



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

FUTE

FUTE

Teacher Training Module



Erasmus+

Table of contents

1. Introduction.....	4
Characteristics of the Teacher Training Module	4
Symbols used in the Teacher Training Module	5
How to use these cards?	5
2. Where does the concept of design thinking come from?	6
What is Design Thinking?	6
3. Design Thinking in education	8
Design thinking for teachers	8
Design thinking for pupils.....	8
Questions.....	8
4. Why use design thinking?.....	9
Questions.....	9
5. The FUTE model.....	10
The model.....	10
Questions.....	11
6. What is a design challenge?	12
Characteristics of design challenges.....	12
How to formulate a good design challenge	12
Complexity score	12
Questions.....	13
7. Examples of the power of design thinking	14
8. Design Challenge 1	15
9. Design Challenge 2	16
10. Design Challenge 3	17
11. Design Challenge 4	19
12. Design Thinking in the classroom.....	21
Questions.....	22
13. Case study 1.....	23
14. Case study 2.....	24
15. Design challenge for the classroom 1.....	25
16. Design challenge for the classroom 2.....	26
17. Design challenge for the classroom 3.....	27

18. Design challenge for the classroom 4.....	29
19. List of possible design challenges for the classroom.....	30
Cross-disciplinary challenges.....	30
Languages.....	30
History.....	30
Mathematics.....	30
Natural sciences.....	30
Social sciences.....	30
20. Further reading.....	31
Design Methodology.....	31
Teacher Design Teams.....	31
Design Thinking in the Classroom.....	31
References.....	32

1. Introduction

This Teacher Training Module is designed to help you use the FUTE cards and the FUTE Design Thinking method in the organisation of your school and in your teaching. The Teacher Training Module contains background information on design thinking, shows the potential of design thinking in an educational setting and provides several exercises to get acquainted with the method. Design thinking can be used in different educational settings: teachers can use this method to solve challenges in their organisation (teacher design teams), while teachers can also use design thinking as a teaching method that fosters creative and active learning (pupil design teams).

The quality of design challenges is of utmost importance for ensuring an efficient and effective design cycle. Hence, we focus on formulating qualitative design challenges throughout this module. This training module also contains several assignments for a step-by-step application of design thinking into practice. The way this module is designed, makes it usable in different ways, but there are some guidelines to get the most out of this training module. It is important to know that this set of cards, the Teacher Training Module, is different from the set of FUTE method cards.

The Teacher Training Module is divided into **three parts**.

In the first part, a general introduction is given on design thinking and the FUTE model. We recommend reading this part for everyone who is new to the concept of design thinking and/or the FUTE method.

The second part is about using design thinking by school teams (teacher design teams).

The third part is about using design thinking in the classroom as a teaching method (pupil design teams). We recommend to teachers who want to use design thinking in the classroom to do at least two challenge cards from the second part, as we believe it is important that teachers experience design thinking themselves before they let their pupils do so.

Characteristics of the Teacher Training Module

The teacher training module is built upon a set of cards that can be used in different ways to suit your needs as a teacher or as a school team.

- There are two types of cards: **information cards** and **challenge cards**. The type of card is indicated with a symbol.
- You can use these cards **alone** or **in group**.
- You can use **as many cards as needed** to meet your goals or as many cards as possible in the time you have.
- We believe that you can best **learn** about design thinking **by doing**. This means that the majority of this training module consists of solving design challenges and reflecting on your process.

Symbols used in the Teacher Training Module

-  = this flag indicates that we recommended reading this card before proceeding to the challenge cards
-  = amount of information processing needed (part of the complexity score)
-  = amount of structure (part of the complexity score)
-  = complexity of the underlying structure (part of the complexity score)

How to use these cards?

This set comprises **10 information cards** and **8 challenge cards**. Depending on your goals and the time you have, you can use more or less cards before you start tackling your own design challenge or use design thinking in your classroom.

The **information cards** provide information and sometimes questions that help you process the new information and apply it to your own context. If an information card has a flag in the top right corner, we highly recommend you to read it before starting your first challenge.

The **challenge cards** ask you to solve a design challenge and suggests which method cards to use. Furthermore, they ask you to reflect on your process. Each challenge is given a complexity score, indicating how complex the challenge is in terms of time, new information to be processed, level of structure provided on the challenge card, and complexity of the underlying structure.

All cards indicate the goal of that card and the time it will take, enabling you to choose which cards to use. If you do all challenges in this training module, you will need about 25 hours to finish it.

The main goal of the challenges in this training module is to get to know the design thinking methods in the set of method cards. As there are many method cards, not all of them are part of this training module. We highly recommend you to read through all method cards before starting to solve your own challenges, as your design process will benefit from the use of relevant and varied design thinking methods. Also, the set of method cards should be seen as a starting point, we encourage you to adjust methods or even add other methods you might find useful.

2. Where does the concept of design thinking come from?

By Anne Katrine G. Gelting, Designer, Ph.d., Teaching Associate Professor at The Design School Kolding, Denmark

Time needed: 10 minutes

Over the last 60 years design has changed substantially, from being only an activity with the aim of producing physical products – fashion, graphics, interior decors etc. – to becoming an all-round approach to the innovation process.

Since the early 1960ies there has been a parallel and ongoing discussion and reflection among design educators and scholars about what it is designers do when they design, in this continuously evolving and expanding field. This discussion has been conducted through design method conferences and articles and books about design methodology and has evolved from a desire to create a more methodological approach to designing to studying what actually constitutes “designerly” approaches to development.

Some of the key figures in the first developments of this discussion between the 1960ies and 1990ies are: Christopher Alexander, Bruce Archer, John Christopher Jones, Horst W. J. Rittel and Melvin M. Webber, Bryan Lawson, Donald Schön, R. Buchanan and Nigel Cross who talked about “Designerly Thinking”. The discussion and reflection are still ongoing today and has diverged into many different subtopics such as co-design, emotional design, creativity and design, importance of sketching and prototyping, etc. Many of the important articles are published in peer reviewed design research journals such as Design Issues, at Elsevier and Design Studies, at MIT Press.

The concept of “Design Thinking” as a way of talking about how designers work when designing, was coined in 1987 by architect Peter Rowe but popularised by Tim Brown from IDEO:

“Design thinking is a human-centered approach to innovation that draws from the designer’s toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success.” — Brown, Tim. 2008. Design thinking. Harvard Business Review June: 1-9.

Design Thinking as an approach is presently used in all kinds of innovation areas: products, services and experiences, in private companies but also in the public area. But what are the most important components of Design Thinking?

What is Design Thinking?

Design Thinking is about creating a relevant or interesting framework or perspective on an issue or problem by “opening it up”: This means asking lots of questions, challenging and possibly reframing the problem or issue, to discover and identify the real or most interesting problem that needs to be solved to help users or to provide new and better ways of providing services for companies and organisations.

Different visual tools like data visualisation, mood boarding, collaging, hand sketching, renderings and prototyping tools are then used to research, quickly test and iterate concepts and solutions in the process and to communicate potential solutions.



The design-oriented process and solution combine attention to usability, feasibility and aesthetics. (Aesthetics in the broad meaning of creating a world where we pay due attention to the human senses).

Design Thinking focusses on doing things, and a “Design Thinking” process is therefore a very tangible and pragmatic approach to innovation, where insights and results are documented and communicated in a way that is easily understood and shared inside a design team and also outside through 2D and 3D visuals and models.

The Design Thinking approach is not a simple five-stage gate process as many Design Thinking maps show, but more like a creative” dance” between many different and opposite positions or states that push the innovation process forward. Designers alternate:

- Between finding problems and creating solutions
- Between choosing the framework and dealing with detail
- Between analysis and synthesis
- Between divergent (open) and convergent (closed) thinking
- Between abstract (thinking) and practical/tangible actions
- Between working by yourself and cooperating with others
- Between developing an idea and communicating about it
- Between dealing with aesthetics and with technology and functionality

Designers work “iteratively” because they not only move forward but move forward through repeated stages of research, analysis, ideation and creation, but working at a more and more detailed and refined level. A Design Thinking approach is therefore quite complex but also very fun because it creates the kind of engagement and critical reflection that is needed to truly innovate. If done properly, it is truly a journey of learning, exploration and creation!



3. Design Thinking in education

Goal of this information card: get insight into ways design thinking can be used in education
Time needed: 20 minutes

Recently, design thinking is also being introduced in schools. This is done on two levels: the organisational level and the classroom level.

On the organisational level, *teacher design teams* are formed to find creative solutions for different challenges in the school. Examples of challenges are: how to reduce the amount of traffic around the school, how to stop bullying, how to use smartphones in the school in a positive way, or how to incorporate a topic like citizenship into the curriculum.

On the classroom level, *learners are challenged* to find creative solutions for different challenges. This can be challenges in their own classroom or school (like bullying or too much noise during the individual working time) or challenges that are aimed at learning a specific part of the curriculum in a different, more active way. Examples of these latter problems include designing a house of the future, finding a solution for the traffic problem in the city, designing a game to learn about fractions, or finding ways to diminish food waste.

Design thinking for teachers

Design Thinking focusses on combining thinking with doing, and a design thinking process is therefore a very tangible and pragmatic approach to innovation, where insights and results are documented and communicated in a way that is easily understood and shared in a design team and communicated outside the team. With schools needing to adapt rapidly to the changing society and shifting educational needs, design thinking seems to be a good way for teachers to redesign their schools organisational and educational activities.

Design thinking for pupils

Design thinking involves pupils more extensively in the planning and execution of teaching and learning. By bringing more meaningful and real-life problem solving into the classroom, pupils will be more engaged and teaching can become more collaborative and interesting for pupils. The design thinking method also contributes to the development of important 21st century skills, on which education is focusing more and more, like creativity, critical thinking, information processing, communication and collaboration.

Questions

1. How would you use design thinking in your school?
2. Do you already have ideas about design challenges you would like to solve?
3. Have you recently worked on a problem or theme for which design thinking would have been an interesting approach?

4. Why use design thinking?

*Goal of this information card: get insight into the benefits of design thinking
Time needed: 20 minutes*

Design thinking is a step-by-step way to structure creative problem solving and develop creative ideas and tangible solutions. Design thinking can be used to solve all kinds of everyday problems and to look at these problems in a positive way by calling them 'design challenges'. In other words: design challenges are problems or challenges that can be solved by using design thinking methods. Design thinking starts from various values:

1. **Everyone can be a designer.** By using the design thinking methods, everyone can be creative and find good solutions to design challenges.
2. **There is no such thing as 'the' solution.** For every design challenge, different design teams will come up with different solutions than can all be good solutions for the given challenge.
3. **It is important to leave beaten paths, experiment and be creative** in order to find the most optimal solutions for a challenge.

Design thinking provides teachers with a set of powerful tools to kickstart their problem solving in teams. Teacher teams are often an amalgam of very different personalities with strong opinions, making it difficult to find solutions supported by the whole team. The methods can help to find unexpected solutions that the team really found together, without anyone having to compromise. Teacher design teams have proven to be very powerful, not only in the professionalisation of teachers, but also in the successful implementation of educational innovation¹. However, teacher design teams need support during the design process in order to improve the quality of the design outcomes². The FUTE method and FUTE cards could provide such support.

There are various reasons why design thinking is also an interesting method for use in the classroom. First, design thinking is being used more and more in a myriad of organisations as they are being confronted with open and complex problems in modern society^{3,4}. It is a benefit for pupils when they get familiar with these methods and ways of thinking as it prepares them for the challenges they will be working on in their professional lives. Second, design thinking provides an active way of constructing knowledge, engaging pupils in their learning⁵. Third, design thinking is very good for training 21st century skills such as creative and critical thinking, communication, and collaboration^{4,5}. Of course, design thinking will also foster these competencies in teachers when they use the methods.

Questions

1. Is design thinking a good approach for the pupils and subject you teach?
2. Which benefits appeal to you most with respect to the pupils and subjects you teach?

¹ Huizinga, Nieveen, Handelzalts & Voogt, 2013

² Huizinga, Handelzalts, Nieveen & Voogt, 2013

³ Dorst, 2011

⁴ Luka, 2014

⁵ Lor, 2017

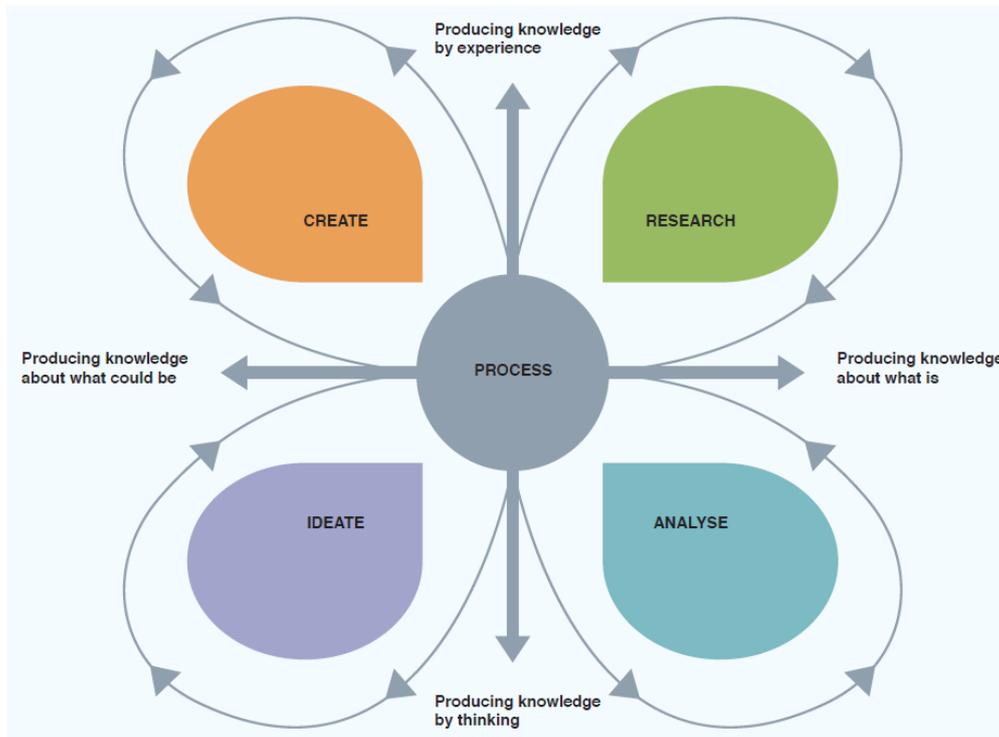


5. The FUTE model

Goal of this **information card**: get insight into the design process using the FUTE model
 Time needed: 20 minutes

The model

The FUTE research project has resulted in a model and a set of method cards, specifically fit for educational purposes. The following figure shows the FUTE model for design thinking in schools.



The model is cyclic in nature, meaning that one can go through it multiple times to find the best design for the design challenge at hand. It is not a linear process, which means you can shift back and forward between steps as needed. The model is set up on two axes, making four categories of design activities, with process activities in the middle of the axes. Below we explain each of the five different categories.

Research

During the research step, we want to produce knowledge about what already exists, and we want to do this in an active way, by experiencing. This means that we gather information in different ways, like doing interviews or observations, ...

Analyse

During the analyse step, we want to process knowledge about what already exists, but now by thinking. This means that we analyse and synthesize what we learned during the research step, for example by categorising the answers our interviewees gave.

Ideate

During the ideate step, we want to produce knowledge or ideas about what could be and we do this by thinking. In other words: we try to come up with new ideas and solutions for our challenge.



Create

During the create step, we try to produce new knowledge and we do this by doing, which means that in this step the solution for the challenge is created in the form of a tangible product. In other words, during this step we create a solution for the design challenge.

Process

The process step is in the middle of the model as we can use this step during and after each of the design steps. The process steps are designed to support the design process in various ways. The collaboration cards aim at supporting the collaboration process, for example by setting team rules or exploring the specific talents of the team members. The framing cards help framing the problem, or dividing the problem in smaller more manageable problems. The communication cards provide ways of communicating the design problems inside and outside the design team.

Questions

1. Browse through the method cards. Are they familiar to you? Have you used any of these methods already?



6. What is a design challenge?

*Goal of this **information card**: learn how to formulate a good design challenge; get insight into the complexity score*

Time needed: 20 minutes

Characteristics of design challenges

Design challenges require more than a simple internet search to find a solution. For design challenges there is not one solution and when posing the question it is not easy to predict what the solution will be.

How to formulate a good design challenge

It is important to formulate a design challenge carefully. Here are some guidelines that can help you formulate a good design challenge.

1. The challenge should be solvable by designing something tangible. ‘Why’ questions are usually not good design challenges.
2. The design challenge should be an open question, asking for example ‘how’ or ‘what’, instead of yes or no questions.
3. Think about the feasibility of the challenge. Do not pose a larger challenge than you and your design team will be able to solve.
4. A good way to formulate a design challenge is to start with the words ‘how might we’.

Complexity score

For the design challenges in this training module we have used a complexity score based on the model of Gill & Hicks (2006). This complexity score is made up out of three categories:

1. Information processing requirements.
2. Amount of structure.
3. Complexity of the underlying structure.

Below the name of each design challenge you will see the three categories with one to three pictograms behind them. The combination of these scores gives you an idea of what to expect when starting this challenge.

The first category, **information processing requirements**, is about the time needed to solve a challenge and the amount of knowledge that needs to be acquired. The time needed to solve a challenge can range from several hours to several months, it is good to consider the expected time, both when solving challenges in a teacher design team and in the classroom. Framing the challenge in a different way, can alter the time needed to increase feasibility. For instance, when solving the design challenge worked out on card 17, concerning lowering the ecological foot print of Kinder eggs, you could frame it differently by focusing only optimizing shape and packaging for transport, making it more of a mathematics challenge and reducing the information processing requirements. When framing the question to focus on the materials and production methods used, about which your pupils probably do not know a lot yet, you increase information processing requirements.

The second category, **amount of structure**, concerns the amount of structure given in the challenge card, the novelty of the task, and the degree of uncertainty. The novelty of the task is largely dependent on who is solving the challenge, the degree of uncertainty is about how many possible solutions there could be: the more possibilities, the higher the complexity. The amount of structure is especially important when using design thinking in the classroom: you as a teacher can choose to impose the use of specific cards, give pupils a choice between specific cards, or even let



them choose freely between all cards. The degree of uncertainty can be altered by framing the challenge differently: the more specific the challenge, the less uncertain the outcome.

The third category, **complexity of underlying structure**, is about the context where the challenge is situated. In a design challenge concerning climate change, many more and complex factors play a role than in a design challenge situated in a school. This latter design challenge will be much more complex than a design challenge about establishing a morning routine for a family. If we look at the example on challenge card x, we can say the complexity of the underlying structure is rather low, as it is only about the time schedule of one person. If the challenge would be about the morning routine of a household, the challenge would become more complex. Even more complex would be a challenge in which we want to find solutions in the way schools are organised to suit the needs of families with different schedules.

Questions

1. Think of a design challenge you have in mind for your organisation or your classroom. Think about the different components of complexity for this challenge. How could you make the challenge more or less complex?



7. Examples of the power of design thinking

Goal of this information card: get inspired by real-life examples of the power of design thinking

Baby incubators in Uganda

About 15% of babies in Uganda is born prematurely. Because not many incubators were available in Uganda, many of these baby died. Charity provided many incubators for the hospitals and baby mortality decreased. However, a few years later mortality numbers increased again. How was that possible? A design thinking company, Design That Matters, found out that without regular maintenance, incubators did not work properly anymore and that the broken incubators were not repaired because no one was familiar with the modern technology. The company found a solution to this problem by looking at what the technicians in Uganda were used to repairing. Uganda technicians turned out to be very well at repairing cars. The solution was hence simple: design incubators made from car parts! Baby mortality decreased again as broken incubators were quickly repaired with parts that were widely available in Uganda.

Source: Design your city

8. Design Challenge 1

Complexity: information processing  structure  complexity 

Goal of this challenge card: get familiar with the design thinking process and the various FUTE method cards

Time needed: 1 hour

Design challenge

Think of a friend, family member or co-worker who is always late in the morning. How can you change this persons morning routine in such a way that the person is not late anymore.

Research

Card 23. The journalist

Read through the card and follow the instructions. This step helps you collect data concerning the current morning routine of your friend.

Analyse

Card 28. Day cycle

Read through the card and follow the instructions. This step helps you process the data from the interview and find out where the problems are.

Ideate

Card 36. Brainstorm

Read through the card and follow the instructions. This step helps you come up with different solutions for the problem.

Create

Card 42. Role play

Read through the card and follow the instructions. This step helps you create the time line of the morning routine you designed.

Reflection

1. What do you think about the result of your first design thinking challenge? Would you have been able to find an equally good solution without using the method cards?
2. Can you think of a problem in your school that could benefit from the design thinking approach?

9. Design Challenge 2

Complexity: information processing    structure    complexity   

*Goal of this **challenge card**: formulate a design challenge, get familiar with the design thinking process and the various FUTE method cards*

Time needed: 1 hour

Formulate your first design challenge, try to keep the complexity low

Design challenge

Research

Choose a card and write down why you think this card could be helpful for solving this design challenge. Perform the method on the card.

Analyse

Choose a card and write down why you think this card could be helpful for solving this design challenge. Perform the method on the card.

Ideate

Choose a card and write down why you think this card could be helpful for solving this design challenge. Perform the method on the card.

Create

Choose a card and write down why you think this card could be helpful for solving this design challenge. Perform the method on the card.

Reflection

1. Are you happy with the result of the design process?
2. How did the process go? What would you do different next time? Are there any process cards that could have helped with these difficulties?

10. Design Challenge 3

Complexity: information processing    structure    complexity   

Goal of this challenge card: get familiar with the design thinking process and the various FUTE method cards

Time needed: 3 hours

Design challenge

How can we make the canteen experience for our pupils more efficient and relaxing?

Research

Choose one card or use both cards: Card 21 – The Anthropologist & Card 23 – The Journalist

Read through the card(s) and follow the instructions. This step helps you collect data concerning the current refectory experience for the pupils.

Process

03 The Expectations

Read through the card and follow the instructions. This step is important because it ensures everyone in the group thinks about what they want to achieve. There should be a facilitator to coordinate ideas and thoughts and to help ensure that everyone in the group is working towards the same expectations while discussing each side along the way. The list of expectations or wishes should be recorded and can be referred back to as the project progresses to ensure that everyone is working in a constructive way.

Analyse

Card 27 Biography

Read through the card and follow the instructions. This step looks for historical patterns – how have things been done in the past and why were they done in this way. Is there a better way which can alleviate the problem under scrutiny?

Ideate

Card 34 Multiple Perspectives.

Read through the card and follow the instructions. This step is about getting the perspectives, ideas and opinions of others. In this scenario, the canteen staff could be asked for their perspective on the lunch time problem.

Create

Card 40 Prototyping

Read through the card and follow the instructions. In this step a proposed solution to the lunch time problem could be trialled or prototyped. This might mean changing one aspect of the queuing system or staggering the lunch times by class group. A series of small-scale changes when tested or proto-typed in this way may find a solution to the larger problem



Process steps

Card 11 – The Success Criteria Grid

Read through the card and follow the instructions. This card can be used in conjunction with the results of The Expectations 04 card which was used earlier. At this stage in the process, it is important to ensure that any findings and subsequent recommendations are in line with the original expectations that were highlighted at the beginning of the process. The Success Criteria Grid helps to galvanise the most important aspects of the problem to ensure the proposed solution befits the problem.

Reflection

1. Are you happy with the result of the design process?
2. How did the process go? What would you do different next time? Are there any process cards that could have helped with these difficulties?

11. Design Challenge 4

Complexity: information processing    structure    complexity   

Goal of this challenge card: get familiar with the design thinking process and the various FUTE method cards

Time needed: 3 hours

Design challenge

How can we make reading more fun for the pupils so they will read more?

Process – Framing

08 Fact and inspiration finding

Read through the card and follow the instructions. This step helps you preparing the research step, as it helps in finding out which information you need to find a solution to the challenge.

Research

Card 20 – Desktop research, Card 21 – The Anthropologist, Card 23 – The Journalist

Choose a card that can help you collect information on your challenge. This could be either of the suggested cards or any other card(s) depending on your needs as defined in the previous step.

Process – Communicate

15 – Data wall

This step helps in communicating the information all team members collected.

Analyse

Card 29 - Personas

Read through the card and follow the instructions. This step lets you create fictional characters that all have different reasons to (not) like reading.

Ideate

Card 31 - What if?

Read through the card and follow the instructions. This step helps you evaluate the different ideas you might already have, based on the different personas you created.

Create

Card 39 - The relay

Read through the card and follow the instructions. In this step you work together to create a solution for the challenge, based on all previous steps.

Process - Communicate

Card 16 – Pecha Kucha



Read through the card and follow the instructions. This card helps you communicate the ideas you created to the other members of the school team.

Reflection

1. Are you happy with the result of the design process?
2. How did the process go? What would you do different next time? Are there any process cards that could have helped with these difficulties?

12. Design Thinking in the classroom

Goal of this information card: get insight into ways design thinking can be used in the classroom
Time needed: 20 minutes

Design thinking can be used as a teaching method in different ways. Below we formulate guidelines for the use of design thinking in these various ways.

Projects or courses based on the pupils' perspectives or interests:

Start by making the pupils ask themselves or each other what they are interested in, what they do in their spare time, what they like and what they are good at.

They then formulate problems, issues or challenges and try to understand whether they all face the same challenges and problems. The next step is to develop solution concepts and prototypes.

For example, if there is a keen interest in computer games, what are the challenges: limited time to play, social isolation, lack of physical activity, areas of the body that hurt because of monotonous use of arms and fingers? The solution and the concept presented could be a training programme for gamers or a new piece of furniture.

Developing this concept involves doing research into what kind of damage gaming can do to the body, learning about sports training programmes, biology and physiology or the many different subject areas that would be involved in designing, constructing and launching a new piece of gaming furniture on the market: materials, applied geometry, form and aesthetics as well as socio-cultural issues of creating a material object that needs to fit into daily life and a home's interior decor.

Projects or courses based on cross-disciplinary problems or challenges:

Broad concepts like biodiversity or sustainability, immigration, inequality or "peace" but also more specific issues like social media, food waste, stress or lack of areas for children to play in the city could be interesting starting points for a cross-disciplinary course.

Based on these broad concepts the pupils should ask each other how they experience the issue, do research amongst their family and friends and engage in further desktop research on the subject chosen.

On the basis of those results they formulate specific challenges to investigate and work with, for example, "How can young girls be made aware of how social media influences them?" or "how might we create habitat areas for bees and insects in our schoolyard?"

Working with such problem areas would require the pupils to gather knowledge about the functionality and programming of social media, to study the natural habitats for bees and insects and the impact of a lack of biodiversity on humans.

This would create a motivation for investigating certain aspects of for example biology, psychology and computer programming.

To create solutions the pupils would also have to learn how to create a website, design a campaign, build a bee hive or plant flowers that would attract bees and insects and other kinds of subject areas.

Projects or courses based on academic concepts, phenomena or objects:

The methods in the collection can also be used to create a learning experience and a course based on specific academic subjects like history, arts and crafts, home economics and math. For example the teacher of history could ask the pupils to research different wars or revolutionary periods and events in their own country and then create a board game that would illustrate the relationships that lead to the situation.

Another way of working with the methods in the collection could be in mathematics, where pupils could be asked first to define, research and then plan a holiday making them learn about distance calculation, VAT, use of percentage, time calculation etc.

In arts and crafts the pupils could be asked to design a product that would keep people warm in a cold winter. The teacher could take the class to a sledding hill for the next lesson to observe what kind of products are used there and then frame challenges and opportunities for new products that the pupils can then develop and craft.

When teaching younger pupils:

- 1) Read through the material.
- 2) If you are doing a project, plan the process, the project or the course, selecting one or two methods from each category (refer to the cases presented later). Plan how you want to work through the phases, if and when you are going to do mini-presentations and how the results will be presented.
- 3) Present the methods that will be used one at a time, help the pupils use the method and be sure to create a tight framing for the use of methods – time spent, results expected and deadlines for mini-presentations and end presentation.
- 4) Start the process!

When teaching older pupils:

- 1) Read through the material and examples of how to use the methods.
- 2) Plan the process, selecting two methods from each category that the pupils have to use (refer to the cases presented later). Plan how you want to work through the phases, if and when you are going to do mini-presentations and how the results will be presented.
- 3) Present the process and the different phases to the pupils: Research, Analysis, Ideation, Creation and Process Methods.
- 4) Print out all the method cards for each team and templates for notes that help them reflect and gather insights.
- 5) Point out which methods the pupils should use and then make them do the "Road Map" method from the Process Method category and make each team or pupil present their process map on a poster.
- 6) Help the teams work through the different methods and phases and be sure to make the pupils evaluate the process along the way; re-evaluate their process and collaboration issues using the different Process Methods.

Questions

1. In what way would you incorporate design thinking into your teaching?
2. Which tips do you think are most important to use in your specific situation?

13. Case study 1

Goal of this information card: get insight into ways design thinking can be used in the classroom
Time needed: 5 minutes

Using design method for “making the school a better place”

A large team of teachers and pupils across a school began to plan a project to make their school a nicer place for everybody. They used *Expectations* (method no. 03) for sharing what specific changes they would want the project to bring to their everyday school life: An end to bullying, better physical surroundings, better eating and exercise habits, etc.

In a *Challenge Framing workshop* (method no. 07) the problems were reformulated as challenges such as: “How can we improve every classmate’s enjoyment of school days?” or “How can we ensure that everyone has a friend?” “How can we make lunch break a calmer experience?” “How can we make it more fun to exercise during school?”

A team of eighth graders was in charge of the project to improve pupils’ eating habits. They started by gathering information they already had about the topic using *The Anthropologist* (method no. 21) and *The Journalist* (method no. 23). The next step was using *Clustering* (method no. 25), to sort the information into three categories: physical space, food and behaviour. They also mapped their insights using *Day Cycle* (method no. 28) to learn how the canteen was used during the day. They used *Personas* (method no. 29) to create four fictional characters who represented different types of pupils in the school, for instance “Thomas,” a 16-year-old in his final year of school, who loves fast food and hanging out with friends and “Sarah,” a 13-year-old quiet girl, who prefers to chat with her friends and brings her own food to school, etc.

This approach allowed the team to identify new possibilities for creating different areas of the canteen for different types of behaviour and also using the canteen outside of the lunch hour for different activities. The team then used *Prototyping* (method no. 40) to create three prototypes, scale models of the new canteen made out of paper, cardboard and small objects. The approach enabled the team to discuss and evaluate the design of the new canteen. Finally, the strongest elements of the three prototypes were combined into one prototype that was presented to several stakeholders such as pupils and teachers.

14. Case study 2

Goal of this information card: get insight into ways design thinking can be used in the classroom

Time needed: 5 minutes

Using design methods in arts and crafts teaching

As part of the arts and crafts programme at a nearby secondary school, the staff of a retirement home had invited a class to help redecorate the home's lounge, which the nursing home staff found boring and clinical. The craft teachers and pupils used *Fact and Inspiration Finding* (method no. 08) to plan how they could gather inspiration and knowledge about the needs of the residents and their taste in colours and themes.

First they created a process map using *Road Map* (method no. 13). The average age of the residents was over 90, so the pupils had to carefully plan how to initiate a conversation with them about a pleasant lounge environment. As a result of thorough consideration, the pupils used *The Journalist* (method no. 23) and conducted interviews, asking residents about their favourite seasons, colours, landscapes and childhood memories. They also used *The Photographer* (method no. 22) to collect pictures of favourite belongings at the retirement home. The project continued as art workshops with the pupils, residents, family and staff using *Multi Perspectives* (method no. 34). Along the way the pupils also used *Challenge Framing* (method no. 07) and *Success Criteria Grid* (method no. 11) to specify that they wanted to create a decoration piece that related to the residents' stories and lives and also clarified what aesthetic criteria it should fulfil.

The arts and crafts teacher felt that the pupils' original design ideas lacked richness and personality, so she gathered the pupils to do *Show and Tell* (method no. 10) during the sketching and designing segment, but also during the testing and making part. As a result the pupils came up with new ideas by sharing their work with others, which allowed the class to evaluate, elaborate, inspire and ideate together.

They also used *Creative Constraints* (method no. 35) to restrict what kinds of materials and shapes they could use. The final project was a unique, joyful and co-operative arts and textile ensemble for the lounge of the retirement home.

15. Design challenge for the classroom 1

Complexity: information processing    structure    complexity   

Goal of this challenge card: get familiar with the use of design thinking in the classroom

Time needed: 2 hours

Choose one of these challenges or change it into a challenge more suited to your learning goals

Design challenge

How can we make learning foreign language vocabulary into a fun game?

How can we make learning countries and capitals into a fun game?

How can we make learning the multiplication tables into a fun game?

Research

Card 23. The journalist

Read through the card and follow the instructions. Pupils can interview each other or other pupils about their difficulties when studying the subject under study. Maybe they have already played games concerning this topic?

Analyse

25. Clustering

Read through the card and follow the instructions. This step helps to find common difficulties and games that were brought up in the interviews.

Ideate

36. Brainstorm

Read through the card and follow the instructions. This step helps finding ways to make the subject content into a game.

Create

40. Prototyping

Read through the card and follow the instructions. This step helps to find out which games are indeed fun and aid learning.

Reflection

1. Were the pupils engaged during the design process?
2. If you were to tackle this design challenge in another class group, what would you do differently?

16. Design challenge for the classroom 2

Complexity: information processing    structure    complexity   

*Goal of this **challenge card**: get familiar with the use of design thinking in the classroom*

Time needed: 2 hours

Formulate a design challenge for your class, try to keep the complexity low

Design challenge

Research

Choose a card and write down why you think this card could be helpful for solving this design challenge. Perform the method on the card.

Analyse

Choose a card and write down why you think this card could be helpful for solving this design challenge. Perform the method on the card.

Ideate

Choose a card and write down why you think this card could be helpful for solving this design challenge. Perform the method on the card.

Create

Choose a card and write down why you think this card could be helpful for solving this design challenge. Perform the method on the card.

Reflection

1. Are you happy with the result of the design process?
2. How did the process go? What would you do different next time? Are there any process cards that could have helped with these difficulties?

17. Design challenge for the classroom 3

Complexity: information processing    structure    complexity   

*Goal of this **challenge card**: get familiar with the use of design thinking in the classroom*

Time needed: 4 - ? hours

Design challenge

How might we reduce the environmental footprint of Kinder Egg production?

Research

Card 20 – Desktop Research + Card 21 – The anthropologist

Read through these cards and follow the instructions. Card 20 encourages learners to learn about what influences the environmental footprint and the effects on the environment. Card 21 encourages children to see the problem for themselves. This might be by inspecting/ dissecting a Kinder Egg – looking at packaging, ingredients and materials.

Process – framing

Card 8 – Fact and inspiration finding

This step allows children to discuss what they already know about the Kinder Egg and it allows them to work out what it is they want to find out about its production process.

Analyse

Card 25 - Clustering & Card 26 – visualising data

Both cards encourage children to work together to collate the data they have uncovered.

Ideate

Card 31 – What if & Card 36 - Brainstorm

Both cards allow for free-flowing ideas based perhaps on intuition or perhaps a hunch. Children should be asked, what if they were asked to help solve the problem of the Kinder Egg environmental footprint - how would they tackle it?

Create

Card 42 – Role play

Children can imagine that one of them (or the teacher) is manager of the Kinder Egg production factory, questions can be put to them to find out the policy on reducing the environmental footprint.

Process – communicate

Card 17 – Pitching

Children could present their findings to other pupils or teachers in the format of a pitch. It could culminate in a debate, or even an activity to write to the company, to illicit an actual response.

Reflection

1. Are you happy with the result of the design process?



2. How did the process go? What would you do different next time? Are there any process cards that could have helped with these difficulties?

18. Design challenge for the classroom 4

Complexity: information processing    structure    complexity   

*Goal of this **challenge card**: get familiar with the use of design thinking in the classroom*

Time needed: 4 - ? hours

Design challenge

How can we as a school live a day like the Romans?

Research

19 – Personal stories & 20 – Desktop research

Read through the cards and follow the instructions. Card 19 allows pupils to share their knowledge and experience on the way Romans live. Card 20 helps to expand the knowledge of the pupils.

Analyse

28 – Day cycle

Read through the card and follow the instructions. This card helps to structure the information collected in the previous step into the form of a day cycle to really get an insight in the way Romans spend their day.

Ideate

32 – Inspiration

Read through the card and follow the instructions. In this step, the pupils look for inspiration on ways they can re-enact a day in the life of a Roman.

Create

42 – Role play

Read through the card and follow the instructions. In this step, the pupils play the role of Romans to see if the day in the life of a Roman the ideated in the previous step is good enough to present to the whole school and organise this as a school event.

Reflection

1. Are you happy with the result of the design process?
2. How did the process go? What would you do different next time? Are there any process cards that could have helped with these difficulties?

19. List of possible design challenges for the classroom

This is a list to inspire you as a teacher to incorporate design thinking in your teaching. It is of course possible to adjust these challenge to suit your pupils and curricular needs.

Cross-disciplinary challenges

How might we design a house/school for the future?

How might we change the design of Surprise eggs to decrease their environmental foot print?

Languages

History

Mathematics

Natural sciences

Social sciences

20. Further reading

Design Methodology

- Brown, Tim (2008), Design thinking, Harvard Business Review June: 1-9.
- Buchanan, Richard, 1992, *Wicked Problems in Design Thinking*. Article in *Design Issues*, Vol. 8, No. 2 (Spring, 1992), pp. 5-21, The MIT Press, Cambridge, Massachusetts
- Cross, Nigel, 2004, *Expertise in design: an overview*. Article in *Design Studies*, 25(5) pp. 427–441. Elsevier
- Dorst, Kees, Frame Creation and Design in the Expanded Field, Article in *She Ji: The Journal of Design, Economics, and Innovation*, Volume 1, Issue 1, Autumn 2015, Pages 22–33
- Friis S.A.K. and Gelting A.K.G, 2014, *The 5 C model*. Proceedings of DesignEd ASIA i Hong Kong, december 2014, Hong Kong
- Kolko Jon, (2010), Abductive Thinking and Sensemaking: The Drivers of Design Synthesis, *Design Issues*, Volume 26, number 1, pp.15-28
- Lawson, Bryan, 2006 4th edition (1st edition 1980), *How Designers Think, The Design Process Demystified*, Ch. 3 Route Maps of the Design Process pp. 31-50 and Ch. 4 The Components of Design Problems pp. 53-62, Elsevier, Oxford
- Liedtka, Jeanne & Mintzberg, Henry (2006), *Time for Design*, article in *Design Management Review* spring 2006, first printed in DMR, volume 17:2

Teacher Design Teams

- Alayyar, G. (2011). *Developing pre-service teacher competences for ICT integration through design teams*. The Netherlands: University of Twente.
- Handelzalts, A. (2009). *Collaborative curriculum design in teacher design teams*. The Netherlands: University of Twente.
- Huizinga, T., Nieveen, N., Handelzalts, A., & Voogt, J. (2013). Ondersteuning op curriculumontwikkelexpertise van docentontwikkelteams. *Pedagogische Studiën*, 90, 4-20.
- Huizinga, T. Handelzalts, A., Nieveen, N., Voogt, J. (2013) Teacher involvement in curriculum design: Need for support to enhance teachers' design expertise. *Journal of Curriculum Studies*, 46(1), 33-57.
- Jenlink, P. M. & Kinnucan-Welsch, K. (2001). Case stories of facilitating professional development. *Teaching and Teacher Education*, 17, 705-724.
- Koehler, M. & Mishra, P. (2005). What happens when teachers design educational technology? The development of Technological Pedagogical Content Knowledge. *Journal of Educational Computing Research*, 32(2), 131-52.

Design Thinking in the Classroom

References

Design your city (n.d.). *Design your city - werkboek*.

Dorst, K. (2011). The core of 'design thinking' and its application. *Design studies*, 32(6), 521-532.

Huizinga, T., Handelzalts, A., Nieveen, N., & Voogt, J. M. (2013). Teacher involvement in curriculum design: Need for support to enhance teachers' design expertise. *Journal of curriculum studies*, 46(1), 33-57.

Huizinga, T., Nieveen, N., Handelzalts, A., & Voogt, J. (2013). Ondersteuning op curriculumontwikkelexpertise van docentontwikkelteams. *Pedagogische Studiën*, 90, 4-20.

Lor, R. (2017). Design Thinking in Education: A Critical Review of Literature. *Proceedings of the Asian Conference on Education & Psychology*.

Luka, I. (2014). Design thinking in pedagogy. *Journal of Education Culture and Society*, 2(2), 63-74.