Teacher's Training Manual

DESIGN FUTURES

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

DesignaThon WORKS

paco designing worlds of opportunities

Stimmuli for social change

ΑΡΙΣΤΟΤΕΛΕΙΟ ΠΑΙΔΙΚΟΣ ΣΤΑΘΜΟΣ - ΝΗΠΙΑΓΩΓΕΙΟ ΚΟΛΛΕΓΙΟ ΔΗΜΟΤΙΚΟ-ΓΥΜΝΑΣΙΟ-ΛΥΚΕΙΟ

ALL GROW

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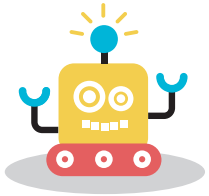
CHAPTER 1

Introduction



Future challenges and 21st-century competencies

We live in a world that is rapidly changing and becoming extremely complex. With the current rate of technological progress and change in society, the future is now more unknowable than ever before. Schools have the role to prepare children for what lies ahead and supply students of any educational level with the necessary tools. We need to make them develop skills that will allow them to handle these uncertainties. As such, new approaches are being adopted by teaching communities in order to foster different ways of thinking in a more collaborative environment. [1]

In particular, 21st-century skills, provide an interesting background to this topic. This theory describes the abilities that will be key for the adults of the future to thrive and bring meaningful change in the world. 21st-century skills have been part of the educational debate since the last decades of the 20th century.

While there isn't a unique model adopted worldwide, many frameworks suggest that education should be no longer only knowledge-based, but it should extend to soft skills, meta-learning, and project-oriented learning. Skills related to digital literacy play a key role in this type of framework as well.

It's important to note that 21st-century skills shouldn't be seen as a replacement for more traditional ones. On the contrary, they should be regarded as an addition and a way to diversify the learning experience even further.

A rather complete and renowned framework is the one created by SLO, the Dutch expertise center for curriculum development. The framework includes basic ICT skills, media literacy, information skills, computational thinking, creative thinking and acting, problem-solving thinking and acting, critical thinking, self-regulation, social and cultural skills, communication, and collaboration.

Different learning approaches are needed

Over the last decades, research studies have investigated the different ways in which people learn

Figure 1.1
Adapted from the 21st-century skills as defined by SLO (Thijs, Fisser, & van der Hoeven, 2014).

[1] Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., & Rumble, M. (2010). Draft white paper 1: Defining 21st century skills.

new skills and notions, both in the professional and the educational context. Models that are based on learning from direct experience tend to be the most effective in helping people retain what they have learned.

An example is the 70-20-10 rule, developed by Morgan McCall, Robert Eichinger, and Michael Lombardo at the Center for Creative Leadership. [2] It defines that 70% of the learning in the working environment happens through hands-on experience. 20% derives from interacting with colleagues, 10% from formal learning. While the exact same proportions may not apply in education, this study offers interesting data points to support the importance of learning by doing.

If we look at the educational context, learning-by-doing is only one way in which learning can take place. The Learning Pyramid is a comprehensive framework that presents and compares different teaching techniques, looking at their retention rates, and showing that participatory methods are more likely to make a long-lasting impact. However, these models aren't mutually exclusive, also because they are complementary and equally necessary to ensure a meaningful learning experience. Figure 1.2 is a more synthetic adaptation of the Learning Pyramid. It shows the three main learning approaches that are applied in school:

Receiving: Students receive information and are provided with the necessary context so that they can successfully apply this knowledge later on (lecture, reading, audio-visual).

Participating: Students participate in the learning process and in the activities proposed by the teacher (play, exercises, discussion, demonstration).

Learning by doing: Students are the main actors of the learning process, they learn by exploring/doing/making by themselves (to work with a coach, immediate practicing).

The Design Futures method we propose in this manual will show how all of these approaches can be used, but leaning more towards a *'learning by doing'* approach.

RETENTION OF LEARNING

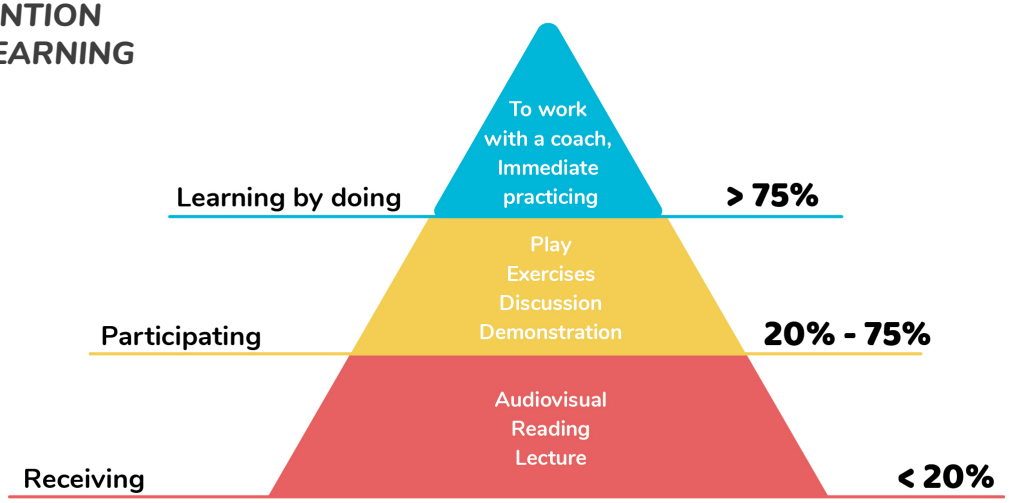


Figure 1.2
Adapted from the Learning Retention Pyramid (Kokcharov, 2015).

[2] McCall, M., Eichinger, R., & Lombardo, M. The Formula 70-20-10. Center for Creative Leadership.

Figure 1.3 and 1.4 *Analyzing the problem from different perspectives through a visual map.*

The Design Futures method: combining Design Thinking and Maker Education to solve complex problems

such as those addressed by the UN Sustainable Development Goals (SDG)

The Design Futures method relies on a combined action between Design Thinking and Maker Education. First, it leverages Design Thinking to allow students to imagine solutions for a real-world problem and then continues with its construction, supported by the core principles of Maker Education. The Design Futures method aims to solve the complex problems we are facing in the world, and that's why it is focused on finding innovative solutions for the Sustainable Development Goals (SDG) developed by the United Nation. E.g. Sustainable energy; poverty in the community, ...

What is Design Thinking?

Design Thinking is a combination of Design + Thinking. In this context, 'design' is not limited to an expressive act or the production of a beautiful form, but it refers to the ability to envision different possible futures. 'Thinking' refers to the ability to unpack a topic or challenge from many different perspectives.

Overall, Design Thinking is a methodology that helps to solve complex problems through tangible solutions that can make an impact on other people's lives. It has been developed across engineering, business, and management communities and has been widely adopted by enterprises and public administrations. In the last years, it has become more popular in learning and educational settings too.

On a more practical level, Design Thinking is concerned with understanding human needs and motivations in order to better define the problem. At the same time, it leverages the ability of the designer (the student, in this case) to propose creative and thoughtful solutions that stem from a deep understanding of the context and from the ability to think outside of the box. Design Thinking can help to generate innovation and it can effectively contribute to imagining and creating a better and more sustainable future. Design Thinking is inherently

iterative. This means that going through the same phases multiple times or moving back and forth between phases (as needed) can help students to achieve more impactful solutions, which better address the needs of the people involved and generate a more transformative value. The Design Thinking methodology is also deeply human in itself, as it requires people to work in teams and collaborate, leveraging the expertise and ideas of all team members.

Example

The Design 39 Campus (San Diego, California), has made a huge investment in innovative teaching methods. For instance, middle school students applied Design Thinking to try to solve the problem of giving people access to clean water, in a geographical context where it is not possible to get it right away. They watched videos and got information to really understand the context of the people they were going to design for. They brainstormed many different solution approaches and they decided to focus on the creation of a filtering system. Afterward, they tested different filtering options and they ran multiple experiments using a meter and a turbidity scale until they achieved the desired result: obtaining drinkable water.

What is Maker Education?

Maker Education is a learning method that focuses on the production or fabrication of physical or digital artifacts (prototypes) that put the students' ideas into practice.

The "Maker Movement" emerged in the last years. It aims to create a technical and creative revolution. It focuses on giving more people access to old and new digital fabrication methods through dedicated spaces, called fab labs or maker spaces. This movement inspired educators and helped to form the so-called Maker Education pedagogy, which brings the core elements of this movement into the learning environment of the school.

Compared to Design Thinking, Maker Education focuses is more on the 'making' that the 'thinking' aspect. It helps students to become more active problem-solvers while also becoming familiar with current technologies and other scientific fields and to apply theoretical notions.
On a more practical level, Maker Education activities are focused on equipping students with the skills to physicalize an idea, object, or solution. Making activities may utilize modern digital technologies, but also traditional construction techniques and the use of physical materials. The application of this method tends to rely on the interactive participation of and collaboration among students, their knowledge sharing, and the

Figure 1.5
Building a prototype.

creative use of technology.

Example

The Van Ness Elementary school in Washington DC strongly believes in the importance of 'making' as a key learning experience and teaching method. They have invested in the creation of a maker space, a room dedicated to making activities, where children can bring their ideas to life, learn to plan, organize their time, self-regulate, and craft prototypes.

For example, students joined a catapult challenge, in which the goal was to throw a ball as high and as far as possible. This made them experiment with various different techniques and materials to perfect their idea.

Figure 1.6
Engaging with kids in project activities at school.

Figure 1.7
Teachers are the designers of the everyday learning experience.

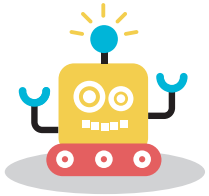
Embedding the Design Futures method in the educational program: Teachers are designers

Teachers already are designers, since they are constantly focusing on the creation of meaningful learning experiences for the students. Likewise, everybody can design: creativity isn't a sudden event, but it is a process that everyone can learn, that can be organized and facilitated and comes from the ability to connect notions and ideas in a certain way.

The Design Futures method can offer significant chances for educators and change the way students face a problem and generate new ideas and perspectives. In order to adopt the Design Futures method in the educational program, teachers need to deeply understand how to promote a creative way of thinking inside their classrooms. They should develop hard skills, like working with different physical and digital materials to craft prototypes. Also, soft skills are essential, such as empathy, flexibility, and the ability to help them to stay focused during the process even when difficulties arise.

CHAPTER 2

The Process



The process and its phases

The Design Futures method is applied through a process that consists of 6 phases. Each phase includes several steps and activities, as the curriculum demonstrates. Thinking about the method through these phases can help teachers to structure the activities in a more sequential way.

This chapter presents the various phases and the logic behind the process in detail, and it complements this introduction with tips. The following page shows a complete overview of the process structure.

The Process

The process of the Design Futures method consists of 6 phases, as illustrated below.

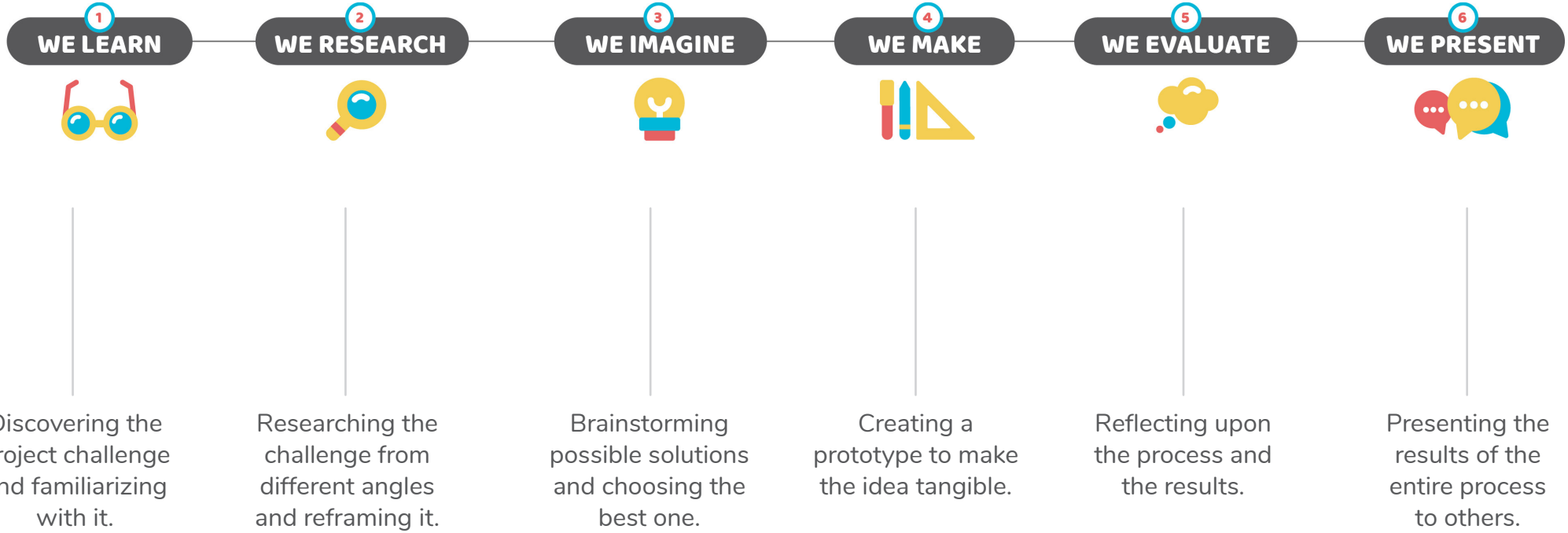


Figure 2.1
Process overview.

1. We learn

During this phase, students become aware of the topic and receive initial inputs. It is a particularly important and sensitive moment in the process because it is where engagement with the proposed topic first occurs.

Tips! *It is important to inspire students by showing what's possible through a diverse array of examples, both focused on solutions and techniques. Also, giving students a role (eg. 'we are all experts/ designers') and telling them that they can make the difference can strengthen their motivation.*

2. We research

Students gather stimuli and information on the project topic, in order to deepen their understanding of the project challenge and define the problem.

Tips! *Assigning students a role during research activities (eg. interviewer, note-taker, photographer) can help to keep the work of the team more organized. Upon completion of the research activities, it is useful to schedule some time to exchange opinions and share different viewpoints.*

3. We imagine

Students start imagining new solutions, through ideation activities or by looking at further references and examples that can inspire them. They discuss alternatives and converge towards a solution. It is important to encourage students to define criteria based on which to prioritize a solution.

Tips! *the keyword is 'Yes, and...' Encourage students to stay open-minded during brainstorming and to build on top of each other's ideas. On the contrary, when choosing an idea to develop, students should be encouraged to give feedback and apply critical thinking skills.*

4. We make

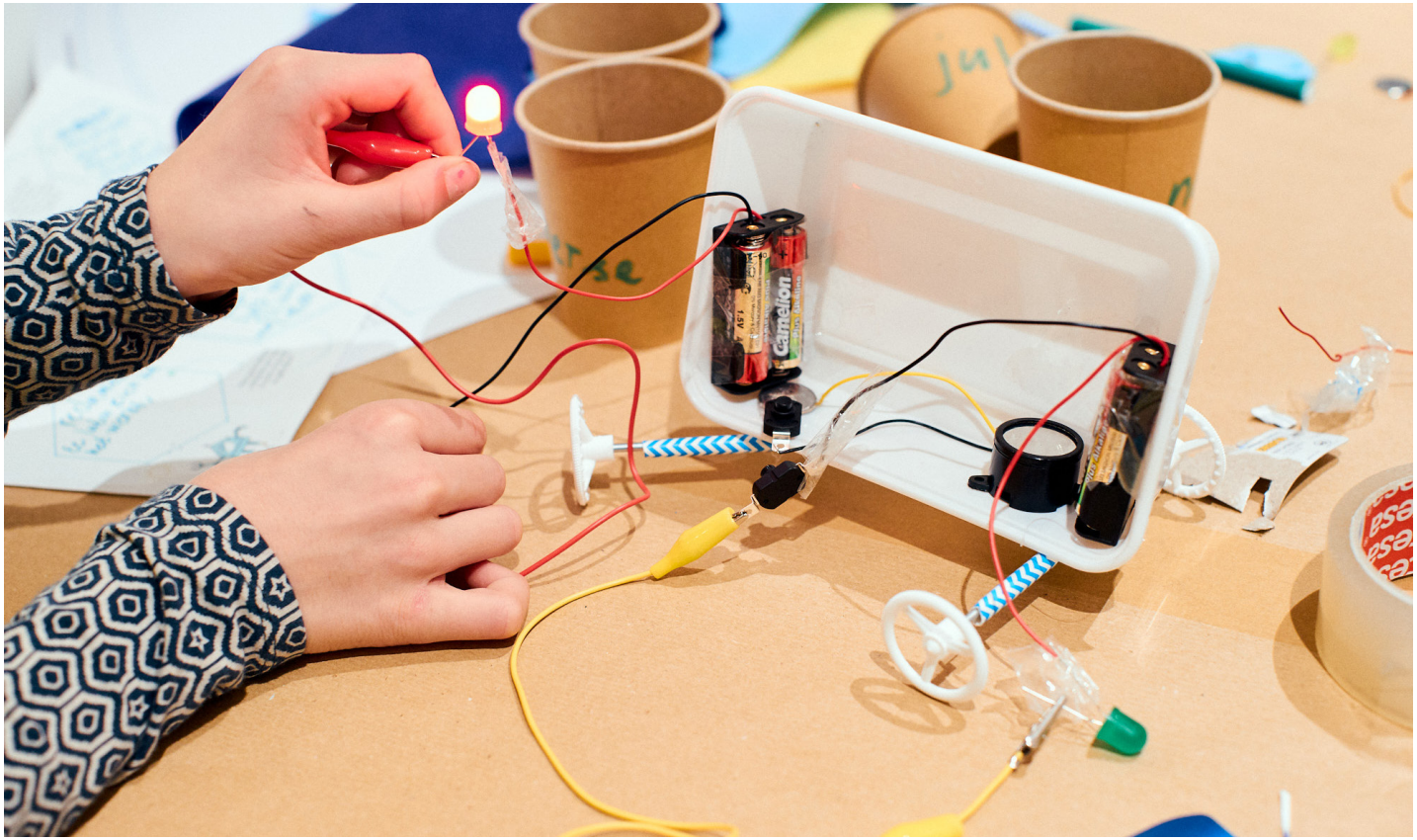
At this point, students focus on making their idea more tangible by creating a prototype, or a more detailed visualization of it. This activity can generate different kinds of outputs (a physical model, a sculpture, a paper prototype, a storyboard, a video, a script, ...): what is important is for the students to focus on how their idea works and on its 'form'.

Figure 2.2
Students learn about the project topic.

Figure 2.3
Students interview an adult and take notes during a workshop.

Figure 2.4
Students sketch out their ideas.

Figure 2.5
A student connects electrical components from a maker kit to build a circuit.



Tips! *help students reflect upon what is the best medium to convey their idea, thinking about which tools/ materials/techniques will make it easier to communicate. Help students to get feedback from as many people as possible.*

5. We evaluate

This phase refers to a moment of general evaluation of the process and the progress made so far.

Tips! *make students engage in a group discussion around their learnings. Make sure they also invest some time in individual reflection.*

6. We present

This phase is dedicated to sharing the results of the process with the entire group. As the last phase of this process, 'present' offers a unique opportunity that goes beyond giving visibility to the output: it is, in fact, important to close the loop of the creative process with a moment of reflection, allowing the learnings to sediment and making space for constructive

feedback on the solution as well as shared reflections on the learning experience.

Tips! *Consider inviting external guests or having an audience to both maximize the students' engagement and the impact of the initiative.*

Each phase can be executed in several different ways and through different activities. Oftentimes, using tools (in the form of paper templates or activity guidelines) can help students to stay on track and feel more guided.

At the same time, tools shouldn't be a limitation to creativity. Facilitators should feel free to adapt the tools to the specific activity and create new ones. Also, students should be encouraged to use them critically and flexibly, adapting them to their needs. As the word suggests, they are 'just' tools to achieve something greater.

As mentioned earlier, iteration is important for this method. Students should become familiar with the idea that the process may not be linear, but that it could be useful to move back and forth between phases. For example, after the 'make' phase, new research may be necessary to deepen the understanding of the problem, as new knowledge gaps are uncovered. Or perhaps, repeating brainstorming activities in several rounds can help to generate a greater variety of ideas.

Figure 2.6 *Children present their solution and demonstrate how the prototype functions.*

Figure 2.7 *Children role-play the solution*

The Thinking Modes

The process proposed in this manual leverage two specific thinking modes, which are particularly relevant in some of the phases.

- **Divergent Thinking:** it is a thinking mode that focuses on the exploration of several different alternatives. It encourages students to explore options and stay open to new inputs.
- **Convergent Thinking:** is a thinking mode that focuses on the evaluation and selection of the best alternatives, in order to move forward and progress through the design process.

These two thinking modes can be seen as the building blocks of the overall process. They are used in alternation and help students to move from problem to solution in a structured way.

Applying the methodology through different formats

Although the proposed process may appear particularly complex and articulated, it doesn't mean that the only way to implement it is through a long and extensive program that takes place over the course of several months.

Provided that there is a clear project topic, shorter formats are possible too. The following list describes 3 possible formats, which are only meant to provide a reference for what is possible.

Intensive event format

In this format, there is usually a strong emphasis on making quick decisions and getting started early with prototypes.

Early phases of the process are included too, but the main driver of this format is teaching students how to quickly come up with alternative solutions and build a prototype for testing. For example: schedule 6 hours over the course of one day, or perhaps a couple of 3-hour long sessions over the course of 2 consecutive days.

Project format

In this format, activities tend to be more spread out and students have time to carry out individual/group work between sessions. Each session

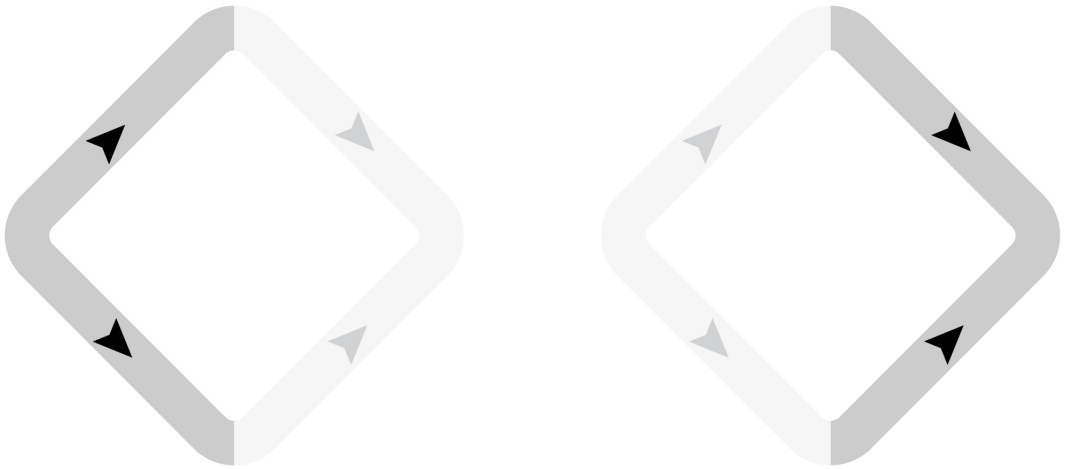


Figure 2.8
The two thinking modes

may be dedicated to one phase of the process, thus allowing students to focus on one phase at a time and then consolidate the intermediate outputs. For example: schedule 4 weekly sessions of 1-2 hours each.

Long program format

These formats are planned around an existing didactic program in order to introduce a holistic approach to learning. Their extended duration allows for the integration of contributions from different curricular disciplines and topics. For example: schedule a minimum of 8-10 weekly sessions (up to approximately 15 sessions) of 1-3 hours each.

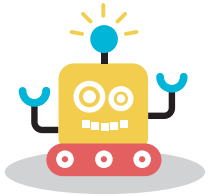
Figure 2.9 *A quick prototype built to test out a concept*

Figure 2.10 *Testing new technologies to bring the solution to life*

Figure 2.11 *The research phase during a school project*

CHAPTER 3

Applying the Design Future method in school



The role of the teacher within the Design Futures method

A school is a place of knowledge transfer and as such, whoever runs it must act as a designer. As previously mentioned, teachers and educators are already doing so on a daily basis: from the welcoming in the classroom, the management of the space, to the execution of the activities, there are no neutral choices, they need to be designed to contribute to the success of the teaching and the learning experience. While applying the Design Futures method, the role of the teacher is to be a facilitator of the process. But, what is a facilitator? It is someone who helps other people do something more easily, by understanding their objectives

and planning how to achieve them, finding the answer to a problem by discussing without taking a particular position, suggesting ways of doing things, and giving guidelines to improving group dynamics and effectiveness.

Much of the role of the facilitator has to do with helping groups accomplish their tasks and get along with each other while doing so, empowering them by providing the proper support and tools. A good facilitator is able to listen and help the students to conceive and make decisions. [3]

There are three main aspects that this role should pursue:

1. **Manage** group discussions and processes in a way that allows group members to have a positive experience;

2. **Deliver** service that promotes valuable results in group dialogue, analysis, and planning;

3. **Provide** techniques or practice that make it easier for groups to interact and/or accomplish goals.

There are four core competencies dimensions in the facilitation role: communication, relationships/climate, tasks, and organization.

The communication and relational/climate dimensions involve watching the group and its individuals in light of group dynamics, a variety of listening skills including the ability to paraphrase; stack a conversation; draw people out; balance participation; and make space for more reticent group members. The tasks and organizational dimensions are related to good meeting practices, such as timekeeping, structuring, and following an agenda, and keeping a clear record.

Figure 3.1
A facilitator guiding the prototyping process, ensuring every child is contributing to the making

[3] Frey, 1994; McLagan & Bedrick, 1983; Pierce, Cheesebrow, & Braun, 2000.

Additionally, the activity of a facilitator requires adopting a functional attitude to the success of the collaborative work. This means knowing how to adapt to the situations, taking on a different role or relational style from time to time, while being aware of respecting one's own characteristics and personality.

Some fundamental values to be shared by the facilitator are:
Respect for the students' ideas *(inclusive atmosphere)*.
Suspension of judgment *(there are no right or wrong ideas)*.
Playfulness *(design while having fun)*.
Collaboration *(being a partner of the students' ideas and projects)*.
Authoritativeness when necessary *(the roles of adults and students must always be evident)*.

Becoming a facilitator needs time and practice. It is always a good habit to self-reflect on the activities done at the end of each lecture in order to keep improving the performance with the students.

Figure 3.2
Framework of a facilitator's core competencies. Adapted from Kolb, J. A., Jin, S., & Song, J. H. (2008).

The educational space

Learning environments convey messages about how to do things, what is expected or allowed in educational didactics, so they can be supportive, restrictive, or guiding for students in terms of their actions, expectations and possibilities to develop their goals.

In a school context, a Design Thinking methodology can enhance didactic activities, using engaging activities and tools to stimulate students in the learning process and transforming the classroom, to open the boundaries to a series of new activities, dynamics, and interactions.

Understood as a pedagogical practice, the physical learning

environment must consider the following two main aspects, to collaboratively transform the classroom into an encouraging place to explore, imagine, and create.

The space itself and the furniture may have different possible configurations according to the diverse didactic modes. The variety of materials, tools, and resources to work with that we find in the classroom, might stimulate the students to actively participate in the activities.

That being said, the physical and environmental educational space must be designed to facilitate learning experiences of various kinds. The space will be a reflection of the methodology, therefore, it should be:

- **Flexible:** offering multipurpose spaces that are easily adaptable to the needs and objectives of the methodology and recognizing the diverse possibilities of social interactions and learning modes.
- **Empowering:** being customizable by encouraging active participation and consequently, provoking an appropriation and a resignification of the place enhancing the students' desire to explore and create. Students are inhabitants of the educational spaces and therefore as "citizens" who have a voice and power to influence the decisions that concern them.
- **Inclusive:** allowing physical and cultural access to all.
- **Meaningful:** recognizing the diverse socio-cultural identities of its school community.

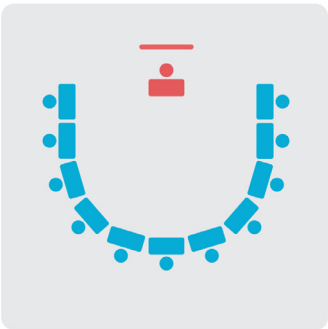
Classroom learning modes

- **Explicit:** learn from an expert.
- **Guided:** learn with an expert.
- **Discussion:** talk about and share ideas.
- **Experiential:** make, explore and investigate.
- **Collaboration:** learn with others.
- **Independent:** learn by myself.
- **Feedback and Reflection:** learn about my learning.
- **Demonstration:** present my learning.

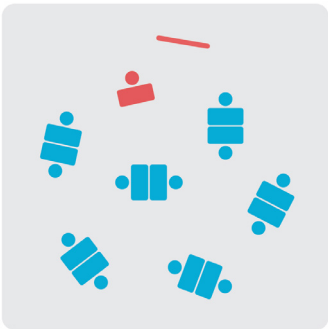
Classroom configurations according to specific learning models

- **Traditional lecture:** students face the teacher with their backs to one another, typically for explicit and independent learning.
- **Horseshoe:** the desks are placed in a semicircle facing the front of the room and focusing students' attention to the center, ideal for group discussion, as it fosters class connection.
- **Clusters (in pairs or groups):** an arrangement in small groups encourages student-to-student

TRADITIONAL LECTURE



HORSESHOE



CLUSTERS IN PAIRS

Figure 3.5-3.10 (continues on the next page) *Classroom configurations.*

interaction for guided learning, collaboration, and experiential learning.

- **Seminar:** the whole class seat in a rounded arrangement facing each other for feedback and reflection.
- **Runway and Stadium:** an aisle is left in the middle of rows of desks facing each other so that a presenter can walk through the classroom for demonstration or presentations.
- **Makerspace:** different working stations are distributed in the classroom, mainly for experiential learning.

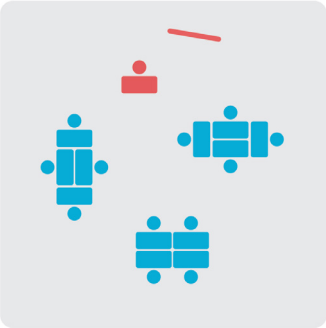
Awareness of the community ecosystem

The preparation of any project activity must take into account a phase of preparation and reception by the school, as well as a phase of reflection and return to the community.

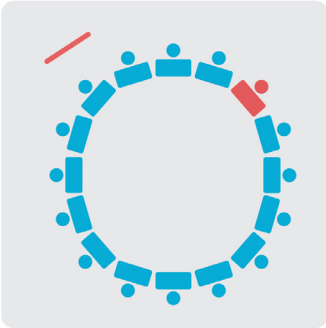
Experience shows that maximum impact is achieved when teachers and parents are involved and aligned on objectives, but also when the experience is integrated with the students' growth path. It is essential to create opportunities for exchange with the community and also to calibrate the activities to the actual skills of the students.

After the activities, it is important to collect feedback from those who took part in the process (students, teachers, and parents) through moments of confrontation that take into account the role of the interlocutor. In addition, in order to ensure maximum impact on the initiatives, it is appropriate to create moments of dissemination and celebration of the results open to the wider community (for example, an exhibition allows to bring the community together in a single event and create an opportunity to meet).

Now that you know the theory behind the Design Futures method, discover how to bring it to your class. Learn more downloading the Curriculum Manual.



CLUSTERS IN GROUPS



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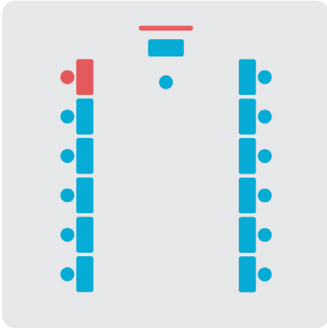
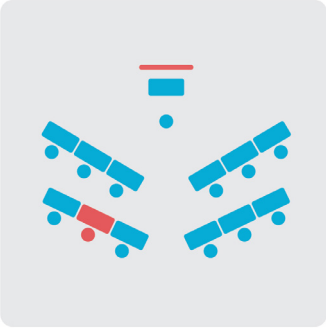


RUNWAY



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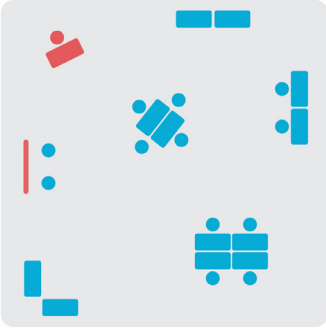
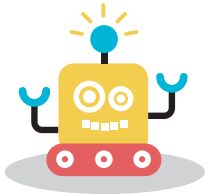


MAKERSPACE

Appendix



Glossary, Credits
& Project Partners

Glossary

Convergent Thinking
Is a thinking mode that focuses on the selection of the best interpretations or ideas. As a thinking mode, it helps us to draw conclusions, make decisions, and take action.

Design Thinking
Is a methodology that helps to solve complex problems through tangible solutions that can make an impact on other people's lives. It can help to generate innovation and contribute to creating a better and more sustainable future.

Divergent Thinking
Is a thinking mode that focuses on creating different interpretations or ideas for a specific challenge. When using it, our brain explores options and stays open to new inputs.

Fablab
Also called maker space, is a physical space (a corner, a room, a lab, ...) dedicated to making activities. It usually contains tools, materials, and machinery or devices that are needed to build prototypes.

Facilitator
Is a person that guides the students during project-based activities. The facilitator has the role to oversee the activities and help students progress through the creative process with a maieutic approach.

Maker Education
Is a learning method that focuses on the production or fabrication of physical or digital artifacts (called prototypes) that put the students' ideas into practice.

Prototype
Is a physical or digital artifact that can be built with materials of different kinds. It helps students (and designers in general) to make a solution tangible in order to test it and get feedback

Warm-Up Exercise
Also called icebreaker, is an activity that helps students to prepare for teamwork activities, energize and loosen up. It usually takes the form of a simple game or playful task.

Credits

Graphic Design

PACO Design Collaborative.

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Photo Sources

- Figure 1.3, Pg.6: Google
- Figure 1.4, Pg.6: PACO Design Collaborative, project archive.
- Figure 1.5, Pg.7: PACO Design Collaborative, project archive.
- Figure 1.6, Pg.8: unsplash.com
- Figure 1.7, Pg.8: scuolasenzazaino.org
- Figure 2.2, Pg.11: unsplash.com
- Figure 2.3, Pg.11: PACO Design Collaborative, project archive.
- Figure 2.4, Pg.12: ALL Grow, project archive.
- Figure 2.5, Pag 12: Designathon Works, project archive.
- Figure 2.6, Pg.13: unsplash.com
- Figure 2.7, Pg.13: unsplash.com
- Figure 2.9, Pg.15: PACO Design Collaborative, project archive.
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- Figure 3.1, Pg.17: ALL Grow, project archive.

Project partners

Eindhoven University of Technology (The Netherlands)

Department of Industrial Design, Systemic Change: The Systemic Change research group uses design and technology to study socio-technical systems at the level of a community, by designing technology-enabled interventions addressing societal challenges and analyzing their effect on the eco-system. We focus on researching through designing innovations that have impact on systemic structures and groups of people, ultimately aiming to address large-scale issues such as vitality, social resilience and learning.

Stimmuli (Greece)

STIMMULI is a non-profit organisation working on projects focused on social impact envisioning to inspire future education and ignite positive change in society. To achieve our mission, we design and implement educational projects that cultivate changemaking attitudes, inject entrepreneurial thinking and nudge behavioural shifts for more sustainable lifestyles.

PACO Design Collaborative (Italy)

PACO Design Collaborative is an international network of design driven professionals. We believe all individuals have the potential of creating positive change. As a network, we train ourselves to use Design and Education to foster social innovation, sustainable behaviours and fair business opportunities.

Designathon Works (The Netherlands)

Designathon Works envisions a world in which all children - regardless of background, race, or level of ability - are engaged in designing a better world for themselves and the planet. Our goal is to equip children with a changemaking attitude and to teach society to see children as co-designers of a better world, recognizing that every child is unique and has something valuable to contribute.

Aristotelio College of Thessaloniki (Greece)

ARISTOTELIO COLLEGE is a modern private educational institution, with over 50 years of contribution to education and innovation. Adapted to the demands of the modern internationalist society, our educational programmes offer students, side by side to knowledge, the potential for agency, collaboration, creation and digital literacy. We create a school of “open horizons”, and, while fully respecting individuality and diversity, we aim at the all-round development of our students.

All Grow (Romania)

All Grow is a non-profit organization aiming to create change through collaboration between individuals, organizations and institutions by fostering social innovation and knowledge sharing. Our mission is to contribute to building an inclusive society, in which ALL members have the tools, resources, and opportunities to GROW.

DESIGN FUTURES

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https://designfutures.eu/