# WORKBOOK

Problem-Based Learning for Sustainable Development

South Asia

Co-funded by the
Erasmus+ Programme
of the European Union

This workbook is made for a Massive Open Online Course (MOOC) which is created by the Problem-Based Learning South Asia project (PBL SA). The project is funded by the European Union Erasmus+ Programme and made in collaboration with ten different universities:

Aalto University, Finland
Jigme Namgyel Engineering College, Royal University of Bhutan, Bhutan
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Asian Institute of Technology and Management, Nepal
Kaunas University of Technology, Lithuania
Nepal Engineering College, Nepal
Indian Institute of Science, Bangalore, India
Indian Institute of Technology, Bombay, India

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# Introduction

You are most welcome to this workbook about Problem-Based Learning (PBL)! The workbook accompanies a Massive Open Online Course (MOOC) on PBL that has been co-created between 2019 and 2022 by ten different Higher Educational Institutions in Europe and South Asia. This project was funded by the Erasmus+ programme of the European Union. Please note that our version of the PBL method is not necessarily the only real method, but it is rather a product of the co-creation process that we went through during the project. This workbook guides you a PBL journey with a selection of key exercises to put the learnings of the PBL MOOC into practice.

## WHAT IS PROBLEM-BASED LEARNING?

You will learn about this method in module 0, and you will experience the PBL method while doing the various exercises that are provided in this workbook. The workbook follows the order of the PBL MOOC modules, which is depicted in the PBL roadmap (see page 3). The roadmap starts with module 0, and ends at module 8. All modules are surrounded by co-creation because when analyzing and trying to solve a problem you cannot just do it on your own. Therefore, throughout the PBL journey we highly recommend you to work with a team. In module 1 you will be guided to learn about and practice your team building and team work.

## WHY DO WE EMPHASIZE THE PROBLEM?

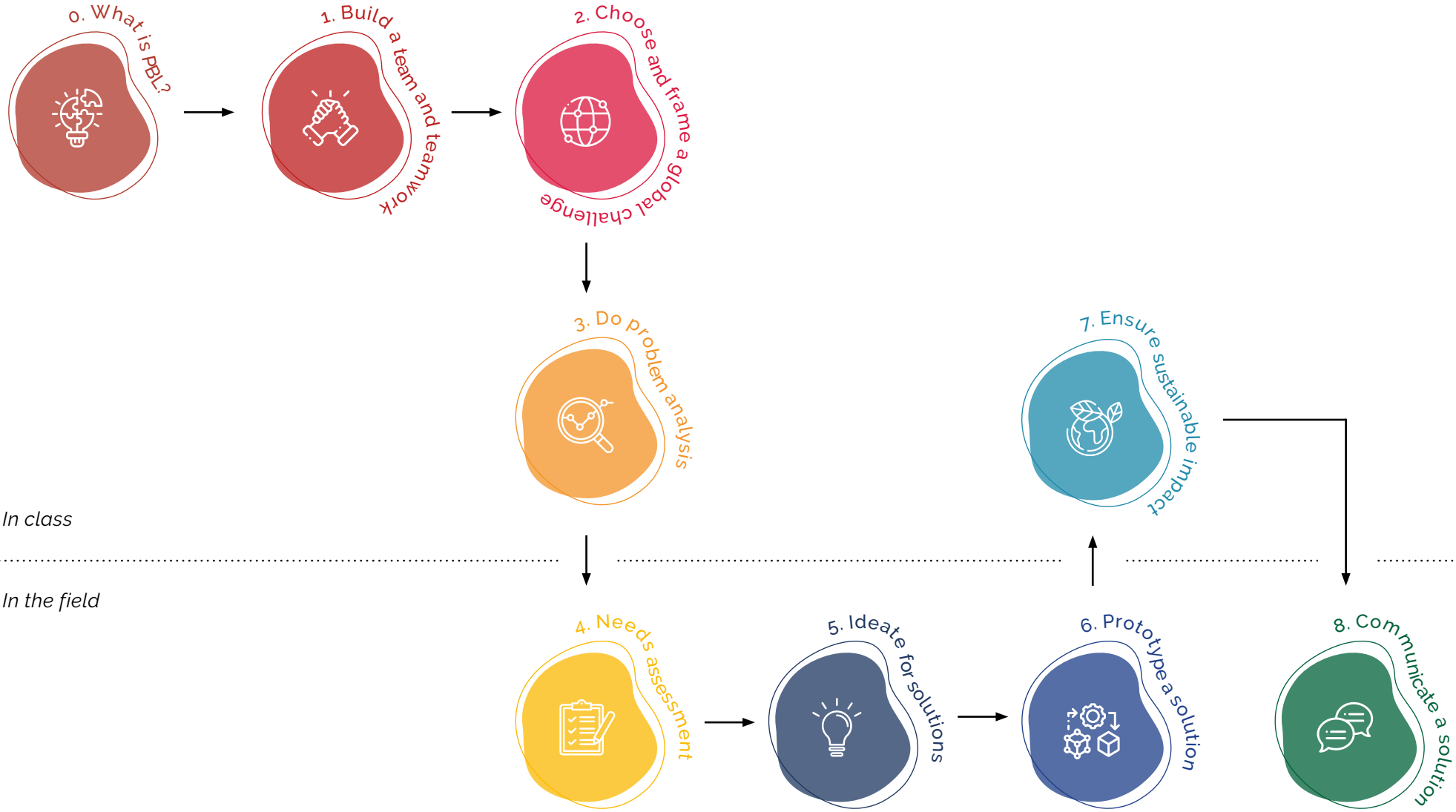
When trying to come up with a solution, defining the right problem set is key. The PBL MOOC comprises three modules that are strongly related to analyzing the problem. Module 2 is about choosing and framing a global challenge, which allows you to consider problems that occur at the macro-level. Module 3 handles the problem analysis and lets you research the problem that you wish to work on and make it more concrete. In module 4 you are asked to zoom in to the micro-level of the problem and discover the needs of the people that face the problem.

## WHAT WILL BE THE FINAL RESULT?

After analyzing the problem you will ideate for solutions, and validate one of them by using a prototype technique. Once you have validated your prototype you are asked to assess the impact of your intervention and at the end to come up with a communication plan and presentation outline.

We wish you a joyful and insightful PBL journey!

The PBL team.


0. What is PBL?
1. Build a team and teamwork
2. Choose and frame a global challenge
3. Do problem analysis
7. Ensure sustainable impact
In class
In the field
4. Needs assessment
5. Ideate for solutions
6. Prototype a solution
8. Communicate a solution

# 0 What is PBL?

Links to lectures

Learning Methods - Lecture 0.1
What is PBL? - Lecture 0.2

To better understand the Problem Based Learning teaching technique, it is important to understand teacher and student-centred learning approaches. PBL is a student-centred learning approach that uses problems as a context for students to acquire problem-solving skills and knowledge. This module will look at the teacher-centred learning approach and compare it with the student-centred learning approach. In this module, we provide learners with a fundamental understanding of PBL and explain the characteristics of PBL.

## LEARNING GOALS

- Gain a fundamental understanding of the 'Problem Based Learning' method.
- Analyze the differences between traditional learning and PBL.

## WHAT'S NEXT?

Now you know what PBL is, you may want to experience it. Are you ready for the first step in PBL? The first step in PBL, however, is not to start with the problem but to start with you and your team, as the PBL method demands teamwork. Why not work by yourself? The saying goes, 'If you want to go fast, go alone; if you want to go far, go together. Learners can achieve great insights when working in teams by learning with their peers. You will learn what it means that 1+1=3.

Notes

*Write down your notes here (e.g. key insights from the lectures, teamwork decisions, random thoughts).*

# 1 Build a team and teamwork

This module highlights the characteristics and the advantages as well as the challenges of working in (diverse) teams. You will be introduced to various forms of collaboration. It also gives insights in the five stages of team building and how teams achieve goals collectively and the various challenges involved at every stage. You will get examples of traits that make the most successful teams doing effective work.

## LEARNING GOALS

- Acquire fundamental concepts of team building and its various aspects.
- Understand and differentiate the different stages of team building.
- Understand the importance of co-creation in team building and teamwork.
- Develop team-building attributes.

## WHAT'S NEXT?

Working together is critical in the current world with wicked challenges, not only with your team but also with relevant stakeholders. Therefore, one must learn about all actors involved. How to choose and frame a global challenge is key in the next module.

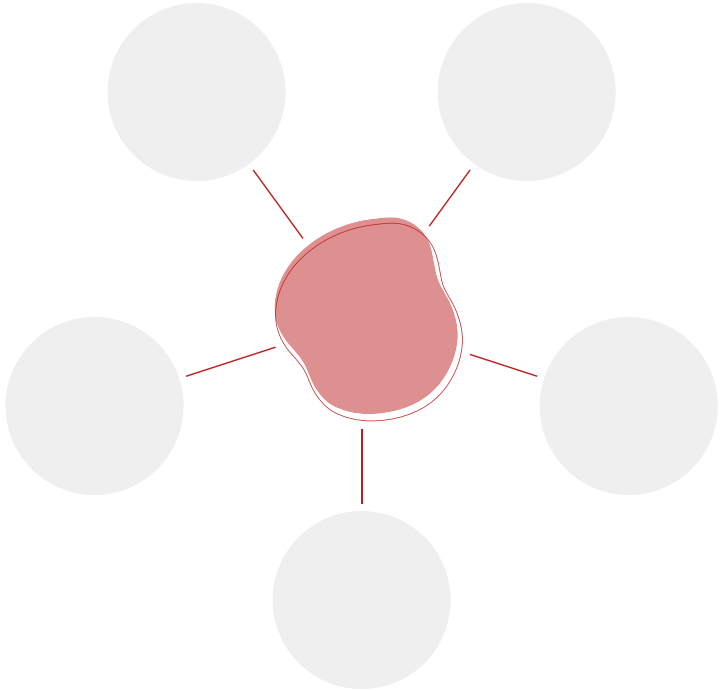
Links to lectures

Fundamentals of Team Building - Lecture 1.1
Team Building Process - Lecture 1.2
Introduction to Co-creation - Lecture 1.3

Notes

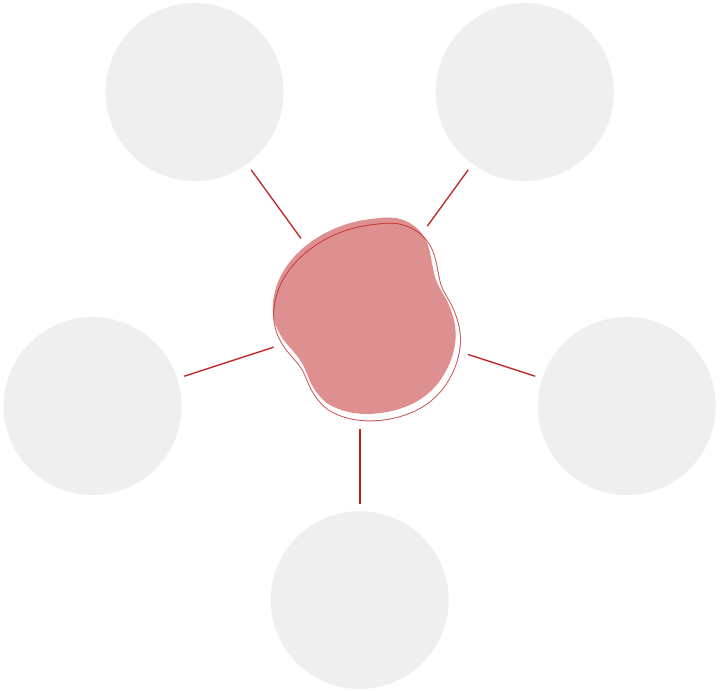
## EXERCISE 1.1

Watch this video. Ceate your own Paseo Circle.



## EXERCISE 1.2

Watch this video. Create a Paseo Circle together with your team.



## EXERCISE 1.3

Watch this video. What is your personality in the 16 personalities framework? Summarize your most important findings here.

## EXERCISE 1.4

How does the description of your personality interfere with your own personality?

# 2 Choose and frame a global challenge

This module helps you and your team to identify, describe and frame challenges faced globally. What are global challenges, which one will you work on and which actors are linked to the challenge of your choice? You will identify and map stakeholders that are linked to a global challenge.

## LEARNING GOALS

- Identify and map various stakeholders involved in the global challenge at stake (with co-create).
- Identify, describe and frame challenges faced globally.

## WHAT'S NEXT?

On a macro-level you now know a bit more about the challenge you would like to tackle. In the next module you will zoom in more to the problem details that you will be working on.

Links to lectures

Choose and Frame a Global Challenge - Lecture 2.1
Stakeholder Analysis - Lecture 2.2

Notes

## EXERCISE 2.1

Describe your project.

## EXERCISE 2.2

Watch this video. Summarize the discussion on SDGs your project may contribute to.

## EXERCISE 2.3

Watch this video. Do a PESTEL analysis on your project.

P Political

E Economic

S Social

T Technological

E Environmental

L Legal

# 3 Do problem analysis

With this module you will learn how to do problem analysis. It introduces the concept of co-creation and mentions the importance of stakeholders' in doing proper problem analysis for solving challenges. Some problem analysis tools are explained in more detail such as the 5 WHY-tool, for you to try out within your project.

## LEARNING GOALS

- Develop an understanding on the tools involved in problem analysis.
- Analyze the role of various stakeholders in problem analysis (co-create).
- Understand the role of problem analysis in PBL scenario.
- Understand the philosophy/theories of problem analysis.

## WHAT'S NEXT?

Now you know more details of the problem and the related stakeholders, it is time to start selecting one user (group) and to learn more about this user by doing a needs assessment.

Links to lectures

Problem Analysis - Lecture 3.1
Step-by-Step Approach Problem Analysis - Lecture 3.2

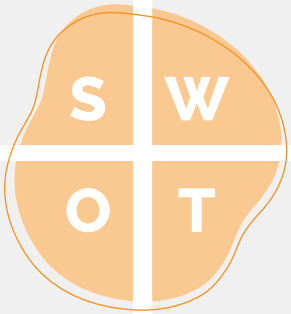
Notes

## EXERCISE 3.1

Describe your project.

## EXERCISE 3.2

Watch this video. Do a SWOT analysis on your project.




## EXERCISE 3.3

Watch this video. Do the 5 WHY analysis.

Problem:

Root cause:

## EXERCISE 3.4

Watch this video. Do the WWWWWH analysis.

Why:

When:

Where:

Who:

What:

How:

# 4 Needs assessment

In this module, you are introduced to practical guidelines for a needs assessment in a 3-step process. Gathering and analysing data skills are explained as well as the stakeholders' role in the process.

## LEARNING GOALS

- Assess the current and desired condition (needs and wants) of concerned stakeholders (co-create).
- Evaluate the gap between current and desired condition of concerned stakeholders.
- Address the need of concerned stakeholders.

## WHAT'S NEXT?

So far, you have done a lot of research on the problem at stake. You know more about the user you would like to target but with what solution? In the next module, you will start the ideation process to know a good solution for the problem you are working on.

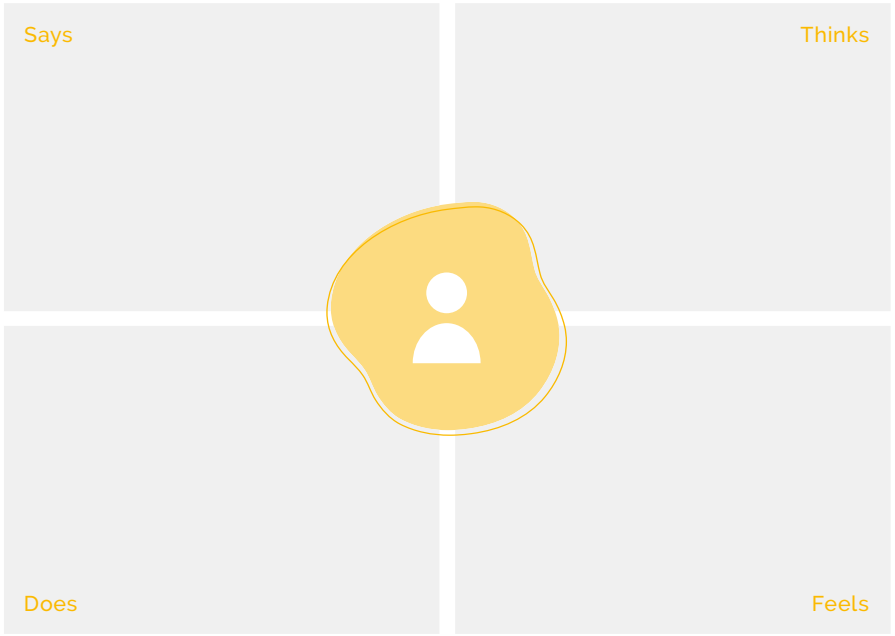
Links to lectures

Needs and Needs Assessment - Lecture 4.1
How to Conduct a Needs Assessment? - Lecture 4.2

Notes

## EXERCISE 4.1

Watch this video. Create an empathy map. Why is this person (e.g. user or other stakeholder) relevant for your case?




## EXERCISE 4.3

Watch this video. Create a list of requirements and wishes, seen from the perspective of the user and/or other stakeholders.

## EXERCISE 4.2

Watch this video. Draw a customer journey.

# 5 Ideate for solutions

In this module, you will be equipped with some ideation tools that stimulate creative thinking to get multiple ideas that can potentially become the solution for your project. Also, the role of the user and other relevant stakeholders is addressed to help you find and select the best solution to take with you to the next step.

## LEARNING GOALS

- Remember method and create ideas and combine to form multiple solutions.
- Remember, analyse and evaluate the solutions and select solution for prototyping.
- Understand terminologies, such as ideation, generation, conceptualisation, idea, solution, concept, etc.
- Understand and apply evaluation and selection methods with external stakeholders: SWOT analysis, Evaluation Matrix (Weighted-objectives).
- Understand and apply ideation/conceptualisation methods to generate ideas for the chosen problems: empathy exercise, mind-mapping, brainstorming, etc.

Links to lectures

Idea Generation Method: Brainstorming - Lecture 5.1
Concept Generation Methods - Lecture 5.2
Concept Evaluation and Selection Methods - Lecture 5.3

Notes

## WHAT'S NEXT?

Congratulations, you have found a solution to tackle a wicked problem! Let's see how this solution works out in practice. Before you start building your solution, you have to validate if the solution will really work according to you and other actors involved.

## EXERCISE 5.1

Come up with three different concepts using brainstorm methods such as the How Could You method, the Duck Game and a morphological chart (see lecture 5.2). Carry out your brainstorm session on another piece of paper. Keep the rules of brainstorming in mind:

1. Everybody can generate all ideas (nothing is off limits).
2. Criticism kills spontaneity and creativity.
3. Ideas should be picked up and developed.
4. The duration of a brainstorm is 20 to 30 minutes.

## EXERCISE 5.2

Explain your final three concepts here.

## EXERCISE 5.3

Evaluate these concepts using the weighted objectives method (see lecture 5.3).

| Criteria | Weight | Concept 1 Score | Concept 1 Total | Concept 2 Score | Concept 2 Total | Concept 3 Score | Concept 3 Total |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
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# 6 Prototype a solution

With this module you get insights in what a prototype is, and what the purpose is of building a prototype and minimum viable product. You get introduced to tools related to (rapid) prototyping, such as the napkin sketch and paper prototyping exercise. You will develop your prototype and test it within your team and with relevant stakeholders. Through the interactions you will obtain new insights and you can go back to the drawing table to adjust your solution according to the user demands.

## LEARNING GOALS

- Understand the purpose of building a prototype and the different types of prototypes.
- Develop a prototype to test your problem-solution fit with relevant stakeholders (with co-create).
- Understand what a prototype is.

## WHAT'S NEXT?

The solution is becoming more and more tangible. You are almost ready to communicate your solution! But first, you must think through how you will ensure you operate sustainably. How you do this will become clear in the next module.

Links to lectures

Basics in Prototyping - Lecture 6.1
How to Prototype - Lecture 6.2
Prototyping Step-by-Step Approach - Lecture 6.3

Notes

## EXERCISE 6.1

What are the five core hypotheses for your project?

What is the riskiest hypothesis and how will you test this hypothesis?

The hypothesis is proven if...

## EXERCISE 6.2

Create a prototype for your project. We distinguish three product categories, each with their own prototypes (see lecture 6.2).

1. Tangible products: sketches, foam models, 3D printed models.
2. Digital products: storyboards, paper and digital prototypes.
3. Intangible products: business plan, role-play.

## EXERCISE 6.3

I observed that...

From this I learned the following...

Therefore, I will adapt the following...

# 7 Ensure sustainable impact

In this module, you are introduced to the concept of sustainable impact. What is it, and how can you measure it and take action to achieve more? Good intentions are not enough, so you are encouraged to reflect critically on your solution and its potential global and local impact.

## LEARNING GOALS

- Develop critical and holistic viewpoints towards sustainability concepts and understand its complexity.
- Be able to discuss proposed sustainability solutions in both local and global contexts.
- Build know-how on ways of addressing and responding to global development, technology and related sustainability challenges.

## WHAT'S NEXT?

Once you have figured out how you can ensure sustainable impact, you are ready for the last (but not least!) step: communicate your solution.

Links to lectures

Challenges of the Global Development Context - Lecture 7.1
Sustainability and Technology in Development - Lecture 7.2

Notes

## EXERCISE 7.1

Analyze your project using the Theory of Change tool.

What resources do you need to organise necessary activities?

Which activities are needed to bring about change?

What are the measurable effects of your work?

What are the wider benefits of your work?

What is the long-term change you see as your goal?

## EXERCISE 7.2

Discuss the outcomes of your Theory of Change analysis.

## EXERCISE 7.3

For your project, discuss the impacts and sustainability.

# 8 Communicate your solution

This module how to present the solution to stakeholders. What constitutes a good presentation? Furthermore, you learn about leaders' need to lead effective change management. It advocates seven strategies leaders could form to achieve this for their teams.

## LEARNING GOALS

- Participate in social issues with a lens on sustainability impact: different phases, actors, approaches, etc.
- Reflect on different types of results and assessments in PBL projects.
- Learn how to capture, disseminate and communicate the learnings and findings obtained during the PBL journey to different stakeholders.

Links to lectures

Results and Assessment - Lecture 8.1
Communicate your Results - Lecture 8.2

Notes

## EXERCISE 8.1

Describe the results (both outputs and outcomes) of your project.

## EXERCISE 8.2

Set up a communication plan for your project.

## EXERCISE 8.3

Watch this video. Prepare a 5 minute pitch using these guidelines.

# Assessment of the learning goals

Use the check boxes to check whether you understand and master the learning goals of each module.

## 0 WHAT IS PBL?

- ☐ Gain fundamental understanding of the 'Problem Based Learning' method.
- ☐ Analyze the differences between traditional learning and PBL.

## 1 BUILD A TEAM AND TEAMWORK

- ☐ Acquire fundamental concepts of team building and its various aspects.
- ☐ Understand and differentiate the different stages of team building.
- ☐ Understand the importance of co-creation in team building and teamwork.
- ☐ Develop team-building attributes.

## 2 CHOOSE AND FRAME A GLOBAL CHALLENGE

- ☐ Identify and map various stakeholders involved in the global challenge at stake (with co-create).
- ☐ Identify, describe and frame challenges faced globally.

## 3 DO PROBLEM ANALYSIS

- ☐ Develop an understanding on the tools involved in problem analysis.
- ☐ Analyze the role of various stakeholders in problem analysis (co-create).
- ☐ Understand the role of problem analysis in PBL scenario.
- ☐ Understand the philosophy/theories of problem analysis.

## 4 NEEDS ASSESSMENT

- ☐ Assess the current and desired condition (needs and wants) of concerned stakeholders (co-create).
- ☐ Evaluate the gap between current and desired condition of concerned stakeholders.
- ☐ Address the need of concerned stakeholders.

## 5 IDEATE FOR SOLUTIONS

- ☐ Remember method and create ideas and combine to form multiple solutions.
- ☐ Remember, analyse and evaluate the solutions and select solution for prototyping.
- ☐ Understand terminologies, such as ideation, generation, conceptualisation, idea, solution, concept, etc.
- ☐ Understand and apply evaluation and selection methods with external stakeholders: SWOT analysis, Evaluation Matrix (Weighted-objectives).
- ☐ Understand and apply ideation/conceptualisation methods to generate ideas for the chosen problems: empathy exercise, mind-mapping, brainstorming, etc.

## 6 PROTOTYPE A SOLUTION

- ☐ Understand the purpose of building a prototype and the different types of prototypes.
- ☐ Develop a prototype to test your problem-solution fit with relevant stakeholders (with co-create).
- ☐ Understand what a prototype is.

## 7 ENSURE SUSTAINABLE IMPACT

- ☐ Develop critical and holistic viewpoints towards sustainability concepts and understand its complexity.
- ☐ Be able to discuss proposed sustainability solutions in both local and global contexts.
- ☐ Build know-how on ways of addressing and responding to global development, technology and related sustainability challenges.

## 8 COMMUNICATE YOUR SOLUTION

- ☐ Participate in social issues with a lens on sustainability impact: different phases, actors, approaches, etc.
- ☐ Reflect on different types of results and assessments in PBL projects.
- ☐ Learn how to capture, disseminate and communicate the learnings and findings obtained during the PBL journey to different stakeholders.

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