





Science & Technology in Dutch primary and secondary education Inquiry based & Design Based Learning

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Program

- Introduction
- Science & Technology in the Netherlands

 \odot Inquiry- and Design based learning

• Experience yourself:

 \odot Inquiry based learning

BREAK

 \odot Design based learning

• Plenair discussion and reflection



Who am I and who are you?





Who am I and who are you?





What do you know about Science & Technology?

- To do: Write it down on Post-its and put them on the table/wall!
- Think about:
 - Experience?
 - Association?
 - Definition?
 - Implementation?
 - Etcetera...





Science & Technology (S&T)

"Science and Technology (S&T) is a way of approaching the world. It starts with curiousity: why does the world look the way it is right now? Having this attitude leads to the identification of all kinds of questions and problems.
The search for answers to these questions and problems leads to solutions in the form of knowledge and/or products. At the same time, these solutions are often a starting point that will lead into new questions."

Source: definition based on the Advies-verkenningscommissie W&T PO en SLO/Techniekpact



Confusion in NL: Technique versus Technology

- technology ≈ the science about a certain technique
- technique ≈ the application of a certain technology

NB: maybe in your home country this won't give any confusion at all...



Inquiry based learning (Researching) & Design based learning (Designing)



from curiosity/question \rightarrow to (new) knowledge/answers



from problem/need \rightarrow to solutions/products



The importance of S&T-education

- technological literacy
- developing their own talents
- developing their own skills:
 - 21st century, research & design





The (successfull) implemantation of S&T-education

Three important pre-conditions:

- Plan
- Resources
- Competence & skills

The Knoster Model for Managing Complex Change



Adapted from Knoster, T. (1991) Presentation in TASH Conference. Washington, D.C. Adapted by Knoster from Enterprise Group, Ltd.

Source: The Knoster Model for Managing Complex Change (1991) Adapted image: Laura Bain – http://www.laurabain.com.au/blog/ the-knoster-model



The Knoster Model for Managing Complex Change

Vision	Skills	Incentives	Resources	Action Plan	=	Success
Vision	Skills	Incentives	Resources	Missing	=	False Starts
Vision	Skills	Incentives	Missing	Action Plan	=	Frustration
Vision	Skills	Missing	Resources	Action Plan	=	Resistance
Vision	Missing	Incentives	Resources	Action Plan	=	Anxiety
Missing	Skills	Incentives	Resources	Action Plan	=	Confusion

Adapted from Knoster, T. (1991) Presentation in TASH Conference. Washington, D.C. Adapted by Knoster from Enterprise Group, Ltd.

Source: The Knoster Model for Managing Complex Change (1991); Adapted image: Laura Bain – http://www.laurabain.com.au/ blog/the-knoster-model



The Maakotheek implemantation of S&T-education

Three important pre-conditions:

- Plan
- Resources
- Competence & skills





https://www.maakotheek.nl/introductie | https://vimeo.com/258078923





Experience yourself – Inquiry based learning

ASSIGNMENT

- Create mixed teams
- Choose a table to work on
- The subjects to explore are:
 - \odot Connecting without tape or glue
 - o Gears & Cranks
 - Transmission and movement (automaton)

○ Pneumatics

• Wait for further instructions (next slide)

6. Presenting L.Amazo	
Researching	Exploring
P. Aerrorming research 3. preparing res	of the second se



Specific assignment for each table

 Table 1 – Connecting without tape or glue: create a bird house with the cardboard building plate 	 Table 2 – Gears & Cranks: explore and experiment with the materials and tools on the table making use of the student worksheet
 Table 3 – Transmission and movement (automaton): choose and make one of the seven automata from the workbook 	 Table 4 – Pneumatics: choose and perform one (or more) of the experiment(s) on page 11 of the teacher manual



Additional assignment for each table

- formulate and write down your hypotheses/expectations
- check your hypotheses/expectations

 change or adapt your design/construction
 write down your conclusions

NB: it's possible to check multiple hypotheses/expectations

Table 1 – Connecting without tape or glue:

create a bird house with the cardboard building plate

Table 2 – Gears & Cranks:

 explore and experiment with the materials and tools on the table making use of the student worksheet

Table 3 – Transmission and movement (automaton):

choose and make one of the seven automata
 from the workbook

Table 4 – Pneumatics:

choose and perform one (or more) of the experiment(s) on page 11 of the teacher manual



Sharing the results

- What were you curious about? / Which expectations did you have?
- What (new) knowledge/answers did you find out?







Feedback and reflection – Inquiry based learning

• Did you experience the different phases of the research proces?





Feedback and reflection – Inquiry based learning

Tips:

- Act like a coach
- Ask (open) questions
- Focus on the process
- Multiple answers are possible
- Be curious and amazed yourself







Good Practise: Research – Ice cubes





Research process – Amaze & Exploring

The ice cube is melting: "hûh, my hands are becoming wet..."









Exploring the subject







Research process – Preparing & Performing

Preparing the ice cubes, getting the instruments and materials, etc.















Different ways to keep the ice cubes as long as possible in their original shape has been tested





Research process – Concluding & Presenting







The result: in order of melting time





Sharing the results & conclusions of the research (and the process)











Good Practise: Design based learning



https://www.youtube.com/watch?v=gGuG8Bb5Fpw







Design Cylce & Process

- Divergent thinking
- Convergent thinking







Time for Action



Experience yourself – Design based learning

ASSIGNMENT

- Make new mixed teams
- Choose a table to work on
- Wait for step 1 (next slide)





Formulate a design problem / design question

- Define a target group / problem owner
- Think of possible needs/problems this target group has
- Choose two problems and write them down above on two different A3 papers as a design question

Example design questions:

- How can we make learning the tables more fun for students?
- How could you help a mover to make his work easier?
- Design a kitchen machine for a chef to cut vegetables.
- How could you make a drawing without your own hands? / Design a drawing machine (inspired by the artist Jean Tinguely).
- Design a new toy (including a mechanical drive or transmission) for children.





Formulate a design problem / design question

- Randomly combine two cards: location + persona
- Think of possible needs/problems the persona could have on this specific location. Write down the design question above the A3 paper.
- Combine two new cards and repeat the two steps above

Example design questions:

- How can we make learning the tables more fun for students?
- How could you help a mover to make his work easier?
- Design a kitchen machine for a chef to cut vegetables.
- How could you make a drawing without your own hands? / Design a drawing machine (inspired by the artist Jean Tinguely).
- Design a new toy (including a mechanical drive or transmission) for children.





Brainstorming: generating & selecting ideas

Brainstormproces:

- Do an Energizer!
- Take into account the brainstormrules
- Choose a brainstormtechnique
- Start generating ideas
- Make use of inspiration & creativity techniques
- Come up with more & out-of-the-box solutions





Brainstormrules

- No restrictions (everything is possible)
- Prefer drawings
- Ideas belongs to everyone
- Postpone judgement
- As many ideas as possible
- 1+1=3
- Compliment each other





Brainstorming: generating & selecting ideas

ASSIGNMENT

- Fold your two A3-papers into 6 boxes
- Keep one and put the other in the middle: 'the pool'
- Draw one solution per box
- After drawing a solution (filling a box) change your paper with another A3 from the pool. Draw a solution for this new design question.
- Repeat this process till further instructions





Selecting an idea for further development

ASSIGNMENT

- Choose the two most interesting design problems / design questions
- Share and discuss about the created solutions
- Choose the most promising/desired idea to continue with
 - Selection method: Judge each idea individually on a scale from 1 to 5 by putting the corresponding amount of fingers at the same time. The idea with the highest number wins.





The next phase(s) after choosing an idea

Following the whole design cycle:

- 3. Generating & selecting concepts
- 4. Building a prototype
- 5. Testing & optimizing
- 6. Presenting







Presenting:

- How did you come up with the solution? (Process)
- Can you explain the solution? (Result = idea/concept/prototype)

Go straight to:

OR

6. Presenting



Feedback and reflection – Design based learning

- What did you notice/experience during the assignment?
- Which skills did you work on?









Feedback and reflection – Design based learning

Tips:

- Make use of Energizers
- Use brainstormrules
- Use divergent thinking techniques
- Keep the flow going
- Multiple solutions are possible





Plenair discussion and reflection

Topics:

- Blended Learning
- Implementation in your own eductation
- What did suprise you this session?
- Other questions and remarks





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