for achieving SDGs (bottom-up). The target group is the school's students. Hence, the survey can be conducted with a bigger group to have a more accurate understanding of the problem through the data collected.

EXAMPLE 4

Problem Our school bag is big and useful for us. However, it was difficult for us to find the things we needed in the bags, and we took a very long to find what we wanted.

What evidence should we collect?	How?	Where? Who?
① How many students face difficulties in finding things in their school bag?	Survey Interview	Students in the school
② Why did they find it difficult to find things they needed in the bag?	Survey Interview	Students in the school
③ What are the things they have difficulty finding inside their bag?	Survey Interview	Students in the school
④ What do students put in their school bags?	Survey Interview	Students in the school
⑤ For students who don't have a problem with their bags, why is it so?	Survey Interview	Students in the school
⑥ Are there any improvements students would like to make to the school bags?	Survey Interview	Students in the school
⑦ What are the different designs of school bags or bags available on the market for different purposes?	Internet	General search
⑧ How are sustainable bags designed?	Internet	General search

NOTE The target group is school students. Hence, the survey can be conducted with a bigger group to gain a more accurate understanding of the problem through the data collected. The last question on sustainable bags is added to link to achieving SDGs.

How do you conduct accurate and reliable research?

You need to take note of the following when conducting research.

- Cite the source of information to give credit to the source and as evidence.
- Choose reliable sources for accurate information. For example, a newspaper, an official website, a book, a magazine, a research paper from established publishers, etc.
- Find information from more than one source to justify the accuracy of information.
- Find information from relevant people to provide accurate information. If your target group is children, you should not interview your classmates. However, if the age group is very young, depending on what you want to find out, it may be better to interview the parents with young children.
- Find information from more than one person to ensure the information provided is not biased and representative of the target group. For example, if you are only interviewing one student, whether he has done anything for SDGs in the school, your results will depend on his reply, which is not representative of all the students in the school.
- For information on current solutions, it is important to include what other people in other countries did. They may have different solutions that we can learn from. Also, find out if the solutions are effective from others' perspectives.

Research Methods

Surveys and **interviews** are two methods for gathering information using relevant questions from a sample of people to understand the situation, a particular subject of interest, etc. They provide critical sources of data and insights for everyone engaged in the information economy, from businesses to media to government and academics.

They can be used independently or together. Surveys can first be used to sense the general opinions and follow up with interviews on a particular area you want to know more in-depth.

Survey **METHOD**

Surveys are designed to collect information from a small number of people to represent a larger number of people and learn about their behavior, preferences, opinions, etc.

How do you design good survey questions?

1. State your objectives clearly. It will guide you in designing the survey questions.
2. The questions should be clear, easy to understand, and not too long or ambiguous. This is to ensure the accuracy of the data collected.
3. Do not try to address too many issues in one question. Respondents may miss out on some parts of the questions.
4. Do not ask too many questions in one survey. If there are too many questions, respondents may not attempt or complete the forms.
5. Do not ask too difficult questions.
6. Arrange the order of the questions in a natural and logical sequence, starting with easy or familiar questions to encourage participation.

What are the question formats?

There are two basic formats: 1) Closed-ended, and 2) Open-ended. Depending on your objective, you can use a combination of both in a survey.

Close-ended questions ask respondents to choose from a distinct set of pre-defined responses, such as “yes/no” and multiple-choice questions.

Open-ended questions are free-form survey questions that allow and encourage respondents to answer in an open-text format based on their complete knowledge, feelings, and understanding. They may start with “Why,” “Describe,” or “Can you explain?”

What is the advantage of an e-survey?

If you are collecting many surveys and the target group is IT savvy, you may want to consider using an e-survey, which is an easy and convenient way to collect the replies and collate the data.

Interview **METHOD**

Interviews are designed to collect a richer source of information from a small number of people on their behavior, preferences, feelings, opinions, etc. They help you explain and better understand the information collected. Interview questions are usually open-ended so that in-depth information will be collected.

How do you prepare for the interview?

1. Identify the purpose of the interviews

- State your objectives clearly. It will guide you in designing the interview questions.
- Who are the relevant people that you should interview?
- What kind of information do you want to obtain from the interviews?

2. Design interview questions

- Prepare a self-introduction that includes the objectives of the interview and addresses the confidentiality of the data collected.
- Design the questions bearing in mind the information you need.
- Avoid leading questions that will direct the interviewee to the answers that you want to hear.
- Make sure the questions are simple and clear to

understand, not ambiguous.

- Organize your questions by topics/themes and in a logical sequence.

3. Conduct the interviews

- Practice active listening to the interviewees and avoid interrupting the conversation.
- Remember that your tone, follow-up comments, and nonverbal cues will affect the interviewee's response to your questions. If interviewees feel that they are being interrogated, they might feel defensive or judged. Thus, not willing to say more.
- Towards the end of the interview, ask the interviewees if they have anything to add.
- Some types of questions that you can consider during the interviews

QUESTIONS

- **Introducing questions:** These questions will be the opening questions to start the conversation on the key topics that you want to find out. “Why did you...?” or “Can you tell me about...”
- **Follow-up questions:** These questions help the interviewee elaborate on their initial answer. “What did you mean...?” or “Can you give more detail...?”
- **Probing questions:** These questions help to obtain more details and deepen the understanding of issues related to your topic. “Do you have any examples?” or “Could you tell me more about...”
- **Silence/Wait time:** This is a non-verbal cue to suggest to the interviewee that you want them to tell you more about your questions.
- **Interpreting questions:** It is important to clarify your understanding of the interviewee's answers to ensure you understand correctly. “Do you mean that...?” or “Is it correct that...?”

4. Plan Logistics

- Do you want to bring a group mate to take interview notes?
- Do you want to audio or video record the

interviews? If so, you need to seek permission from the interviewees.

- Where do you plan to conduct the interview?
- How long will it take?

What other things should you take note of for conducting a good survey and interview?

- A self-introduction that provides confidence and reliability to the interviewee. Include your school's name, the teacher in charge, and the objectives of the interview.
- Provide contact information for interviewees if they have questions and need further clarification.
- Ensure interviewees are aware of the confidentiality of the data collected.
- Provide information such as the number of interviewers, the venue and duration of the interview, etc.
- Before administering a survey or interview, make sure you test your survey or interview in advance with someone who does not know about your survey or interview. Pretesting is important and necessary to determine if your questions are clear and the answers are what you expected.

Documenting Research Findings

Documenting research findings will help you organize your notes and data. It shows the reliability of the sources, adds validity to your work, gives credit to others who provided the information, and makes it easier to share your research with others and review the information again if you need clarification.

A simple way to document your research is to cite the sources and write down the key findings found in the source.

Analyzing Research Findings

After research is done and information and data are collected, you will need to analyze them. Analysis is the process of critically examining research. You can first organize the information and data by categorizing them. Then, you can interpret the information and data and build explanations. You can use the following guiding questions to help you analyze your research findings.

QUESTIONS

- Explain what happened.
- Why is this happening?
- What is the implication?

Consolidate Research Findings

Everyone in the group is researching for different information. You need to come together to consolidate and summarize your findings. If there are discrepancies in your findings, you may need to review the sources of information or look for new sources.

Final Problem Statement

Based on your summarized findings, you will need to rewrite your problems with details and good reasoning supported by the research evidence.

EXAMPLE 1

Initial Problem Statement

The supermarkets throw away a lot of raw meat after it passes the expiry date which leads to food waste.

Final Problem Statement

The supermarkets tried to minimize throwing away raw food each day by monitoring the daily sales of raw food, giving discounts for near-expired raw food, cooking and selling the near-expired food and some tried to give away near-expired raw food. However, some of these strategies do not work well because some people feel that near-expired raw food is not fresh or safe to eat, there is no certainty of how much raw food is left each day and who to give it to, and too little time to deliver or pick up the near-expired raw food to ensure safe consumption. Also, many people don't seem to be aware or concerned about food waste. Hence, supermarkets throw away some expired raw food daily.

EXAMPLE 2

Initial Problem Statement

There are many elderly people who are living alone, and they don't have many friends. They are not engaged and don't go out much. As such, some of them suffer from depression.

Final Problem Statement

According to recent research published by the National Institute of Population and Social Security Research, the number of elderly single-person households will grow from 7.38 million in 2020 (13.2% of the total) to 10.8 million (20.6% of the total) by 2050. Many of these elderly people face the issue of social isolation influenced by many factors such as financial problems, health conditions, family conditions, personality, and social relationships. Numerous studies show social isolation is linked to adverse health outcomes. To address the issue of the declining birthrate and aging population and create a new social system in line with the super-aging society, Fukuoka City started the "Fukuoka 100 project" in 2017. However, there aren't many projects that encourage those elderly living alone, especially those who are mobile, to interact and engage with their community to reduce social isolation.

EXAMPLE 3

Initial Problem Statement

Although the SDGs have been set since 2017, there are not many efforts done by the students in our school because they don't know much about them.

Final Problem Statement

Based on the survey results of 100 students of each grade in the school, 83.3% of the students in year 1 are not familiar with SDGs. Those who know learned about it occasionally from some teachers who mentioned it briefly, TV programs, parents, etc. 85.7% and 90% of Year 2 and 3 students, respectively, know about SDGs, mainly through some of the subjects in Year 2. Though they know SDGs and their importance, less than 15% of all surveyed students take action to achieve them on their own. Those who took action changed some of their daily habits, such as bringing water bottles instead of bottled tea or mineral water, not using straws where possible, turning off the tap when soaping their hands, etc. A few mentioned that they volunteered at the community center or events and two said they implemented simple acts as a family in their house. 75.3% of all the students surveyed said they have no time because they are busy studying. 46.7% do not have the motivation, 23.7% do not know enough about what they can do, etc. Hence, results showed that though students are aware of SDGs, they did not do much, mainly because they have no time and are not motivated.

EXAMPLE 4

Initial Problem Statement

Our school bag is big and useful for us. However, it was difficult for us to find the things we needed in the bags, and we took a very long to find what we wanted.

Final Problem Statement

Our school bag is big and allows us to put everything we need to bring to school. However, 45% of the students surveyed faced difficulty finding small items such as coin pouches, earpieces, lip balm, hair brushes, phone chargers, and sanitizer. These small items are usually buried deep inside the bag among all the bigger items, such as books, PE attire, water bottles, etc. Also, some students cannot remember if they have brought the items to school. Among those who don't face these problems, 63% of the students have their own pouches to keep these smaller items. In our survey, we found other issues the students faced in using the school bags, such as no space to keep a wet folded umbrella, the back feeling very hot and wet during summer when carrying the bag for a long time, etc. Some students hope that they can personalize their bags.

Generating Ideas

After understanding the problem, we can embark on ideation which means generating many different ideas to solve the problem. There are many ideation methods, one of which you will be using is “**How-Might-We**” questions. However, before going into this method, note that when generating ideas, don’t worry if your ideas are good or not. At this stage, just focus on coming up with many different ideas. Your ideas can be wild and crazy. It is fine. You can research to find evidence to support that your idea can work later. If you are stuck, you can think of improving existing ideas or combining two different ideas. Otherwise, you can look for existing solutions in another context to see how to adapt them to solve your problem. There are no rules in how you come up with ideas.

However, you must remember that you cannot copy others’ ideas. You must make some changes to improve them. Otherwise, it is plagiarism.

How-Might-We **METHOD**

The “How-Might-We” questions can turn problems into opportunities for design. It will help you break down your problem into smaller parts to generate solutions. Creating different How-Might-We questions will help you generate ideas based on each question. Your idea may also address a few questions at the same time. It is ok. Also, there is no limit on how many questions you should produce. The more you have, the more ideas you’ll garner.

Why are they called “How-Might-We?”

“How” suggests that we do not yet have the answer. We need to think of ways to solve the problem.

“Might” emphasizes that there are many ways and perspectives when thinking about solutions. We need to be open-minded, wild, and curious and brainstorm creative solutions from different perspectives.

“We” immediately implies teamwork. Creative solutions can be derived when people work in a team, tapping into each other’s strengths and building on each other’s ideas.

EXAMPLE 1

Problem Statement

The supermarkets tried to minimize throwing away raw food each day by monitoring the daily sales of raw food, giving discounts for near-expired raw food, cooking and selling the near-expired food and some tried to give away near-expired raw food. However, some of these strategies do not work well because some people feel that near-expired raw food is not fresh or safe to eat, there is no certainty of how much raw food is left each day and who to give it to, and too little time to deliver or pick up the near-expired raw food to ensure safe consumption. Also, many people don’t seem to be aware or concerned about food waste. Hence, supermarkets throw away some expired raw food daily.

How-Might-We Questions

- How might we encourage people to buy near-expiry raw food?
- How might we change the perceptions of the general public that near-expiry raw food is still fresh and safe to eat?
- How might we reduce the delivery time for the near-expiry raw food to people who want it?
- How might we advertise and connect with people or organizations who want the near expiry raw food?
- How might we raise the awareness of food waste to the general public?

EXAMPLE 2

Problem Statement

According to recent research published by the National Institute of Population and Social Security Research, the number of elderly single-person households will grow from 7.38 million in 2020 (13.2% of the total) to 10.8 million (20.6% of the total) by 2050. Many of these elderly people face the issue of social isolation influenced by many factors such as financial problems, health conditions, family conditions, personality, and social relationships. Numerous studies show social isolation is linked to adverse health outcomes. To address the issue of the declining birthrate and aging population and create a new social system in line with the super-aging society, Fukuoka City started the “Fukuoka 100 project” in 2017. However, there aren’t many projects that encourage those elderly living alone, especially those who are mobile, to interact and engage with their community to reduce social isolation.

How-Might-We Questions

- How might we help the elderly living alone to make friends?
- How might we create an interaction space that is easily accessible to the elderly living alone?
- How might we work with the municipal office to create a care system for the elderly?
- How might we work with different NPOs or government organizations to organize regular events that encourage elderly people living alone to participate?
- How might we get the elderly living alone to contribute to their community through their skill sets?
- How might we create friendships between the elderly living alone and the housewives who have to manage house chores and take care of young children within the community, to support each other?

EXAMPLE 3

Problem Statement

Based on the survey results of 100 students of each grade in the school, 83.3% of the students in year 1 are not familiar with SDGs. Those who know, learned about it occasionally from some teachers who mentioned it briefly, TV programs, parents, etc. 85.7% and 90% of Year 2 and 3 students, respectively, know about SDGs, mainly through some of the subjects in Year 2. Though they know SDGs and their importance, less than 15% of all surveyed students take action to achieve them on their own. Those who took action changed some of their daily habits, such as bringing water bottles instead of buying bottled tea or mineral water, not using straws where possible, turning off the tap when soaping their hands, etc. A few mentioned that they volunteered at the community center or events and two said they implemented simple acts as a family in their house. 75.3% of all the students surveyed said they have no time because they are busy studying. 46.7% do not have the motivation, 23.7% do not know enough about what they can do, etc. Hence, results showed that though students are aware of SDGs, they did not do much, mainly because they have no time and are not motivated.

How-Might-We Questions

- How might we make studying related to achieving SDGs?
- How might we encourage students to achieve SDGs as a class?
- How might we encourage students of similar interests or good friends to come together to do something for SDGs?
- How might we create simple actions or routines as a school for SDGs?
- How might we as a school create awareness for the student’s families and get them involved in efforts for SDGs?
- How might we encourage students to achieve SDGs through rewards?

EXAMPLE 4

Problem Statement

Our school bag is big and allows us to put everything we need to bring to school. However, 45% of the students surveyed faced difficulty finding small items such as coin pouches, earpieces, lip balm, hair brushes, phone chargers, and sanitizer. These small items are usually buried deep inside the bag among all the bigger items, such as books, PE attire, water bottles, etc. Also, some students cannot remember if they have brought the items to school. Among those who don't face these problems, 63% of the students have their own pouches to keep these smaller items. In our survey, we found other issues the students faced in using the school bags, such as no space to keep a wet folded umbrella, the back feeling very hot and wet during summer when carrying the bag for a long time, etc. Some students hope that they can personalize their bags.

How-Might-We Questions

- How might we design a bag that allows students to find small items easily?
- How might we design a bag that allows students to organize their things in the bag?
- How might we design a bag with different openings to take out what they want?
- How might we design a bag with detachable compartments that students can choose based on their needs?
- How might we design a bag that is comfortable to use for different weather?
- How might we design a bag that allows students to personalize the bag in different ways?
- How might we design a bag that takes into consideration of sustainability?

Selecting an Idea

To choose an idea, we need to decide on the criteria. You can use the decision axis method, or if you have many criteria, you can use the decision matrix to select an idea.

One suggestion is the decision axis method, based on two evaluation criteria – the originality

and feasibility of the idea. These two criteria are commonly used to determine innovative and practical solutions.

Originality refers to an idea that has not existed or an improved existing idea that is new, which can solve the problem.

Feasibility means that the idea is possible to realize. You might not have the know-how to develop your ideas, but current research or technology supports the possibility that your idea may work. Some ideas are far-fetched, just like what you have seen in anime, which may be impossible to realize. Experts are needed to research and invent solutions. Hence, it is considered not feasible for you to realize the solution within a given time frame.

STEPS

Decision Axis

- 1 Draw two axes, like a cross, on the big paper provided.
- 2 Label the horizontal axis with “Ordinary” on the left and “Original” on the right. Then, label the vertical axis with “Feasible” on top and “Not Feasible” on bottom.
- 3 Students can evaluate each idea based on these two criteria and place the post-it on the big paper.
- 4 Students can review the ideas pasted on the quadrant of “Original” and “Feasible” that are high on both criteria to decide which idea to choose. It is possible to combine two or more of the ideas and choose the idea.
- 5 Students record the selected idea in their workbooks.

Design Concept

A **design concept** provides more information and details about an idea. It describes and summarizes the important aspects of the idea. Short descriptions and sketches can help others visualize and understand the solution.

Before you start creating the concept, you can consider the considerations for your idea, which can be written as questions. Thinking and asking questions will help you think deeper about how to actualize the idea. The design concept can be formed by answering the questions that you are asked.

EXAMPLE 1

Idea

Create an app for supermarkets to connect with potential receivers and delivery companies and update users quickly on daily raw food to give away as part of corporate social responsibility to reduce food waste and improve people's well-being.

Consideration

- What message does the supermarket want to send to the public through this app?
- What is the purpose of this app?
- What is so special about this app?
- Who are the receivers?
- Who are the delivery companies?
- How to encourage people to use this app?
- How can the app be made easy for the elderly to use?
- What is the flow of the process of using this app for the various stakeholders?
- When and how often do supermarkets upload the data of the stocks to give away?

EXAMPLE 2

Idea

Create an upgraded neighborhood community park (indoor and outdoor space) in collaboration with the municipal office to allow the elderly to interact with the people in the community and encourage the community to self-run the space and support each other with their skill sets.

Consideration

- What message do we want to send to the public on this upgraded community park?
- Who will be using this park?
- What are the various facilities (indoor and outdoor) for the different groups of people?
- How can these facilities allow interaction to take place naturally?
- What other events can be created for the community to mingle and get to know each other regularly?
- How can we encourage the elderly living alone to come to the park?
- How to encourage the community, including the elderly living alone to manage the space?
- How do we publicize the events and facilities?
- What is the role of the municipal office?

EXAMPLE 3

Idea

Create a competition with the theme of what students can do in school to support SDGs with the support of the school teachers. The competition can have different genres such as essay writing, creating products, applying physics concepts to improve or solve problems in school, proposing student's routines for well-being (physical or mental), proposing new school rules, etc., to cater to students of different talents and it could relate to the subjects that they study so that they can apply what they have learned. Concepts that win the competition will be implemented in the school and entered for national or international competitions.

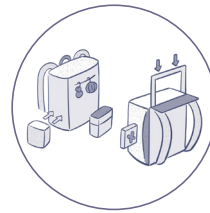
Consideration

- What is the message to send to the students on the purpose of the competition?
- What are the different genres for the competition?
- What are the judging criteria?
- Who are the judges?
- How to motivate students to take part?
- What should be included in the competition's entry?
- How to publicize the competition?
- What and how many types of awards?

EXAMPLE 4

Idea

A new school bag with removable compartments inside and outside. It also includes a compartment that allows students to insert a mini fan or heat pack to keep their bodies cool in summer and warm in winter. The front and sides of the bag have a part that allows students to decorate the bag with accessories.



A new school bag design sketch image

Consideration

- What are the special features and their purpose? How can different views be sketched to show them?
- What are the different compartments and their purpose?
- How do you use the different compartments? How do you sketch different views to show the different options for choosing different compartments?
- Where and how should the bag be decorated? How should enlarged views be sketched to show what it looks like?
- How to design the bag to make it sustainable?
- What technology can be used to make the bag more sustainable?

Prototyping

Prototyping plays an important role in developing and testing the design concepts. Just like a picture is worth a thousand words, prototypes are tangible forms that can be seen, touched, and experienced for essential testing of the concept by the creators, users, stakeholders, etc., to ensure it can solve the problem.

Prototypes may be defined by their level of fidelity. **Low-fidelity prototypes** are commonly found in the early stage of the ideation process. Concept sketches, storyboards, flowcharts, annotations, etc., can be considered low-fidelity prototypes. They are good methods for the development of concepts. These prototypes provide a visual for discussion and evaluation to identify problems and improvement.

Paper prototyping is commonly used as a low-fidelity prototype for solutions, such as campaigns, advertisements, app/website design, products, systems, services, products, competition, programs, food products, fashion, etc. Examples of paper prototypes may come in the following forms:

- a. sketches with information and colour schemes,
- b. sketches of how the user interacts with the app/website upon clicking on the different functions on the screen,
- c. sketches of the storyline of how the system and service are used,
- d. sketches of clothing and patterns,
- e. sketches of the visual presentation of the food dishes, including the recipe, nutritional values, and cooking methods,
- f. and many others.

For solutions that involve designing competition or program-type concepts, paper prototyping can come as proposal drafts with flowcharts, timelines, plans,

budgets, descriptions, etc.

Low-fidelity prototypes can also be made from quick modelling with materials such as paper and cardboard to visualize the product's size, overall appearance, or layout and flow of the architectural space. Low-fidelity prototypes of physical products can be made from foam materials that can be shaped quickly to provide an overall appearance and shape to test for product comfortability. In addition, using simple mechanical, electrical and/or electronic components can also be a form of low-fidelity prototype to test the workability of the concepts. For textile solutions, low-fidelity prototypes may be fabrics sewn quickly to see how the patterns look on the mannequin. For food products, the prototypes, in general, can be cooked dishes for sensory and visual evaluation.

Multiple low-fidelity prototypes can be created to test the different parts of the design concepts and gather feedback for improvement. This process of making the prototypes and gathering feedback can be iterative, which means many improved versions of the prototypes might be required to reach a satisfactory and effective solution.



Low-fidelity Prototypes

App interface sketch, mouse foam model, architectural model

High-infidelity prototypes are often considered a more complete representation of the final solution, considering factors such as function, comfort, overall appearance, etc. Besides, high-infidelity prototypes may also be printed posters, brochures, packaging, etc., to provide a realistic visual appearance of the graphics-based solution. In addition, other examples of high-infidelity prototypes include working models, mobile apps, web pages, cooked dishes, and dresses. These types of prototypes will allow functional interaction, food tasting and visual evaluation. Some high-fidelity prototypes are more technologically advanced, such as computer simulations of systems, 3D printed models, computer animations, videos, etc. These prototypes are usually presented to potential users, stakeholders, or investors for evaluation in the final phase of solution development.

Before embarking on prototyping, you need to consider the type of solution concept you hope to embark on. In addition, you also need to consider the purpose of prototypes. For example, do you want to provide a visual appearance to show the users and stakeholders, or do you need a physical prototype to test certain functions of the solution concept? You may also need to consider the types of materials that you need to create the prototype. Finally, the types of prototypes that are required depend on your solutions. You may even produce a combination of models to show and test your solution concepts.



High-infidelity Prototype
A phone charging dock

Evaluation

Prototype testing and evaluation are important to achieve the best solutions. It can start with the creators evaluating the initial low-fidelity prototypes as they made or in discussion with their teammates. As the design concept develops, users or related people can be asked to evaluate and provide feedback for improvement. This evaluation and improvement process can continue for a few cycles until a satisfactory solution has been achieved. Then, a high-fidelity prototype can be created for evaluation at the formal presentation with the various stakeholders.

How do you provide constructive feedback?

If you are invited to give feedback on the models or prototypes (during the final presentation), you need to give constructive feedback. You can consider the following points.

- Listen to the presenter attentively.
- Seek clarification of the purpose of the prototypes and design concepts to have a good understanding before providing any feedback.
- Start giving feedback on what is good and then what can be improved.
- Give feedback positively and be encouraging. This does not mean that you give only positive affirmation even though you find that the prototypes or concepts are lacking.
- Give feedback about the prototypes or concepts, not about the person.
- Provide feedback that gives suggestions on what can be improved, give your reasons, and think from the perspectives of the user, not merely give vague comments like “This part is not good”, “should have this...” etc.

Presentation

The presentation allows you to pitch your proposal to potential users, stakeholders, government bodies, or investors for implementing your solutions. Your presentation needs to communicate and convince the audience of your proposal effectively. It includes what you say, how you structure it, the materials needed to explain your points, and how you say it.

How can you present effectively?

1. Communicate your ideas clearly and logically

- Consider your audience's needs and interests as you plan the presentation and script.
- Plan your presentation in logical order.
- Use simple and easy-to-understand language.
- Write your scripts to articulate and organize your thoughts in a logical and convincing manner, supported with evidence from your research.
- Do not have too many words on your slides. It is difficult for the audience to read the text and listen to the presentation simultaneously.
- Have sketches or images to help in your explanation.

2. Engage your audience

- A slide presentation or presentation board alone can become monotonous after some time. Use different mediums to engage your audience. You can include a video clip of the process, a simulation of how the idea works, demonstrations with prototypes, etc.
- Interact with the audience with simple questions that the audience can answer easily, or involve the audience in a demonstration, voting, asking questions on an online platform, etc. This may allow the audience to have better clarity of your proposal.

3. Highlight the values, good points, and the impact

- Support your points with evidence, such as your survey results, user feedback, etc.
- Think about how your proposal can lead to the next level of change or a large-scale impact.

4. Prepare for the Q&A

- Try to think about the questions your audience will ask and your answers.
- Think from different perspectives.
- Think about the limitations of your proposal, the reasons and possible solutions.

5. Speak effectively

- Maintain eye contact when presenting to connect with the audience and show your confidence.
- Smile when presenting.
- Use appropriate gestures and body language to get your message across.
- Keep your posture upright in a comfortable way, and do not slouch.
- Speak clearly but not too fast and pronounce every syllable.
- Project your voice and ensure the audience can hear you.
- Vary the tone of voice, do not be monotonous.
- Do not read from the script.

6. Rehearsal many times

- Practice makes perfect. If you prepare well, you will be more relaxed and confident when presenting.
- Practice on your own.
- Record the time taken.
- Practice in front of your group mates or video-record yourself.

Reflection

“The unexamined life is not worth living” - Socrates

We are approaching the end of the project. We hope you will take some time to reflect on what you have learned.

Reflection is an important process for metacognition, which means thinking about your own thinking by looking backward, inward, outward, and forward. Think about what you have learned, how it has helped you, how you can do it better, how you have helped others, and what you can do with your learning in the future. It is a process of constantly bettering yourself.

Closure and the Beginning...

We hope that through the skills, knowledge, and experiences you gained from this project, you will understand the significance of the SDGs, the importance of taking action to help your community, develop compassion and a sense of purpose, and, henceforth, willing and wanting to be a changemaker and contribute to society by solving real-world problems in small and big ways.

You can begin by asking **small questions** as you observe your surroundings in your daily lives.

- Who are the people living in my community?
- Who do I not know?
- What problems do my friends/family/neighbours/people that I do not know face?
- What might be created to solve those problems?
- What if?

Then, taking courage to ask **big questions**, such as

- How might nurturing our relationship with our community support our understanding of people and grow our abilities to think and act creatively and collaboratively for the good of everyone?
- What becomes possible when we share our strengths with our community?
- How will the world change if everyone plays a part in solving a real-world problem?

When you are always asking questions and trying to answer them to improve conditions, you are becoming a changemaker.

Everyone can be a changemaker. You can start by taking a baby step.

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