

# iTEC

Designing the future  
classroom

## Cycle 3 pilot

# Learning activities and Learning Stories

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## INTRODUCTION

iTEC pilot cycle 3 (September-December 2012) can start ! This cycle's pilots are truly special as they will be all about learning through design (and in design). In cycle 3, there are two "packages" of learning activities:

1. Observe and Design
2. Benchmark and Design

Pilot teachers can choose one of two Learning Activity Packages. Both packages include 6 Learning Activities that guide teachers through a design learning process. Both packages are illustrated by two Learning Stories, to show how the activities can be performed in the classroom. The packages and stories are:

### Learning Activity Package 1: "Observe and Design"

Contains these learning activities:

- Design Brief
- Contextual Inquiry: Observation
- Product Design
- Participatory Design Workshop
- Final Product Design
- Reflection

Two stories have been designed to support the implementation of the package:

- Redesigning School
- Visualization the plant surface

### Learning Activity Package 2 : "Benchmark and Design"

Contains these learning activities:

- Design Brief
- Contextual Inquiry: Benchmark
- Product Design
- Participatory Design Workshop
- Final Product Design
- Reflection

Two stories have been designed to support the implementation of the package:

- Designing a physics simulation
- Designing a math learning game



At the beginning of the pilot activities, teachers will need to provide their students with an initial design brief, which the students then flesh out and improve during each phase of the design process. Download: [Design Brief Template](#) (\*.doc)

While the Learning Activities are recommended to be performed as close to the descriptions as possible, the Learning Stories are examples that can be tweaked to better work for you, your students, the curriculum etc. This also means that the design process may be continued by students even beyond the conclusion of the pilot.

A highlight of this pilot is the activity "Participatory Design". It is included in both packages. Teachers who performed this activity reported that Participatory Design was highly motivational for their students.

# 1. LEARNING ACTIVITIES AND LEARNING STORIES FOR CYCLE 3

## Learning Activity 1 : Design brief

**Part of these packages:** Observe and design, Benchmark and design

*You present an initial design brief to the students that ties the design tasks to the curriculum topics, but leaves some aspects open for refinement. During this lesson, you also provide the students with the motivation for and explain the responsibility they will carry for being involved. Students form teams, discuss, question and familiarize themselves with the brief. They refine their design brief context, particularly in relation of who/what they are designing for, initial design challenges and possible design results. Students record a reflection, set up a blog for their documentation, and start their documentation. Classroom time needed: 1 lesson*

### Design results

- Design Brief 1: refine the design brief especially the context
- Reflection Recording 1: record challenges you can foresee
- Blog Setup
- Blog entries for Design Team, Design Brief and Design Process

### Ideas for using technology

- Forming teams: You can use TeamUp to help in creating balanced teams
- Design brief: Each team's brief (what they will do and when) should be laid out visually, using post-it notes or equivalent digital tools.
- Team result reporting: Your students may use blogs they already have or they can create new blogs for themselves. Your school may provide public blogs, but if not, you can consider Blogger or Wordpress.
- Aggregating student blogs: Use Google Reader, Edufeedr or Netvibes to collect the RSS feeds of student blogs and easily see whenever a team updated their blogs.
- Supported by these technologies: [Google Sites](#)<sup>1</sup>, [Blogger](#)<sup>2</sup>, [Corkboard.me](#)<sup>3</sup>

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<sup>1</sup> Google Sites is a web-based tool to create websites. In order to create a site you need a Google-account but it is possible to let other people view and edit without Google-accounts. It favors easy-to-use and collaboration over fancy layout. Since it is a Google product interaction with other Google products like Google Docs, Google Maps and YouTube is rather seamless – you just have to choose “Insert” and pick the service you want integrated. Google Sites can be used for multiple purposes – e.g. as a classroom site where products are gathered and made available for peer review or as a project site where a group can organize their reflections. It can be anything from a private workspace to a global showcase.

<sup>2</sup> Blogger is Google's blogging service. In order to create a blog you need a Google-account. It is possible to let other people view, comment or create posts without Google-accounts.

With Blogger you create a website where you can post eg. text, images or videos regularly. The newest post always appear on the top of the page. It is an easy way to put things on display and you can choose to open up for comments from selected peers or a wider audience.

### You may look forward to...

- a role of coaching and guiding, instead of instructing
- motivating students by letting students shape their own task

### Your students may learn...

- seriously commit themselves to doing thoughtful design
- negotiate on goals and assessment criteria
- question the tasks given to them, and suggest improvements
- tackle real world design challenges

## 1. Getting started

- Prepare a design brief, by (1) choosing one design brief (italics part of a learning story) and (2) adjusting it to match the curriculum requirements and your course schedule.
- Familiarize yourself with all learning activities so you can introduce the process to the students.
- Locate concrete examples that present why it is important to design thoughtful outcomes and to take the process seriously.
- Prepare a list of assessment criteria that reflect the curriculum requirements. If you like, share them with others as comments here.

## 2. Introduction

- Present the idea of the design process, your list of examples and the design brief. Give the students the design brief.
- Present all activities as 1-2 lesson “design workshops” and give the [visualization of the design process](#) (\*.png) and your schedule to the students.
- Go through the assessment criteria with the students. Make sure they understand that their notes and final design need to show to you that they’ve completed the criteria. Give them your list of assessment criteria.
- Form teams of students. You may ask the students to define initial roles for each team member.
- Encourage students to question the brief! Ask them to answer questions such as (a) who is the design for? (b) how can you find out about with those you are designing for? e.g., place, time and type of activity “contextual inquiry”, (c) What is the challenge that you are tackling?, (d) How are you planning to address the challenge?, and (e) although everyone has to be involved with all steps, who is responsible for which area?
- Give students enough introductory information so they can make decisions on what they want to do in their design. You may want to give this material to students before the course starts so they can look at it as homework.

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3 Corkboard.me is a simple online bulletinboard – you don’t even need to sign in. Each board has a unique URL. You can share the URL with others so they can add new post it notes on the board. Any changes will show up instantly. It is free but you must pay if you want more advanced options like adding pictures.

### 3. Activity

The green icons stand for "homework" (🏠) and "schoolwork" (📖). These are only recommendations and it is up to the teachers to decide how to organise the work.

📖 In teams, students discuss the design process, ideate what they will design, and refine the design brief.

📖 Students record a reflection (see reflection activity).

📖 🏠 Each team sets up a project blog using a suitable blogging platform and sends the URL of the blog to the teacher.

🏠 About page: Students describe their project team including their roles in the project. They may include a picture of themselves, a screenshot of TeamUp and contact information. The page can be called, e.g. "Design team".

🏠 Design Brief blog post: Students add their first Design Brief to the blog. They label or tag the post with "design brief".

🏠 Design Process blog post: Students use their reflection recording to write what they did, what challenges they had and what challenges they can foresee (use tag or label "design process" to describe the post).

🏠 In total, each team should have a blog with 1 page and 2 posts after this homework.

🏠 You add the URLs of the student blogs to this form: <http://bit.ly/itec-c3-blogs>. We then promote the blogs on the [iTEC website](#).

Tip 1: Initial confusion about the design brief is common, even among professional designers. There is no need to answer all questions right away. You will figure out the answers as you go along. This is part of the beauty of design.

Tip 2: Exercise your educational expertise! It is up to you to push students beyond their comfort zones, if you notice that they chose a topic that is not challenging enough for them to research.

Tip 3: Smaller teams often afford larger learning outcomes. Try to limit teams to no more than 4-5 people.

## Learning Activity 2.A : Contextual Inquiry - Observation

**Part of these packages:** Observe and design

*Based on their design brief, students identify who and what to observe to inform their design result, for example practices or environments of particular people or animals. Their choice depends on who they are designing for, what they are designing and the initial challenges they want to address. Student teams perform their planned observation by using digital cameras, notebooks and microphones to document what they see. They share their collected media files and analyze them. Based on their collected information and analysis, the students refine their design brief, especially the design challenges and design results. They then record a reflection and update their blog. Classroom time needed: 1-3 lesson(s)*

**TERMINOLOGY** – An inquiry is an act of asking for information. Observation is indicated to be the way. In our design activities, the word contextual refers to the circumstances that the students would like to design for or place their design into. So, here, the students use observation to collect information about the situation and factors of their design and that may inform their design.

### Design results

- Observation notes and media files
- Design Brief 2: refine the design brief especially the challenges and ideas
- Reflection Recording 2: record challenges you faced and can foresee
- Blog entries with these tags (or labels): Design Brief, Design Process and Design Results

### Ideas for using technology

- Record observations using pen&paper, smart phones (apps such as AudioBoo, Bambuser, Qik, Rehearsal Assistant, Instagram, etc.) and other suitable devices.
- Collect notes and media to a shared space. Use eg. DropBox, Google Docs, Flickr,, video sharing sites, suitable smart phone apps.
- Supported by these technologies: [Dropbox](#)<sup>4</sup>

### You may look forward to...

- sending students to observe their environment as group homework assignments

### Your students may learn...

- observe and record natural phenomena and/or people
- empathize with others
- collaborate online

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<sup>4</sup> Dropbox is a widely used service to save private files in “the sky” enabling you to access them from different computers or devices.

- identify real world design challenges
- question and improve tasks given to them

### 1. Getting started

- Look at the blogs of each student team, especially their design briefs.
- Support the teams that have not updated their blogs and design briefs.
- Listen to the reflection recordings of each team.
- Identify suitable locations and settings for each team, to support them if needed.

### 2. Introduction

- Introduce the activity/the workshop to the students
- Tell them that all of their senses need to be there when observing the people, practices or environments they identified.
- Make sure that each team has documentation equipment (cameras, notebooks, microphone etc.)
- Make sure that each team has selected people, places and/or practices to observe.

### 3. Activity

*The green icons stand for "homework" (🏠) and "schoolwork" (📖). These are only recommendations and it is up to the teachers to decide how to organise the work.*

🏠 🏠 Teams go out to do their observation, either together or individually.

📖 Teams sort through the media files and notes they collected, they group and annotate them.

📖 Teams analyse their notes and record design challenges and design ideas.

📖 Teams discuss the following questions: 1. How did the workshop go? What interesting information was collected? Does the design brief still make sense or does it need changes? How does it need to change?

📖 Students write their Design Brief 2 and record their Reflection 2.

🏠 Teams find more information on the topic (from books, internet, etc.) and collect it to a shared space.

🏠 Design Brief blog post: Students add their Design Brief 2 to the blog and label or tag it with "design brief".

 Design Process blog post: Students use their reflection recording to write what they did, what challenges they had and what challenges they can foresee. They label or tag the post with “design process”.

 Design Results blog post: Students add their collected pictures and other media files to the blog and describe what these findings mean in relation to their design. They may include drawings of design ideas. They label or tag the post with “design results”.

**TIP** – Teachers who tried this activity reported that it presented a great opportunity for reflecting with students about the pros and cons of using ICT tools in school. Try that with your students.

## Learning Activity 2.B : Contextual Inquiry - Benchmarking

**Part of these packages:** Benchmark and design

*Based on their design brief, students identify what kind of examples of existing works to collect. Their choice depends on who they are designing for, what they are designing and the initial challenges they want to address. Student teams collect 10 examples of the kind of artifact that is similar to the one they are trying to design. They share their collected media files and analyze the differences and similarities of the example works they collected. Based on their collected information and analysis, the students refine their design brief, especially the design challenges and design results. They then record a reflection and update their blog. Classroom time needed: 1-2 lesson(s)*

**TERMINOLOGY** – An inquiry is an act of asking for information. Benchmarking is indicated to be the way. In our design activities, the word contextual refers to the circumstances that the students would like to design for or place their design into. So, here, the students use benchmarking to collect information about the situation and factors of their design and that may inform their design.

### Design results

- List of comparable existing designs made by others
- Design Brief 2: refine the design brief especially the challenges and ideas
- Reflection Recording 2: record challenges you faced and can foresee
- Blog entries for Design Brief, Design Process and Design Results

### Ideas for using technology

- Collect links to a social bookmark service such as Diigo or Delicious Pinterest
- Take photos or other recordings of benchmarked designs and share them on a suitable media sharing service (DropBox, Flickr, Pinterest)
- Supported by these technologies: [Dropbox](#)<sup>5</sup>

### You may look forward to...

- finding dozens of innovative designs from around the world

### Your students may learn...

- find and evaluate designs of various fields
- empathize with others
- collaborate online
- identify real world design challenges

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<sup>5</sup> Dropbox is a widely used service to save private files in “the sky” enabling you to access them from different computers or devices.

- question and improve tasks given to them

## 1. Getting started

- Look at the blogs of each team of students, especially their design briefs.
- Support those who have not updated their blogs and design briefs.
- Listen to the reflection recordings of each team.
- Identify suitable websites for each team. We collected and will continue to collect websites full of inspiring examples at the Diigo Group '[Design Inspiration for School](#)'.

## 2. Introduction

- Introduce the activity workshop to the students and tell them that they need to find and analyze 10 different examples, and explain how they relate to their project.
- Make sure that each team member knows what kind of examples they are looking for.

## 3. Activity

*The green icons stand for "homework" (🏠) and "schoolwork" (📖). These are only recommendations and it is up to the teachers to decide how to organise the work.*

📖 🏠 Teams search for comparable designs and discuss them. Remind the students about time-management.

📖 🏠 Teams select the 10 most relevant related designs.

📖 Teams analyse their examples, list similarities and differences, and identify design challenges and design ideas.

📖 Teams discuss the following questions: 1. How did the workshop go? What interesting information was collected? Does the design brief still make sense or does it need refinement? How does it need to be refined?

📖 Teams write their Design Brief 2 and record their Reflection 2

🏠 Design Brief blog entry: Teams add their Design Brief 2 to the blog. They label or tag the post with "design brief".

🏠 Design Process blog entry: Teams use their reflection recording to write what they did, what challenges they had and what challenges they can foresee. They label or tag the post with "design process"

🏠 Design Results blog entry: Students add description and analysis of their 10 projects to the blog. They describe the similarities and differences of these existing designs and how they relate to their design. They may include drawings of design ideas. They label or tag the post with "design results".



**TIP 1** – Slow Internet connection? Try to schedule the use of the Internet for each team to avoid Internet traffic congestion.

**TIP 2** – The learning activities culminate towards a design. Some students may be overwhelmed by the multitude and quality of benchmark examples and find it difficult to proceed productively. If you recognize limitations of your students' ability to produce, stop the benchmarking activity.

## Learning Activity 3 : Product Design

**Part of these packages:** Observe and design, Benchmark and design

*Based on their Design Brief 2 and their initial design ideas, students create their first prototype design. The students discuss their prototype and refine their design brief, especially in relation to the design result and the way the result addresses the identified design challenges. They then record a reflection and update their blog. Classroom time needed: 1-2 lesson(s)*

### Design results

- A design prototype
- Design Brief 3: refine the design brief especially the ideas
- Reflection Recording 3: record challenges you faced and can foresee
- Blog entries for Design Brief, Design Process and Design Results

### Ideas for using technology

- Design can happen using paper prototyping, or using suitable digital authoring tools that allow collaboration.
- Supported by these technologies: [Prezi](#), [SketchUp](#)

### You may look forward to...

- seeing creative ideas
- seeing imaginative ways of using digital technology
- guiding students towards acquiring new skills and knowledge

### Your students may learn...

- transform their ideas into concrete prototypes
- find creative ways of addressing problems

### 1. Getting started

- Look at the blogs of each team of students, especially their design briefs and design results.
- Support those who have not updated their blogs.
- Listen to the reflection recordings of each team.
- Prepare the material, software and technology for the teams to create their designs based on their early design ideas.

### 2. Introduction

- Introduce the activity workshop to the students
- Remind them that their designs should address the identified design challenges.

### 3. Activity

The green icons stand for "homework" () and "schoolwork" (). These are only recommendations and it is up to the teachers to decide how to organise the work.

  Teams develop their designs.

 Teams set up their prototypes in the classroom and discuss it with other teams.

 Teams refine their Design Brief into the third version and record their third Reflection.

 Design Brief blog post: Students add Design Brief 3 to the blog. They label or tag the post with "design brief".

 Design Process blog post: Students use their reflection recording to write what they did, what challenges they had and what challenges they can foresee. They label or tag the post with "design process".

 Design Results blog post: Students add the documentation of their first prototype(s) to the blog. Among other files, they may use drawings, videos or digital photographs in addition to descriptions. They label or tag the post with "design results".

**TIP 1** – Team building exercises are recommended to support cooperation and collaboration towards a shared goal. Examples: Playing a game, solving a puzzle, having an ice-cream with all team members etc.

**TIP 2** – Regular feedback sessions support letting go of initial, not very good, ideas and to develop the feeling of ownership over the project.

## Learning Activity 4 : Participatory Design Workshop

**Part of these packages:** Observe and design, Benchmark and design

*The students teams meet with 3 - 4 people, whom they consider to be the future users of their design and perform a Participatory Design Workshop. The students use their prototype and Design Brief 3 to communicate their design ideas to a group of people they are designing for. This may involve prints of their prototype, drawings or models, pens and post-it notes that the participants can use to draw on and modify the prototype. After the workshop the students analyze the comments of the people and decide which ones to consider for their design. They then refine their design brief, especially in relation to the design challenges, context and added value of the result, record a reflection and update their blog. Classroom time needed: 1-2 lesson(s)*

### Design result

- A commented on design prototype
- Design Brief 4: refine the design brief and all of its components
- Reflection Recording 4: record challenges you faced and can foresee
- Blog entries for Design Brief, Design Process and Design Results

### Ideas for using technology

- The workshop is ideally done in a face to face setting, but notes and recordings should be taken and shared on the team's shared space (DropBox, Google Docs, or similar).
- Supported by these technologies: [Corkboard.me](http://Corkboard.me)

### You may look forward to...

- facilitating workshops where students are mainly in charge
- better get to know your students

### Your students may learn...

- empathize with others and work with different people
- present their ideas in understandable ways
- receive criticism and change their opinions
- do paper prototyping

### 1. Getting started

- Look at the blogs of each team, especially their design briefs and design results.
- Support those who have not updated their blogs.
- Listen to the reflection recordings of each team.
- Identify suitable people whom the participatory design workshop could be conducted with, so you can support the students if needed.

### 2. Introduction

- Introduce the activity of facilitating a workshop to the students.
- Make sure that each team has workshop material (cameras, notebooks, microphone, post-it notes and pens) and their prototype (or a representation of it).
- Make sure that each team has invited 3 – 4 people to their workshop and arranged a place for it. It is important to thoroughly and seriously consider appropriate participants, and to be able to say how each participant can inform the project.
- How to approach participants should be practiced before meeting them. You may provide your students with the [workshop guidelines of the iTEC project](#) as an example for how this activity in a large scale European project.

### 3. Activity

The green icons stand for "homework"  and "schoolwork" . These are only recommendations.

  Students present their design brief and prototype design to other people and ask for their comments and ideas. The people may draw on and alter the prototypes to express themselves better. Students take notes and pictures of what is happening and what is said.

  The teams analyse their notes and the drawings of the people. The teams decide how their prototype should change based on the analysis.

 The students discuss their Design Brief 3. Does the brief still make sense? What needs to be more clearly defined?

 Students write their Design Brief 4 and record their Reflection 4

 Design Brief blog post: Students add their Design Brief 4 to the blog. They label or tag the post with "design brief".

 Design Process blog post: Students use their reflection recording to write what they did, what challenges they had and what challenges they can foresee. They label or tag the post with "design process".

 Design Results blog post: Students add the documentation of their changed prototype(s) to the blog and describe their insights from the Participatory Design Workshop. Among other files, they may use drawings, videos or digital photographs. They label or tag the post with "design results".

## Learning Activity 5 : Final Product Design

**Part of these packages:** Observe and design, Benchmark and design

*Based on Design Brief 4 and the analysis of the Participatory Design Workshop, the student teams create their final design prototype. The teams listen to all of their reflection recordings once more to update the challenges they encountered during each design activity workshop and to reflect on the strategies they used to overcome these challenges. The students finalize their documentation blog, and may present their final works to the entire class. Classroom time needed: 1-2 lesson(s)*

### Design result

- Final design prototype
- Finalized Documentation Blog with entries for Introduction, Design Process, Design Briefs, Design Results and Design Team.
- Public presentation of the team's design, the process and rationale behind it.

### Ideas for using technology

- Design work: Appropriate physical or digital authoring tools.
- Publication of final results: Team blog, appropriate image or video sharing services.
- Supported by these technologies: [Google Sites](#), [Blogger](#), [Prezi](#), [SketchUp](#), [YouTube](#).

### You may look forward to...

- seeing very different designs emerge from the same original assignment
- showcasing prototypes designed by your students
- it is rewarding for students to complete a project.

### Your students may learn...

- do paper prototyping
- use digital authoring tools
- thoroughly consider the appropriate participants for the workshop
- more thorough assessment skills

### 1. Getting started

- Look at the blogs of each team, especially their design briefs and design results.
- Support those who have not updated their blogs.
- Listen to the reflection recordings of each team.

### 2. Introduction

- Introduce the activity workshop to the students and remind that that this is the last activity workshop.
- Remind students that their designs should address the identified design challenges and take the comments of the people they met last time into consideration.

### 3. Activity

The green icons stand for "homework" () and "schoolwork" (). These are only recommendations and it is up to the teachers to decide how to organise the work.

  Teams create their final designs

 Teams set up their prototypes in the classroom and demonstrate them to others

  Teams document their designs, by taking pictures of them and videotaping a demonstration of their design in use.

 Design Results blog post: Teams add the documentation of their final design prototype(s) to the blog and describe it. Among other files, they may use drawings, videos or digital photographs. They label or tag the post with "design result".

 Design Process post: Students use all of their reflection recordings to flesh out the older Design Process posts (e.g. by commenting). They go back over the recordings, add missing challenges to each process post and write to each challenge how they addressed it, they discuss about their documented anticipated challenges 'did they happen?', 'were they overcome?'. Finally they create a new blog post about what they would do better next time, and label or tag the post with "design process".

 Introduction page: Students add in introduction of their project including a short description of their aims, process and outcome to the blog.

 Each student visits another team's blog and leaves thoughtful constructive criticism.

TIP: Remember that the pilot activities accumulate towards the creation of an artifact. If you notice that discussions oscillate for a long time without resulting in concrete design decisions, step in and request a decision within a reasonable timeframe. The pressure of a deadline can in some cases support idea creation and focussed decision making.

## Learning Activity 6 : Reflection

**Part of these packages:** Observe and design, Benchmark and design

*The students record, post and share periodic audio updates about their project progression, perceived challenges, changes to the design brief and future plans. The students slowly build a database of learning strategies that is shared with the entire class. The audio recordings and the design brief can be used as a media to prompt reflection, and objects that should be more closely refined after each reflection. Classroom time: at least 15 minutes after each design phase*

### Ideas for using technology

- You may use TeamUp to store 1 minute team reflections. Alternatives include VoiceThread, AudioBoo, Bambuser.
- Supported by these technologies: [TeamUp](#), [Google Sites](#), [Blogger](#)

### You may look forward to...

- reviewing team progress quickly and comfortably

### Your students may learn...

- to quickly resume working in upcoming sessions
- to reflect on their work, and to provide and receive criticism
- a deeper understanding of a study topic
- to summarize, communicate and plan their work in progress
- speaking and presentation skills
- the importance of reflection in design and learning

### 1. Getting started

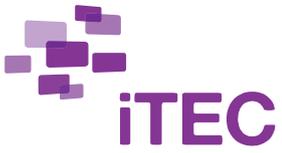
- Decide on the reflection service and set it up.

### 2. Introduction

- Explain that each phase of the learning process ends with 15 minutes where each team summarizes their work so far into a 60 second recording. Explain the benefits and reasons for reflection.
- Emphasize that the reflections are also valuable for the teams so they can update their blogs and later relisten what they've done earlier in the process.

### 3. Activity

- Teams reflect on the following and record it
  - a. What did you do?
  - b. What do you plan to do?
  - c. What challenges did you have?
  - d. Did you overcome the challenges? How?



e. What challenges can you foresee?

**TIP** – A steep learning curve might need to be conquered before the activity goes smoothly. Be prepared for possible initial feelings of frustration or awkward moments when first recording reflections. Be assured, after recording reflections a few times, you will begin to recognize the value of your investment.

## 2. LEARNING STORIES FOR CYCLE 3

Attention: Remember that a learning story is an example. In your classroom the stories might play out differently. For example, you might need more or less time for an activity than what a story suggests.

### Learning Story 1 : Redesigning school

Inspiration for these learning activity packages: Observe and design

Design thinking hat: Spatial Design + Understanding People

I want to engage students in my class to think about the theories and concepts behind spatial design and different motivations of people using a space. I present my students with the following design brief, which I modified to suit my curriculum requirements:

**Design brief:** Design an adequate concept for the future school. Consider authentic and practical experiences. Keywords that may spark ideas: regular meetings, library, newspaper and a video news channel, student enterprises, cross-curricular projects: shops, services. Consider all people who will potentially use your design. As you go along narrow your context, objectives and challenges addressed with the design. You could create a spatial design, a concept and test of an activity or process, etc. You could consider the views of teachers, students, parents, principals, city employers, grandparents, alumni etc.

**Contextual Inquiry:** The students observe the activities in school critically and enrich their observations with deep reflections about their personal experiences. Their analysis for the information collected should include a list of What works in school (good practices that can present design opportunities) and what does not (design challenges, that their designs can address). For example, the students collect photographs of the spatial design of their school. Then they look at the photographs of different spatial designs and analyse and annotate characteristics of the designs together. After that they categorise these aspects into design challenges (stuff that does not work and why) and design opportunities (stuff that works and why). After the activity workshop I listen to their reflections and read their blogs to ensure that all students are still on track with the curriculum requirements. If some students went entirely off tangent, I mention suggestions for focus to them, for example through lectures and supplementary material.

As an additional task the students may consider looking at projects that address the questions of redesigning school, its function in society and the practices within from different perspectives. This can be an informal and volunteering activity. Examples projects include: Design for Change, Project H-Design, IDEO toolkit for educators, Computer Clubhouse, Brooklyn Un-school, Un-School movement

**Product design:** One team decided to redesign the library space and the way students can interact with the library. Another team is thinking about school hygiene, and yet another is planning how physical activities could be highlighted throughout the school. The teams visualise their design from different scales and angles, assess and edit designs. I demonstrate each team's progress on the IWB throughout the activity workshop.

**Participatory design:** The team that decided to redesign the library space and the way students can interact with the library, suggested to bring together some students who are not frequently visiting the library and two librarians of the school. They share their designs with them and the participants annotate and assess them. After meeting the people, the team is eagerly discussing about the information the participants provided, deliberating how the mentioned ideas could be balanced and reflected in the design. The team is realizing that there are different motivations that the design needs to address and that need to be considered for the design to work for all people. This is a tricky challenges that they do not have a strategy for solving right away.

**Final product design:** While listening to their audio reflections and reading their design process blog posts again the students realize that the iterative approach of shaping, changing and editing their designs was their strategy of finding an appropriate balance between the different motivations and point of views of the people who the team considered to be the future users of their design. The team decides to take their project further and presents it to the principal, who is thinking of implementing parts of the design ideas by the students.

## Learning Story 2 : Visualizing the planet surface

Inspiration for these learning activity packages: Observe and design

Design learning brief: Design a guided walk that highlights aspect of the local environment. The guide should focus on [local animal species / historical monuments / geographical features]. It should be designed to serve [community members / tourists]. The final design should be [a geocache or a series of geocaches / a location-aware smartphone game / a Google map with points of interest and suggested routes / a printed guide map / QR-codes placed in the environment / something else].

**1st lesson (design brief):** In my biology course I customize the design brief to focus on my current curriculum topic, which is migratory species. I give the brief to my students and discuss with them the various species that migrate to our area. I then use TeamUp to collect specific ideas, let students vote their favorites, and form design teams. Each team sets up a blog, customizes the design brief to their needs, and approves it with me. I instruct them to record a reflection of their initial work in TeamUp and assign writing the first two blog posts as homework, as well as researching their topic further.

**2nd lesson (observation):** Each team plans their observation trip, including location, time, duration, and goals they have. They also plan future workshops so I can help them contact people they need for them. Students loan sensors and smartphones with suitable, pre-installed geolocation apps from the school. They record their plan on the classroom wall. During the week they do their observation trips, collect material on their team shared space, and process those in preparation of the next lesson.

**3rd lesson (observation and product design):** Teams collaborate on their findings and generate initial design ideas. They assign tasks to each team member, decide on the medium, and start their first paper prototype. They finish the class with a reflection. During the week they contribute to their design by learning more about the topic (eg. identifying the species they've photographed) and adding ideas. I support the teams by arranging Skype calls to local university students who can help in species identification.

**4th lesson (product design and participatory design):** Teams present their prototypes to others in a gallery walk, giving and receiving ideas. They then prepare for their participatory design workshop by thinking about who they should invite to the workshop (parents, acquaintances, friends). Teams organize the workshops in school grounds after class, present their designs to participants, and listen to their reactions and suggestions. During the week the team rethinks their design and looks online for other similar services to get more inspiration.

**5th and 6th lesson (product design and participatory design):** Since I have a long course, I allow for another round of design and another participatory design workshop.

**7th lesson (final product design):** Before class, each team posts a final presentation of their design to their blog, including a demo video and pictures. Teams present their prototypes during class. The local tourist office representative is present for the final presentations.

## Learning Story 3 : Designing a physics simulation

Inspiration for these learning activity packages: Benchmark and design

Designer hat: Engineering Design + Experiments with Nature

**Design learning brief:** Design a dynamic simulation that explores [friction / gravity / relativity / other topic in physics] and can be used to teach that principle to other students. The simulation can be virtual or built using a construction kit. Your simulation needs to reflect reality as closely as possible, while demonstrating the phenomena in an understandable way. Be bold, try out daring and unlikely ideas! Test your design with your classmates and assess your design critically.

I give the design brief to my students and tell them the exact topic of physics their simulations should explore: gravity. One team wants to use Lego Mindstorm to illustrate objects falling, while another uses a physics simulation software to build a rotating solar system. I guide the teams into thinking what their simulations try to convey and how they might best achieve it. As homework, the teams set up their blogs and start collecting examples of physics simulations and different software and construction kits into a Diigo group. They also add videos showing real physical phenomena. The students refine their design briefs, record reflections and start project documentation blogs.

After doing their research, one team decides to switch from MindStorm to Arduino, and another team decides to use a web-based game editor that has a physics model built-in. The teams try out numerous simulations and note what they like and dislike about them, and what their limitations are. I order an Arduino set from our school's IT department.

To get started, each team creates a simple initial simulation (one ball dropping from the table to the floor; a solar system with a star and one planet). I organize cross-team sessions in breakout rooms where one member of each team presents their simulation to members of other teams, and gathers feedback and ideas for further improvements. One team can't make their robot to drop the ball, so they only present the principle as a series of drawings. As homework, each team works on analysing the results and suggests improvements and changes to their design, also changing the underlying technology choice if they see it limiting their design too much. The reflection recordings and blog entries of this session are especially interesting to me and they will support the design learning process of the teams, as they document and share valuable design strategies for overcoming their challenges.

Teams continue to further develop their new design ideas during the next week. During class, we have another PD workshop where different team members present their designs to members from other teams. This time even the robot is functional and the team can demonstrate the acceleration of the ball being dropped. They have several ideas for measuring the speed, which are discussed in the workshop.

Finally the teams finalize their documentation blogs of their design idea, the final prototype, and the design process. They support their entries with embedded web-based simulations and videos.

## Learning Story 4 : Designing a math learning game

Inspiration for these learning activity packages: Benchmark and design

Designer hat: Game Design / Logic

It is my intention for the students to internalize simple geometry concepts as their future understanding of more complex geometry will build on their basic understanding. Although a lot of students already master simple geometry it is good for them to revisit the topic and others to internalize the basic concepts more thoroughly. Combining more advanced logical learning, learning of computer programming, and second order understanding of the motivations, skills and intentions of others, with this, I decide to present the students with the following design brief:

Design a math learning game for one concept of simple geometry for younger students using Scratch. Try to make the game fun and educational at the same time. In this, consider what the younger students find most challenging and what they find most engaging. Your game can be a concept or half functioning prototype.

**Design Brief activity workshop:** The students form teams and start discussing about their personal experiences of learning simple geometry, what they found most challenging with the way I taught it to them and what were the essential experiences that made it “click” for them. It is exciting to listen to their conversations, many of the “clicks” happened outside of school together with friends and family members. I am getting ideas for further developing my teaching approaches. After the lesson, each team has a refined design brief and a recorded reflection about what they did, what they plan to do and what challenges they anticipate. These foreseen challenges include among others that it will be hard to bring together the fun and educational aspect of the game. At home they set up their blogs and add entries.

**Contextual Inquiry:** The teams also start benchmarking existing educational games at home using the Internet. They collect their examples on their blogs. Some of the teams look at what kinds of games have been developed by other children using scratch, others look at geogebra and related larger widely used games. Other team members revisit the simple geometry maths concepts to ensure that the team has enough knowledge about the concept. During class time, the teams discuss the examples they found. They compare and analyze them based on their advantages and disadvantages. After the activity workshop the design brief, in particular the challenges and design ideas, are refined and a reflection is created. At home, the blogs are updated.

**Product Design:** During this lesson, I let the teams explore the Scratch software and let them start creating prototypes of their games. Some of the prototypes are drawings that look much like boardgames and some like paper prototypes of interactive digital games. Some teams actually start with the digital implementation of their games.

**Participatory design:** As all teams are designing for younger students who have math class during the same time on Tuesdays as my class, I agree with the other Maths teacher to let her students test and comment on the designs of the student teams in my class. The teams present their design briefs and their prototypes to the younger students, who start playing the game concepts and tell what works for them and what does not. The younger students also tell what they really enjoy doing that is totally unrelated to school learning. From these interactions, the student teams better understand the challenges with the way the concept is

taught now and what it would engage them into finding out how stuff works geometrically. The student teams further refine their design briefs, especially what kind of game would support the children they are designing for. They also record a reflection and update their blogs.

**Final Product Design:** After the last learning activity workshop, the students have a finalized software game prototype and a finished design blog. The reflection recordings support them in creating a post about their future plans for the project and what they would do differently next time. Some teams are asking me to contact and invite professional game designers to school for lectures and informal Q&A sessions, others would like to visit a game development company. Yet another team is considering to organize a school-wide gaming day where students play the games and vote for their favourite. To push this forward they ask me to send their design blogs to the school principal.

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