



# INTERDISCIPLINARY HIGHER EDUCATION MODEL FOR PROGRAM SUSTAINABILITY

Purposeful Recruitment Of  
Gamers, Rascals And Makers



**PROGRAM**  
LABS

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**MAKERSPACES HAVE A  
SIGNIFICANT IMPACT ON  
STUDENTS' LEARNING  
DEVELOPMENT OF THEIR  
ENTREPRENEURIAL SKILLS  
AND THEIR PERSONAL  
DEVELOPMENT.**



## // INTRODUCTION

As you could read on the home page, **Makerspaces have a significant impact on students' learning**, the development of their entrepreneurial skills and their personal development. They work to democratize access to technology and often aim to actively support the future of young people.

However, we need to focus more on specific programmes for the use of these spaces by pupils of different ages, but in particular pupils and students who lack motivation and are at risk of dropping out of school - the so-called NEET (Not in Education, Employment or Training) young people.

**It is important to involve young people** in a programme designed for them from the beginning and to start from their surroundings as much as possible. They often have a busy schedule, visit a lot of places such as school, sports club, youth movement, music school and they experience a lot during a weekday. Just like adults, young people have ideas for optimizing their daily lives. A weekday is an ideal context that provides many opportunities to identify everyday problems. We just have to know how to isolate and name them. To do this, we use design thinking.



# DESIGN THINKING

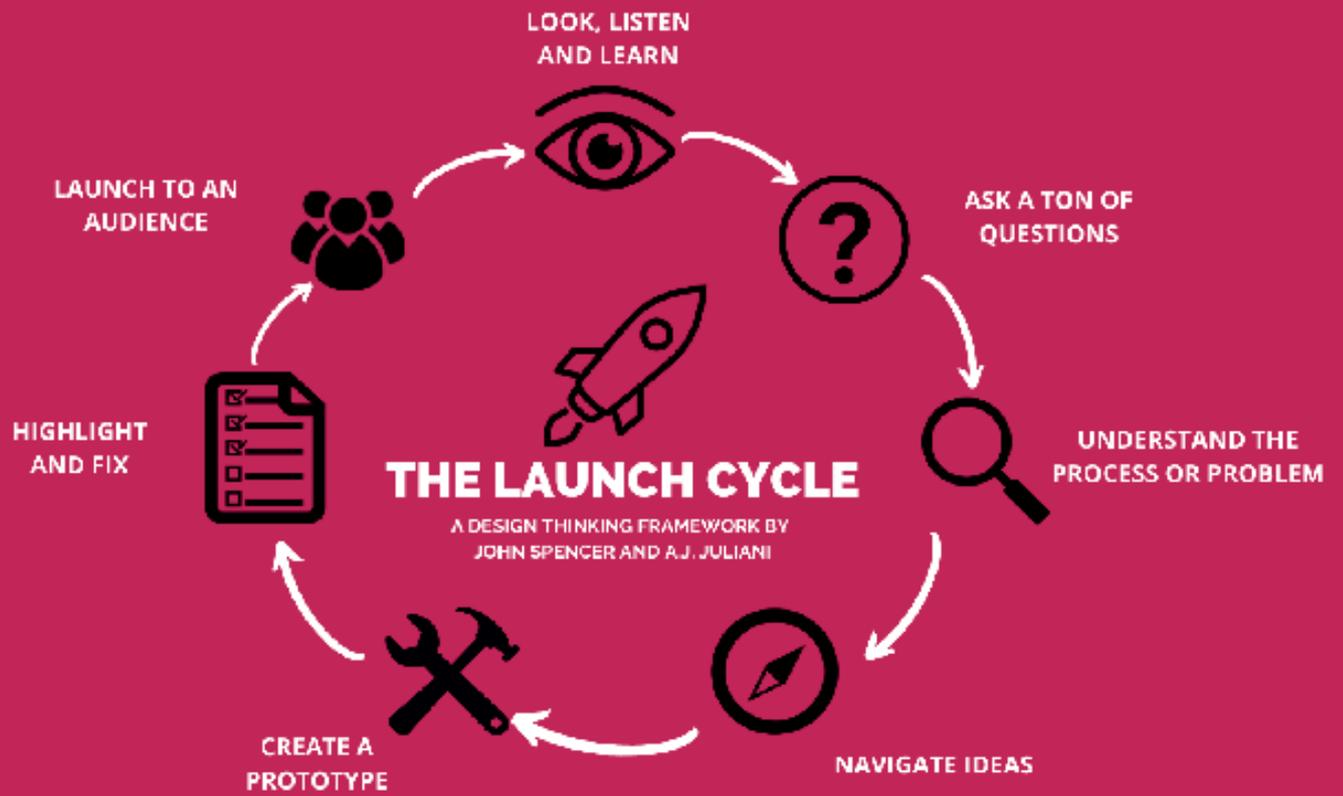
## 1.1. WHAT?

The term “design thinking” is often mentioned together with designing and realizing in makerspaces and STEM labs. But it is more than that. **It is a way of solving ‘wicked problems’**, i.e. complex problems that require 21<sup>st</sup>-century skills such as problem-solving thinking and creativity. It is used not only in subject areas such as science, engineering and technology, but also beyond. You can use it in any subject and for any age group, whether you use it to develop digital content or to build things with tape and cardboard.

**Design Thinking is an iterative process** in which children, pupils and students are allowed to create, test, re-create and test until they finally become a result that is acceptable to them.

The user and his or her needs are central, which means that it is important to understand the people for whom a product or service is being developed. This may sound logical, but in practice it is too often not the case. People are very inclined to think in fixed patterns and systems, to choose the obvious and perhaps safest option. It is very difficult to ignore this way of working and thinking and to come up with innovative solutions based on the needs of a person or a community. Design Thinking is therefore often mentioned in innovation led by Kristof Van De Keere and the Vives Maaklab with coordinator Peter Vanbiervliet. Peter is also the coordinator for the European PROGRAM LABS programme.

We will also make links with **The LAUNCH Cycle**, the way John Spencer approaches it. More information can be found at <https://spencerauthor.com/designthinking/>. Under the item "courses" on this site you will find some of his inspiring videos. At LAUNCH each letter stands for a phase in the process.



## 1.2. DESIGN@SCHOOL

DESIGN@SCHOOL is a didactic model that tries to respond to authentic contexts by linking insights and methodologies from “Human-centered design” to the didactics of “inquiry-based learning”. **DESIGN@SCHOOL offers teachers a basis for guiding children,** as well as young people, in defining problems in an authentic context, in dealing with these problems and in coming up with their own solutions. In this way, problem-solving skills are stimulated and STEM-literacy is built up for each young person taking part in the process

## 1.3. HUMAN-CENTERED DESIGN

“Human-centred design” is a design principle that has its roots in the engineering world. It is characterised by a strong focus on the design of innovative products, services or systems, but departing from the wishes and needs of the user. **The relevance of the developed solution is regularly checked against reality** throughout the entire design process and adjusted where necessary.

In this way, it not only offers tools and techniques to invent and make meaningful and useful things, but it can also be used within an educational context. Especially in an integrated STEM approach where the terms ‘research, design and optimisation’ are central.

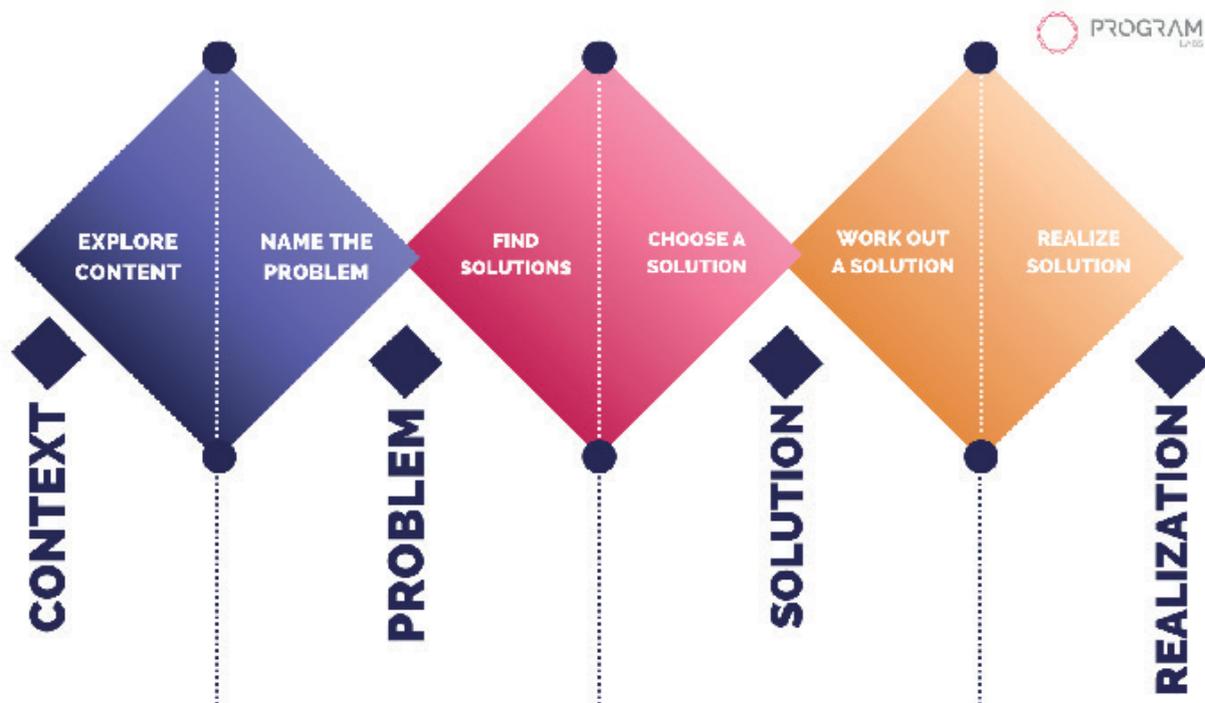
The “human-centred design” model on which DESIGN@SCHOOL relies was designed by the British Design Council (2018). It describes ways of thinking that professional designers also use.

In all creative processes, a number of possible ideas are created (divergent thinking) before being refined and narrowed down to the best idea (convergent thinking).

In this way, a rich variety of ideas can be created and an increasingly strong focus is built. To discover which ideas are the best, the creative process is an iterative process. **This means that ideas are developed, tested and refined a number of times,** while seemingly less good ideas are left in the process.

The aim is to design from real-life insights, to learn quickly from prototypes and from failures, in order to enrich a concept or product into a fully-fledged solution in ever-faster iterations. This cycle is essential to ultimately arrive at a good design or end product.





## 1.4. THE DIFFERENT STAGES OF THE DESIGN@SCHOOL PROCESS

Within “DESIGN@SCHOOL”, the creative process takes place three times, each time a divergent phase is followed by a convergent phase. This is illustrated by six triangles representing three adjacent diamonds.

**The shape of a triangle indicates how we think during a phase:**

Divergent: We broaden and think broadly during phase 1 ‘search for problems’, phase 3 ‘invent solutions’ and phase 5 ‘work out solutions’.

Convergent: We narrow and think concretely during phase 2 ‘selecting problems’, phase 4 ‘choosing solutions’ and phase 6 ‘realising solutions’.

In each diamond, the creative process takes place for a different purpose, building on what has gone before.

During each phase, methodologies can facilitate the creative, iterative process of the young people. These methodologies thus also find their origin in “human-centred design”. They have been translated here to the level of pupils within the 10-14 age group.

The possibility of a realisation being immediately operational is small. We encourage the youngsters to test their design frequently and to check it against the criteria they listed earlier. As a result, the design will have to be adjusted several times so that it can best meet the problem the students want to solve.

In doing so, students may ultimately conclude that it is better to retrace their steps and find another solution. This can also happen earlier in the process, e.g. when selecting a solution, it may turn out that the selected problem for which a solution is being sought is not such a good choice after all, since all the solutions the students came up with already exist or are too ambitious.

The DESIGN@SCHOOL model thus stands for a creative and iterative process in which this process has the upper hand over the final realisation.



## PROGRAMME

It is desirable to spend considerable time on each phase of the process. Below is a suggestion for a programme. This came about based on our findings during several sessions with pupils and students in the MAAKLAB, Makerspace of University of Applied Sciences VIVES (BE) and the FABLAB of CUENCA (ES) and the M-LAB VILNIUS (LT).

Students from the Bachelor Secondary Education - elective course - STEM at Vives Hogeschool in Bruges under the leadership of lector Johan Van Hevel and the students from Frieslandcollege in Leeuwarden under the leadership of Kirsten van der Vegt - Olejnik have guided, directed and supported students from RHIZO College Zwevegem, Freinetschool 't Vier Kortrijk and Spes Nostra in Heule. This programme is of course only a proposal. It can be used freely, for example, on the basis of the available machines, materials, time, etc;

### 2.1. DAY 1 MORNING

On day one, the youngsters get to know the various possibilities that exist in the Make-Lab. They receive, for example an introduction to digital fabrication into the FabLab and see examples of possible practices. They are given, an intro to Design challenge and how to apply it to different problems.

#### First phase: Explore the context

The first phase is to explore the context. Give a clear assignment and possible theme, for example, mobility, sustainability, accessibility, greenery in the city. This will be useful for the city walk during the afternoon.

Also use the information from the first phases of the process: What are the expectations with the context and the naming of the problem. Choose a suitable strategy and distribute it to the pupils. As an example, we choose **PAPARAZZI**.





## PAPARAZZI - THE PROCESS

- The pupils choose a location in their own environment to go out with a camera, for example the playground, the refectory, the park, the railway station, ...
- The pupils take pictures at the location of things they notice.
- The pupils look at their pictures and select those that show things that they consider to be problems, that they think could be improved, ...

### Tips and tricks

- Limit the number of photos they can take, for example 20. This challenges them to think carefully about the things they find relevant to include in the picture.
- Encourage the pupils to be careful when taking pictures. It may be necessary to ask permission.
- The groups of pupils can take photos simultaneously, but it is also possible that each group of pupils takes photos at a different time at the location. In this way, more problems may come to light.
- It may be appropriate to have the students select a limited number of problems during Step 3, for example 3 or 5.



## // AFTERNOON

### Part 1:

In the afternoon you can organize a city walk in order to look for a theme and/or problems. When choosing a theme and/or a problem, we always take into account the authenticity of a context. This can be a relevant (e.g. social) context that touches on the living environment of the pupils. During the first phase, the young people explore the context. We encourage them to look at that context with the aim of discovering new things and gaining insights.

They look for problems, shortcomings, challenges or points of improvement. They identify the problems that users (possibly themselves) experience and their wishes. They do not yet think about possible solutions. On the contrary, it is a search for new questions or problems. Refer again to the assignment and the working method that was discussed in the morning.

Here we use the “L” that stands for Look,  
Listen, and Learn

### Part 2:

It is important that the participants in the course learn to work with the various machines, tools and raw materials. Therefore, make sure to include activities in the Make-Lab to get acquainted with these. For example, link this to a fun end result such as creating your personalised COOL STICKER or using Inkscape to design a key ring and use the laser cutter.



## 2.2. DAY 2 MORNING

The problems that the young people identified on day 1 can now be taken further on day 2.

### Second phase: Naming the problem

The second phase represents the determination and definition of a clear problem. This phase is a kind of filter in which the findings and observations from phase 1, 'exploring the context', are analysed and interpreted. The pupils assess and select with the aim of arriving at a delineated relevant problem that they *want to* and *can* tackle.

They name criteria, such as user requirements and wishes, and give answers to the so-called "W-questions":

- What is the problem?
- For whom is it a problem?
- And why is this so?

Here we use as an example the methodology found under "**Design Challenge**"

## DESIGN CHALLENGE- THE PROCESS

The pupils should complete the following sentence: "**How can we ensure that ...**".

This question should answer

- What (what are we going to solve?)
- Who (who are they going to do this for?)
- Why (why is it important?)
- Where (where does it take place?)
- When (when does it happen?)

## DESIGN CHALLENGE



So they go through the problems in the specific context to select one in the end.

Here we use the A which stands for Ask Tons of Questions and the U which stands for Understanding the Process or Problem



### Third phase: Thinking up solutions

During the third phase, the pupils think up as many solutions as possible for the selected problem. We encourage them to think 'out of the box', but there is room for both existing and new solutions. The ideas thought up in this phase do not have to be feasible or realistic.

In this step, we choose to let the pupils' imagination run free and use imagination as a strength.

## For this we used the "N" which stands for Navigate Ideas

### Fourth phase: Choosing solutions

The fourth phase aims at choosing solutions. This often means selecting one solution, '**the best solution**'. To do this, the students test their invented solutions against the criteria they listed in phase 2, "naming the problem". Feasibility, viability and originality are also evaluated here.

The students ask themselves whether they can implement, "prototype" or model the solution (possibly with the help of experts). When thinking of solutions and choosing one, they not only brainstorm, they also analyze different ideas, they combine ideas, and they develop a concept for what they want to create.

## // AFTERNOON

It is important that the participants in the project learn to work with the various machines, tools and raw materials. Therefore, make sure to include activities in the MakeLab to get acquainted with these. For example, link this to a fun end result such as:

- Intro to 3D Scanning and Printing
- Intro to 3D Design - Workflow - How to 3D Print in 5 Easy Steps
- Intro to Tinkercad and Fusion Slice



## 2.3. DAY 3 MORNING

Again, it is important that the participants in the project learn to work with the various machines, tools and raw materials. Therefore, make sure to include activities in the MakeLab to get acquainted with these. For example, link this to a fun end result such as:

- Intro to Laser cutting - How to design your own models for Laser cutting

### **Fifth phase: Work out a solution**

When the participants have received enough information and learned enough skills to be able to elaborate their solutions, they can start with the fifth phase, elaborate the chosen solution and then also realise it.

Here too, there are many possibilities as to the direction this could/should take. The pupils still have to come up with a design for their solution and think about a plan of approach to realise their design (e.g. choice of materials, planning, ...).

**We use the “C” here which stands for Create a Prototype**

### **Sixth phase: Realising a solution**

During the sixth phase, the solution can finally be realised. The conceived design is elaborated on the basis of the plan of approach.

The implementation can take various forms, ranging from a digital 3D model, a prototype to scale, a tangible product or system to a work of art or even an event. Or a combination of these forms. The design thinking process is an iterative process which means that students will test, evaluate, adjust or even conduct additional research or choose a different solution.

**We use the “H” here which means Highlighting and Improving.**

**When they are ready, then comes the presentation, the LAUNCH in front of an audience.**

## // AFTERNOON

It is important that the participants in the project learn to work with the various machines, tools and raw materials. Therefore, make sure there are also activities in the 'Maaklab' to get acquainted with this. For example, link this to a fun end result such as Creating a personalised wood sing and add some electronics.

- Work out a solution - continued
- Realising a solution - continued

## 2.4. DAY 4 // MORNING AND AFTERNOON

On the fourth day students will be finishing up by developing and realising their solutions. This includes presenting their final design to their peers. This last phase is by no means the least important, as public speaking and being able to market a product are important skills to develop.

The young people must also be prepared for questions and should be able to answer critical questions about their work process and design. After the presentation, they have the opportunity to adjust and improve their design based. New ideas may have emerged based on peer feedback, comments and suggestions.

To end the training event, you are free to plan a closing activity.





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