

Trainings handbook ENGINEER unit
Knee deep
Designing and constructing a water pond
Geotechnical engineering
Geology



The basic ideas of this project and guides are from the Engineering is Elementary program of Museum of Science, Boston.

Index

| | |
|--|----|
| About this handbook..... | 3 |
| About the workshop(s)..... | 3 |
| Aims for ENGINEER workshop and the accompanying trainings handbook | 4 |
| Workshop plans..... | 4 |
| Planning and preparation..... | 6 |
| Long before the workshop | 6 |
| Before the workshop..... | 6 |
| On the day before the workshop | 7 |
| After the workshop | 7 |
| The workshop activities..... | 8 |
| 1. Workshop activity Engineering an Envelope..... | 9 |
| 2. Workshop activity Stable Table | 12 |
| 3. Workshop activity Information about ENGINEER | 15 |
| 4. Workshop activity Lesson 0 – Engineering an Envelope | 17 |
| 5. Workshop activity unit Knee deep, designing and constructing a water pond | 18 |
| 6. Workshop activity Gender..... | 20 |
| 7. Workshop activity Organizing an ENGINEER training..... | 22 |
| 8. Workshop activity Motivating colleagues | 23 |
| 9. Workshop activity Inspiration! | 24 |
| 10. Workshop activity Closure | 25 |
| Appendices | 26 |
| Resources | 26 |
| Covers of Dutch magazines | 28 |
| Partners..... | 29 |

About this handbook

Welcome to the trainings handbook for ENGINEER *Knee deep, designing and constructing a water pond*. This handbook is intended for:

1. Teachers who have attended a professional development ENGINEER workshop run by museum staff and are preparing to introduce this unit to other teachers.
2. Educators from museums who are preparing to give an ENGINEER workshop to teachers or teacher trainers.

The contents of these guides are the plans for the ENGINEER professional development workshop to teachers or teacher trainers. In this handbook is not the information you will need to teach the unit to pupils, therefore you will need the accompanying teacher guide *Knee deep, designing and constructing a water pond*. In total there are 10 ENGINEER teacher guides; in each teacher guide is the information a teacher needs to give the unit to his/hers pupils. In total there are also 10 trainings handbooks. In this handbook are workshop plans for giving ENGINEER workshop to teachers or teacher trainers.

About the workshop(s)

Recommendations for workshop agenda's and programs are in the paragraph *Workshop plans*. Note that the agenda's and programs in this handbook are a guideline. Because of the modular structure of this handbook every educator can determine their own trainings program. To make sure all the ENGINEER units are covered a 3 day trainings plan is included. It is not recommended that a trainings day is shorter than 4 hours, because than there is less time for engagement with the hands-on activities as well as time for reflective discussion. There is made a distinction about giving a workshop to teachers and to teacher trainers. The workshops are broadly comparable, but in the workshop for teacher trainers there will be attention given to the planning and executing of a workshop.

In the paragraph *The workshop* are the different activities separately written down. The number of participants in an ENGINEER trainings workshop can vary, but a minimum 8 and a maximum of about 30 is recommended. You need some people to have a discussion; if the group is too small participants are not inclined to participate in a discussion. But if the group is too big some people are being wiped out by others. In the workshop most activities are done in smaller groups 4 to 6 people in each group is the most effective. Every time you give an ENGINEER workshop think about the background of the participants and adapt accordingly your workshop to it.

In paragraph *Workshop activity Gender*, are some activities to raise awareness about gender stereotypes. The influence of stereotypes is still decisive for the image pupils have about engineers and scientists and subsequently their career choices. Teachers are a role model. They can play a significant role in the circle of influence of their pupils. Most teachers are unaware of the fact that they use stereotypes in their teaching. This is not done deliberately, this happens without knowing this. Everyone, including teachers have consciously and unconsciously stereotypes, and subsequently use those in teaching. May be also you. When giving this workshop be aware of this and try to behave accordingly.

In paragraph *Workshop activity Inspiration!*, are some links to video's that can work to enthusiast the participants. Decide for yourselves if it is something that will work with your participants and when to show it.

Aims for ENGINEER workshop and the accompanying trainings handbook

Regardless of the specific unit and available time, all the ENGINEER training workshops have the same core goals:

- To put participants in an active role so they can experience a learner-centred experience (Engineering is Elementary, Museum of Science, Boston).
- To make participants aware of the importance of hands-on activities in a workshop.
- To give participants enough knowledge of the science and engineering of the units in order that they feel confidence in teaching the units. (Engineering is Elementary, Museum of Science, Boston).
- To give participants the opportunity to develop a vision of engineering.
- To give participant knowledge of the engineering design process and the different steps in the cycle. (Engineering is Elementary, Museum of Science, Boston).
- To give information about and let participants experience inquiry based learning. (Engineering is Elementary, Museum of Science, Boston).
- To ensure that after following an ENGINEER trainings workshop and after studying the teacher guide and trainings handbook participants can give an ENGINEER trainings workshop to teachers.

Workshop plans

Below are suggested agenda's for a three day trainings workshop for teachers and for teacher trainers. These are suggestions of how to fill the trainings workshops; because of the modular structure of this handbook every educator can determine their own trainings program.

Note that in the tables with workshop plans, *time* does not add up to the total workshop time. Extra time is needed for breaks and questions during the workshop.

1. 1,5 day plan for the trainings workshop for teachers

Workshop time: approximately 10 hours spend over 3 half-day session.

Number of participants: 20

| | Workshop activity | Time |
|------------------|--|------------|
| session 1 | Stable Table | 60 minutes |
| | Information about ENGINEER | 15 minutes |
| | Lesson 0 – Engineering an Envelope | 5 minutes |
| | The unit <i>Knee deep, designing and constructing a water pond</i> | 90 minutes |

| | | |
|------------------|--|------------|
| | Closure | 10 minutes |
| session 2 | Exchange experiences about teaching the unit | 30 minutes |
| | Choose a new unit from the ENGINEER units | 60 minutes |
| | Choose a new unit from the ENGINEER units | 60 minutes |
| | Motivating colleagues | 30 minutes |
| | Closure | 10 minutes |
| session 3 | Exchange experiences about teaching the unit | 30 minutes |
| | Exchange experiences about motivating colleagues | 30 minutes |
| | Gender | 30 minutes |
| | Choose a new unit from the ENGINEER units | 60 minutes |
| | The other units a little | 60 minutes |
| | Closure | 10 minutes |

Tip - Before the workshops on day 2 and 3 ask the teachers feedback on what they want in the workshop. If they already used the unit, ask them if they faced problems by teaching the unit? Is there more science knowledge needed? If you do this before, it is possible to prepare something.

2. Plan for the trainings workshop for teacher trainers

The workshops for teachers and teacher trainers are broadly comparable, but in the workshop for teacher trainers there will be attention given to the planning and executing of a workshop. Recommended is to plan this on the third module.

Planning and preparation

Giving a workshop takes time to plan and prepare this. Below is written this in four sections: long before the workshop, before the workshop, on the day of the workshop and after the workshop. The resources needed are in the appendices and also with each activity.

Long before the workshop

1. Pick dates for the workshop.
Teachers often have more obligations to train so do not wait till the last moment to set a date. Be aware of holidays and vacations. Do not plan a workshop in the week before or after a holiday. Also try to avoid busy times, for example in the Netherland December is a bad month to train teachers.
2. Market this workshop to the target audience.
In each country this is probably different how to do this. Most museums do have means to market the workshops and a network of schools.
3. Make sure participant can registrate for the workshop and receive information of the workshop.
Ask the participants about their science background.
4. Ask the participants about their science background, in advance. Check if the workshop is accordingly their science background. Are the participants experiences in science and science teaching or are they not.
5. Arrange a location that has all the facilitates you need.
6. Arrange the facilitators you need to give the workshop.
7. Make a list if all the resources that needs more time and prepare them.
 - For one of the workshop activities about gender some covers of typical magazines for girls, boys and both (gender-neutral) are needed. In the appendixes are Dutch examples.

Before the workshop

1. Read this trainings handbook.
2. Prepare the resources:
 - collect all the resources you need (see table in the appendixes),
 - duplicate the hand-outs you need,
 - make the PowerPoint slides you need.
3. Try all the activities with the materials as a participant.
Does it work the way you want? Is it taking more or less time than you anticipated? If needed you can still adjust the workshop.
4. Walkthrough the workshop as a facilitator.
If there are more facilitators divide the tasks.
5. Prepare a schedule of the workshop for the participants.
Include breaks in this.
6. Decide if and what you want to offer (refreshments) the participants. Arrange the refreshments if needed.

On the day before the workshop

1. Prepare the location and resources:
 - enough tables and chairs arranged in the way you want,
 - materials easy accessible,
 - hand-outs easy accessible,
 - computer, beamer and screen if needed.

After the workshop

Reflect on the workshop with all the facilitators. If participants have filled in a evaluation, analyse these.

- What went well?
- What good have been better?
- Are your aims reached?
- Was the time schedule good?
- Took a workshop activity more time? Why? Was that beneficial?
- Where all the participants engaged in all the workshop activities? If not, at which activity? Do you know the reason?
- When leaving where the participants enthusiastic?
- When leaving did the participants have an understanding of the content and didactics in the workshop?

The workshop activities

The workshop duration for each activity correspond with the times mentioned in the tables in the paragraph *Workshop plans*. When a shorter workshop is given, the times and activities needs adjustments.

Introductory activity – What is engineering? – in groups

- Ask the group to discuss all the things they associate with the terms engineering and technology. As part of the discussion, each individual within the group will then be asked to put one idea on a post it.
- Each group will then be invited to place their post its on to a flip chart sheet and briefly explain their choice.

What is an envelope – in groups/ discussion with all

- Provide each group with a range of envelopes and two objects. Ask the group to select which envelopes would be most suitable for the objects and why.
- The groups discuss and select the best envelop /object fit and the reasons for this.
The following questions can help guide the discussion:
 - What material is the envelope made from?
 - What fixings and fastening are used?
 - What range of objects could the envelope be used for?
 - What other materials it could be made from?
- Each group reports back their ideas. Discuss the possible solutions.
- The discussion should include drawing attention to the thinking process engineers need to be involved in when making something to solve a particular problem. Like an appropriate packaging for an object.
The following questions can help guide the discussion:
 - What might count for an envelope?
 - What is the function of an envelope?
 - Are there more functions?
 - Do all envelopes look the same?

Tip – An important point of this activity is to discuss a range of interpretations of what might count for an envelope. Take examples that might challenge the notion of envelope to include a broader interpretation as something that 'houses', 'protects', 'holds in place', 'covers', 'hides', 'reveals'.

Conclusion and reflection – discussion with all

- Go back to the post-its. Do the participants feel the same about engineering and technology?
- Refer to the tea bag. Mention lots of things about the tea bag that are engineered and designed. The actual tea bag is often in another paper bag. Probably for protection but also you can see which flavour you pick. There is no glue it is attached with little holes in the paper. So it is lighter but also glue can be poisoned. The paper is thin (light) but not too thin that it rips very fast. The teabag it self's is made of a paper with lots of tiny holes in it, the flavour can escape but the tea leaves cannot. It is big enough so that it contains enough tea for one cup and that the leaves can swell. It is folded in a way that is may be convenient for the machines that folds them. And so on....
- An important point to make here is that it is not high tech or low tech but appropriate technology that matters - engineers needs to consider context and resources.

- Reflect on what an engineer does:
 - Emphasise that most things we use are made for a purpose and that engineers use a range of skills in finding solutions to problems.
 - Raise awareness that it is acceptable to have a range of definitions for the terms 'engineer' and 'technology' and that these terms are often used interchangeably, e.g. engineering could be considered as the use of technology for problem solving.

2. Workshop activity Stable Table

Preparation: 5 minutes

Duration: 60 minutes

Context and background

In this workshop activity, the participants undertake a short challenge: they make a structure that can hold a tray with drinks. They discover that when undertaking this challenge or solving other problems, it is very natural to use some form of design cycle. While most people instinctively use a design cycle, most of the time they are unaware of this. This activity is used to introduce the engineering design process and allow people to experience it for real.

Objectives, the participants will:

- succeed or fail in undertaking this challenge;
- find out that the design process is instinctive and used frequently in daily life;
- learn the different steps of the design process.

Preparation

1. Organise the materials so that you can distribute them easily.

Resources

- 12 newspapers (one for each group)
- tape
- tray with two drinks (for example, two coffees) and a plate of cookies
- six pairs of scissors
- hairdryer (optional)
- six rulers
- large illustration of the design process (on a PowerPoint slide or poster)
- flip chart with markers



Tip – You can give the groups a maximum length of tape; for example, 15 cm.

Tip – To make it even more challenging, you can use a hairdryer to test whether the structures are stable.

Introductory activity – the challenge – whole group discussion

Imagine that you're relaxing in a designer lounge chair. It's lovely weather, and you're enjoying your book and a nice drink! But when you want to place your drink on the ground, you find you can't reach it. Clearly, the designer chair has not been designed well.

- How might you solve this problem? Let the participants respond.
- The challenge is to build a structure that can hold a tray with two cups of coffee and a plate of cookies.

Tip – To give the participants ownership, decide together what should constitute a successful challenge; for example, how high the structure should be.

Ask, imagine, plan and create – whole group discussion/in groups

Do the following in the group as a whole:

- What do you need to know? Ask the participants and write the questions on a flip chart.
- Are there any further questions? Answer participants' questions about criteria and restrictions.
- Explain how the structure will be evaluated. It will be successful when the cups can hold their contents and the structure has a minimum height of 30 cm. Will the hairdryer be used?
- Make sure all of the groups know which materials they can use and how much time they have.

Do the following in groups:

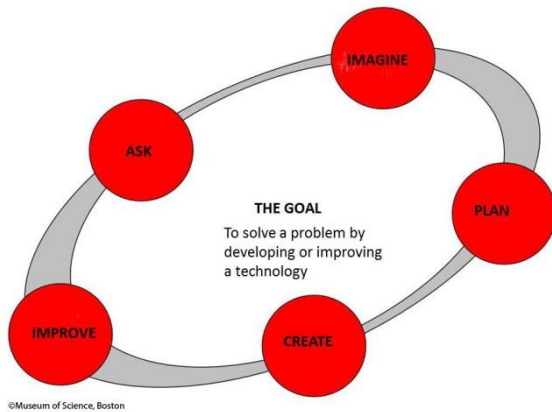
- The groups have 15 minutes to create their table.
- While the participants are building, walk between the groups, observe, and ask what they are doing and why.
- Warn the participants when they have five minutes left.
- After 15 minutes, the participants should stop building.
- Evaluate each structure. Get all of the participants to gather round a structure, and ask what this group has done and why. Test the structure. What would they have done differently if they could repeat the challenge? Do this for all of the structures.

Conclusion and reflection – whole group discussion

The participants can return to their seats.

- Thinking about the process, what have you done? Each group discusses this and writes down, in five or six action words, which actions they undertook to complete the challenge.
- Once all of the groups have done this, ask them which words they have written down and write them on a flip chart. Rather than writing them in one long list, try to group similar words. For example, put 'brainstorm' and 'think' in the same group; the same goes for 'build' and 'make'.
- Once all the words are on the flip chart, link the groups of words to the design process. Go through every step of this cycle. Explain that they all undertook the challenge in a form of design process. Perhaps the order was slightly different or some steps were merged, but this

doesn't matter. Also tell the participants that most people – especially pupils – need additional structure and help during the 'ask' and 'plan' steps.



| Design process | Description of the step |
|----------------|--|
| Ask | What is the problem? What kind of science do we need? What are the restrictions (materials, time, cost)? |
| Imagine | What might the solution be? Brainstorm ideas. Choose the best one. |
| Plan | Draw a diagram. Make a list of materials you'll need. |
| Create | Follow your plan and create it. Test it out! |
| Improve | Make your design even better. Test it out! |

3. Workshop activity Information about ENGINEER

Preparation: 5 minutes

Duration: 15 minutes

Context and background

In this workshop activity the participants get information about the ENGINEER project and the different units. It makes the participant aware that there are 10 different units who have different subjects in engineering and science. Also the aims of the ENGINEER units are mentioned. This section is deliberately after *Engineering in an envelope* and *Stable Table*. Those two activities get the participants enthusiastic and aware of what engineering really is. Something you need in order to get a successful workshop.

Objectives, the participants will:

- learn about the aims of the ENGINEER project;
- learn about the 10 units of the ENGINEER project.

Preparation

1. Make a PowerPoint slide with the aims of the project.
2. Only when given a trainings workshop for teacher trainers: make a slide with the aims for a trainings workshop for teachers.
3. Make a PowerPoint slide with an overview of the other challenges and units.

Resources

- computer, beamer and screen (if PowerPoint is used)
- 20 accompanying teacher guides of the unit.

Information about ENGINEER – presentation

Tell the participants the aims of the ENGINEER project.

Almost every child has a naturally inquisitive attitude and often a fascination with science and technology. However many lose this interest at the beginning of puberty. In this project the aim is to maintain that attitude. The main focus of the unit is the engineering design process. This cycle very naturally, it is only more structured than when naturally used. For example when a child is playing with blocks and a toy train; let's say he/she wants to make a tunnel for the train. Most steps of the design cycle are all passed through; however the child probably doesn't realize it. He/she thinks about how the tunnel has to look (imagine), he/she builds the tunnel (create), and then the tunnel is finished and can be tried out. The child may discover the tunnel is too low for the train so the child changes the tunnel (improve).

There are lesson objectives for each lesson in the units; these are in the teacher guides. Also on a higher level there are aims, these aims apply to all the units, not only this one:

- To raise awareness and open up thinking about what constitutes technology and engineering.
- To challenge stereotypes of engineers and engineering, particular those associated with gender.
- To keep the pupils interested in science and technology.

The units are based on the very successfully materials of *Engineering is Elementary* program of the Museum of Science, Boston.

The units can be done independently, there is no particular order. Each unit consist of four lessons and a preparatory lesson. The preparatory lesson is the same for all the units. A unit takes about 8 to 10 lesson hours. The materials needed are inexpensive and easy to find.

Give the participants an overview of the different challenges in the 10 units.

Tip – Give participants a copy of the accompanying teacher guide so that they can follow along and reference the relevant pages themselves.

4. Workshop activity Lesson 0 – Engineering an Envelope

Preparation: 5 minutes

Duration: 5 minutes

Context and background

Lesson 0 is generic to all units and is intended to raise awareness and open up thinking about what constitutes engineering. The workshop activity *Engineering an Envelope* is part of lesson 0.

Objectives, the participants will:

- Learn the content of lesson 0.

Preparation

1. Make a PowerPoint slide with the content of lesson 0.

Resources

- computer, beamer and screen (if PowerPoint is used)
- 30 accompanying teacher guides of the unit (the participants receive these in activity 3).

Lesson 0 – Engineering an Envelope

The activity the participants did earlier *Engineering an Envelope* is part of the lesson 0. Lesson 0 is generic to all units and is intended to raise awareness and open up thinking about what constitutes engineering. Pupils are supported in developing their understanding that objects in the made world are designed for a purpose and to address a particular problem or need.

5. Workshop activity unit *Knee deep, designing and constructing a water pond*

Preparation: 60 minutes

Workshop: 90 minutes

Context and background

This part of the workshop is the main part of an ENGINEER trainings workshop. It is important that the participants do the activities as the pupils will do in class. In the training the participants experience the activities as a learner and not as an educator. It is not possible to do all the activities from the unit, but it is really important that the teachers do some of the activities. Pay attention to what the science knowledge is of the participants, most teachers do not have a background in science.

Make sure there is enough attention given to the science. If time is a restraint in the workshop choose activities that are more valuable by doing, discussing and reflection, over things that the participants can read in the teacher guide. At the end you want that the participants feel comfortable with the science of this unit. And that they do not have any misconceptions about the science involved.

Objectives, the participants will:

- learn about the content and activities of the lessons in this unit *Knee deep, designing and constructing a water pond*;
- experience activities of this unit as learner;
- learn the science and reflect on their prior knowledge about the engineering and science in this unit;
- reflect on the knowledge and misconceptions their pupils have about the engineering and science in the unit;
- learn tips & tricks about the design challenge (materials, logistics, problems that can occur).

Preparation

1. Arrange the materials needed.

Tip – Make PowerPoint slides for the things you want to mention about the lessons in the unit. For example the unit overview and activities in each lesson.

Resources

- Computer, beamer, screen and PowerPoint
- Materials for the activity 2.3 (see resources teacher guide lesson 2)
- Materials for the activity 3.2 (see resources teacher guide lesson 3)

Introductory activity – overview unit – presentation

- Give an overview of the unit (see chapter *Unit overview* in teacher guide).
- Do the introductory activity *Leo and a pond, a story* (see Teacher guide 1.1).
- What is a pond? (see Teacher guide 1.2).
- What is the engineering problem of the unit? (see Teacher guide 1.6).

Activities from lesson 2 – experiments

The participants work in groups of 4.

Let the participants work on activity *Water meets materials* (see 2.3 in the teacher guide 2.3).

What do we need to know to solve the engineering problem? What is the science of this unit?

This unit is related to geology, in particular to the characteristics of soil. But we investigate also a more general topic: the permeability of matter.

Activities from lesson 3 – experiments

The participants work in groups of 4.

Let the participants designing and make the model of the pond (see 3.2 in the teacher guide 3.2).

In the activity before they discovered which materials are more useful to make the bottom of the pond waterproof. Now they can design and realize the model of a pond.

Conclusion and reflection – discussion with all

Evaluate the models; take also into account the environmental aspect of the chosen materials. (see 4.3 in the teacher guide 4.3).

6. Workshop activity Gender

Preparation: 5 minutes, you need materials that needs to be arranged for long before the workshop (see chapter Planning and preparation).

Duration: 30 minutes

Context and background

The influence of stereotypes is still decisive for the image pupils have about engineers and scientists and subsequently their career choices. A new image of scientists/engineers should be promoted, one that explains their passion to understand the world and visualizes the way they work. Teachers are a role model. They can play a significant role in the circle of influence of their pupils. Most teachers are unaware of the fact that they use stereotypes in their teaching. This is not done deliberately, this happens without knowing this. Everyone, including teachers have consciously and unconsciously stereotypes, and subsequently use those in teaching. The activities from this part of the workshop are from the European project TWIST, towards women in S&T. You can find more activities in the TWIST handbook 'One Size Fits All' which include variety of activities for teachers and pupils about gender and S&T http://www.the-twist-project.eu/media/dyn/TWIST-Onze_size_fits_all.pdf

Objectives, the participants will:

- experiences their own stereotypes;
- reflect on their unconscious response to essays of their pupils;
- experience the stereotypes that the pupils see and hear all day.

Preparation

1. You need materials that needs to be arranged for long before the workshop (see chapter Planning and preparation).
2. Arrange the materials you need.

Resources

- pencil and paper for everyone
- architect story
- flip chart board and marker pens
- covers of magazines made for boys, covers of magazines made for girls, covers of magazines made for both boys and girls. In the appendixes are examples of Dutch covers.

Introductory activity – architect story – discussion with all

Tell the participants the story about the architect (see below). Do not mention gender, age or race.

Tip – This activity may cause language problems. In Italian “architect” and “engineer” are masculine words so in Italian translation we use “the person in charge of designing the bridge”.

Story

Close your eyes and imagine. An architect has thought all day about a new bridge that is to be built. Traffic, including big trucks, has to get across a wide river. The architect wants to make the bridge not only large and safe but also beautiful. After a long day of thinking, the architect gets a great idea for the bridge. Think about how happy and enthusiastic the architect looks. The architect says: 'This is going to be a great bridge!'

- Ask the participants to draw the person they see in their minds when they think of this architect.
- Ask if someone wants to show their drawing and to explain what is on it. Who has drawn a male? Who has drawn a female? Do you have an idea why you have this image of an architect?
- This activity can also be carried out by the teachers with their pupils. The discussion with the pupils can contain the following questions: Who has drawn a male? Who has drawn a female? Do you have an idea why you have this image of an architect? How old is the architect? What do you need to become a good architect? Does it matter whether you are a boy or a girl? Have the students seen an architect on TV or in a magazine? Was the architect male or female? Is it possible that the image they have corresponds with that image?

Conclusion and reflection – discussion with all

Show the covers of the magazines. Start a group discussion by asking:

- Is there difference between the covers?
- What is the difference?
- Why is that?
- Do you think pupils are influenced by this?
- Do you think pupils think they are influenced by this?

Tip – As a class activity the pupils can make collages from the magazines. It can be used it as the start of a discussion about stereotypes or the influence of media.

Tip – Distribute the participants the brochure 'Gender Equality In The Classroom - suggestions for encouraging boys and girls to study the fields of STEM'. If you can't print copies for the all participants, you can show them one brochure and give them the link:

<http://www.mada.org.il/sites/default/files/attached/gender-equality-in-teaching-english.pdf>

7. Workshop activity Organizing an ENGINEER training

Preparation: 5 minutes

Duration: 20 minutes

Context and background

This section is only given to teacher trainers or educators who are going to give an ENGINEER training themselves. It is important to share with them how to organize this. What is the time needed for the preparation, what do you need as a location, etc. At the end of the workshop the teacher trainers and educators get a copy of this guide.

Objectives, the participants will:

- Be able to give an ENGINEER workshop him/herself; after following the trainings workshop and after studying this trainings handbook.

Preparation

1. Make PowerPoint slides with the workshop plans.
2. Make PowerPoint slides with the planning and preparation from chapter *Planning and preparation*.

Resources

- computer, screen and beamer
- a copy of this professional development guide for all the participating teacher trainers

Organizing an ENGINEER workshop – presentation

- It is the intention that after following this workshop and studying this guide, the teacher trainers that follow this workshop can give an ENGINEER workshop themselves.
- Ask the participants what they need order to do that. List their questions and remarks on a flip chart.
- Tell about the different workshop plans (see chapter *About the workshops(s)*).
- Tell about the planning and preparation needed for an ENGINEER workshop. See chapter *Planning and preparation*.
- Go through all the things on the flip chart. Are all their questions answered? If no, arrange to give to answer later or in a different way (for example by mail). Make sure they know your name and email address

8. Workshop activity Motivating colleagues

Preparation: 5 minutes

Duration: 30 minutes

Context and background

For teachers and teacher trainers it can be difficult to implement new lessons and or materials into school. In this part tips are given and participants can share their tips and ideas. It is important that they can acknowledge the difficulties they have by implementing something new. It is important that it is clear that you do not have a perfect solution for this.

Objectives, the participants will:

- have the opportunity to share their possible concerns about implementing something new in school;
- discuss tips & tricks for implementing something new at school.

Preparation

1. Arrange a colleague to take a picture of the chart with tips & tricks and make copies of it. You can hand them out at the end of the workshop.

Resources

- flip chart and markers

Motivating colleagues - discussion with all/in groups

- Often one or two teachers are very enthusiastic to do a new project at school. It is possible that the situation arises where other teachers aren't as enthusiastic. Ask: is this familiar? Let the participants comment on that.
- Let the participant discuss for 10 minutes in groups or pairs about: What do you do in a situation like that?
- After 10 minutes ask the participants if they want to tell their experiences and solutions with all. Write the tips & tricks on a chart paper. Arrange that they take a copy of a picture with them or sent it later to them.

Tip: it can be helpful to pair teachers. After the workshop they may find it helpful to share experiences. Let them share email addresses.

9. Workshop activity Inspiration!

Preparation: 5 minutes

Duration: about 5 minutes each

Context and background

Sometimes it can be useful to get the participants enthusiastic again, to let them see what the bigger reason is that we are doing this. That feeling can be reached with the selected videos.

Objectives, the participants will:

- have a point of rest in the training;
- see what the bigger reason can be;
- be/remain enthusiastic.

Preparation

1. Set the videos ready on a computer with internet connection.

Materials

- Computer, screen, beamer with internet

Main activity of Before breaks YouTube film

1. The video 'The page turner' is an example of a person with a problem (to turn the page) and a solution, as devious as it may be.
http://www.youtube.com/watch?feature=player_detailpage&v=GOMIBdM6N7Q
2. The video 'Audri's Rube Goldberg' monster trap. This is an example of a very enthusiastic child and his inquisitive mind.
<http://www.youtube.com/watch?v=ouDDEEHdf1Y>
If you want more this is when the same child was younger. His first Rube Goldberg machine
<http://www.youtube.com/watch?v=2OhDG4Kxr8U>
3. The video 'A Liter Of Light' shows that engineering is not only for engineers but also for people in their daily live. And that it can make a big differences in the lives of people around the world and not only for the relatively rich Europe and Americas.
http://youtu.be/o-Fpsw_yYPg
4. The video 'The piano trap, the fun project'. Scientist in Sweden tried that people took the stairs more than the escalator. The link with the ENGINEER units and training is fun. Do not forget that it is more motivating for the pupils and for participants in training if it is fun! Fun doesn't have to mean the challenge is about fun things, the atmosphere can be fun and inspiring to.
http://youtu.be/TDM_nRg4bl4

10. Workshop activity Closure

Preparation: 0 minutes

Workshop: 10 minutes

Context and background

Hopefully all the participants are enthusiastic about the ENGINEER unit(s) and cannot wait to start teaching a ENGINEER unit in their class or give an ENGINEER trainings workshop themselves.

However chances are they were very interested and enthusiast leaving the workshop but loose this in the daily routine of teaching, talking with parents, consulting with colleges, attend report meetings etc. Therefore it is important to maintain the contact with the participants. Make it clear that if they have problems or have questions about ENGINEER they can contact you or a colleague.

Objectives, the participants will:

- Get time to ask questions;
- Receive a material kit for one of the ENGINEER units.

Closure

- Are all the questions asked?
- Do the participants feel comfortable with the science and engineering of this unit? If not what can be done about this?
- Make it clear that if they have problems or have questions about ENGINEER they can contact you or a colleague.

Appendices

Resources

In this table are all the resources that are needed for an ENGINEER trainings workshop, the amount are based on 30 participants that will work in 6 groups.

| Workshop activity | Items | each group | 5 groups (20 participants) |
|--|---|------------|----------------------------|
| General supplies | flipchart paper and markers | | |
| | pairs of scissors | 2 | |
| | computer | | |
| | screen | | |
| | beamer | | |
| | pencils | 4 | |
| | paper to write on | | |
| | | | |
| Workshop activity Stable Table | newspapers | 2 | |
| | tape | | |
| | tray with two drinks (for example two coffee) and a some cookies | 1 | |
| | hairdryer (optional) | | |
| | large illustration of design process (on PowerPoint slide or on a poster) | | |
| | | | |
| Workshop activity Information about ENGINEER Workshop activity Lesson 0 | teacher guides of the unit | 4 | 20 |
| | | | |
| Workshop activity unit Knee deep | 30 teacher guides of the unit Knee deep | | |
| | resources for the activity 2.3 (see resources teacher guide lesson 2) | | |
| | resources for the activity 3.2 (see resources teacher guide lesson 3) | | |
| | | | |
| Workshop activity Gender | architect story | | |
| | collages of typical girl's magazine, a typical boys magazine and a neutral magazine | | |
| | | | |

| | | | |
|---|---|--|----|
| Workshop activity Organizing an ENGINEER workshop | a copy of this Trainings handbook for all the participating teacher trainers | | 20 |
| | | | |
| Workshop activity Inspiration! | Internet access | | |

Covers of Dutch magazines

The covers for these magazines are for boys, girls or both according to the publishers.

According to the publisher a magazine for boys.



According to the publisher a magazine for girls.



According to the publisher a magazine for girls and boys.



According to the publisher a magazine for girls and boys.





Partners

Bloomfield science Museum Jerusalem
 The National Museum of Science and Technology "Leonardo da Vinci"
 Science Centre NEMO
 Teknikens hus
 Techmania Science Center
 Experimentarium
 The Eugenides foundation
 Conservatoire national des arts et métiers- Musée des arts et métiers
 Science Oxford
 The Deutsches Museum Bonn
 Boston's Museum of Science

Netiv Zvulun – School
 Istituto Comprensivo Copernico
 Daltonschool Neptunus
 Gränsskolan School
 The 21st Elementary School
 Maglegårdsskolen
 The Moraitis school
 EE. PU. CHAPTAL
 Pegasus Primary School
 KGS Donatusschule

ECSITE – European Network of Science Centres and Museums
 ICASE – International Council of Associations for Science Education
 ARTTIC
 Manchester Metropolitan University
 University of the West of England

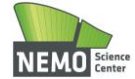
There are 10 units available in these languages.



The units are available on
<http://www.engineer-project.eu/> till 2015 and on
<http://www.scientix.eu/>

The units and guides are developed by above partners and are based on the Engineering is Elementary program from the Museum of Science, Boston.

The gender activities are from the European project Twist, Towards Women in Science Technology.



le cnam



Manchester Metropolitan University



University of the West of England