

Ideeënfabriek

Werken met, niet tegen, intuïtieve voorkennis van leerlingen

bouwen van conceptueel inzicht aan de hand van dialoog

Jan Sermeus, Wim Temmerman, Jelle De Schrijver, Christel Balck

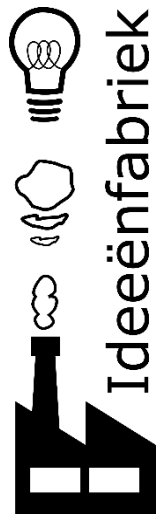


Tsepo Mokuku (National university of Lesotho, Lesotho)

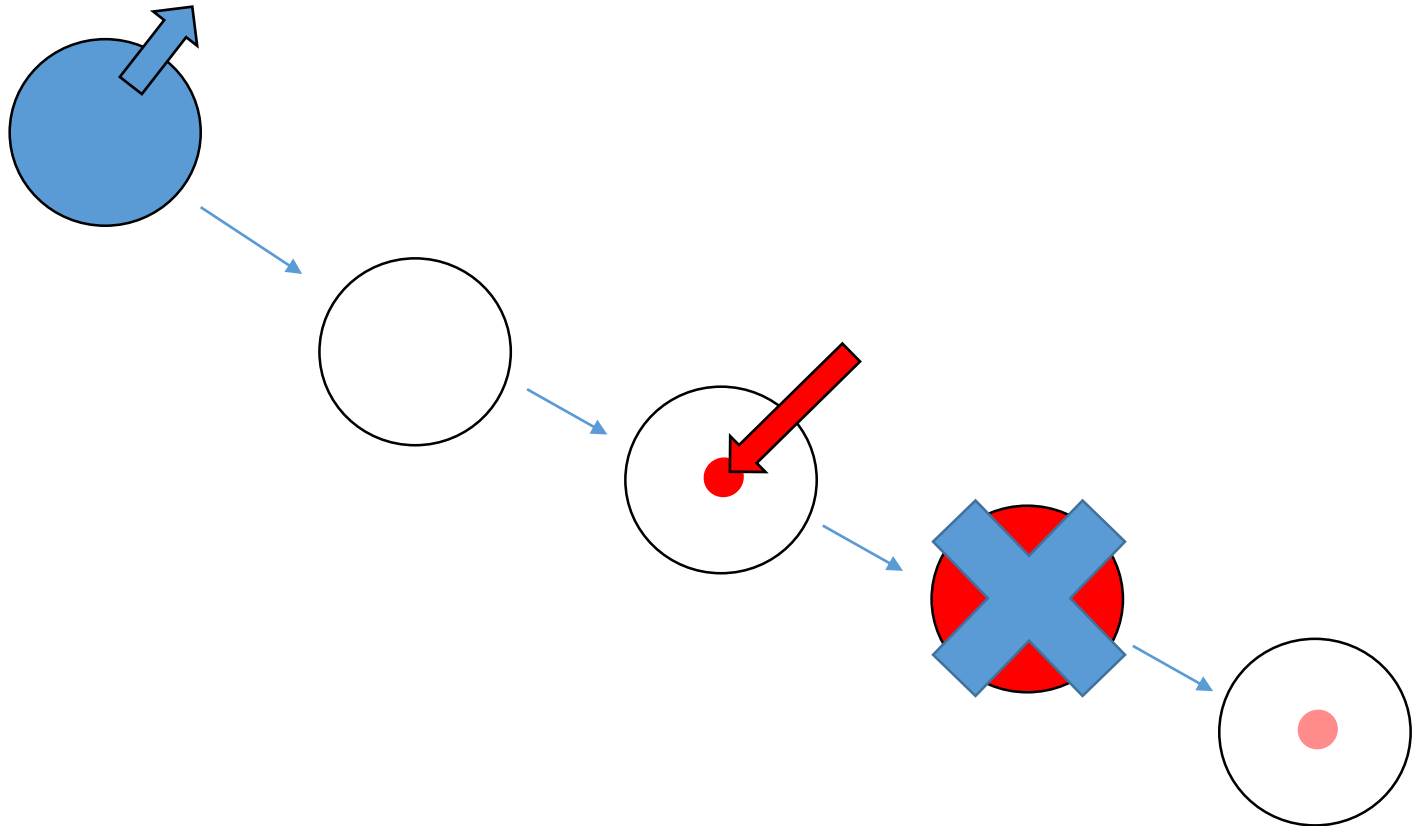


Beatriz García Fernández (University of Castilla-La Mancha, Spain)





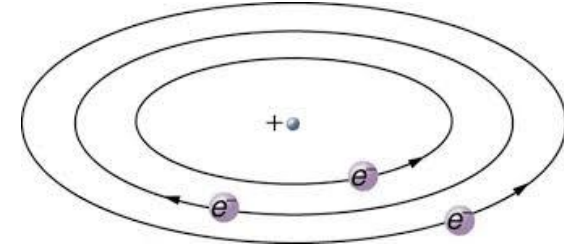
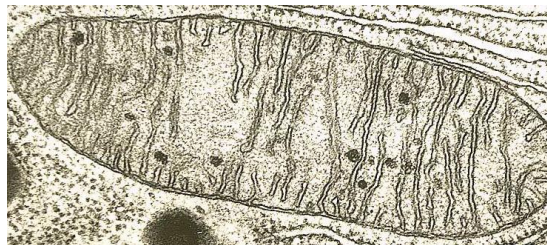
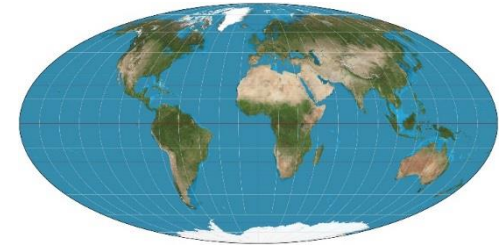
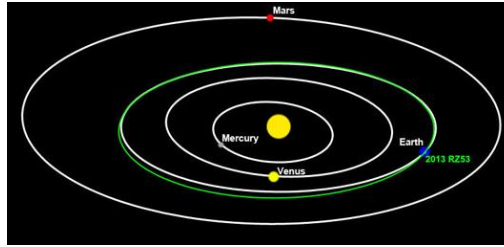
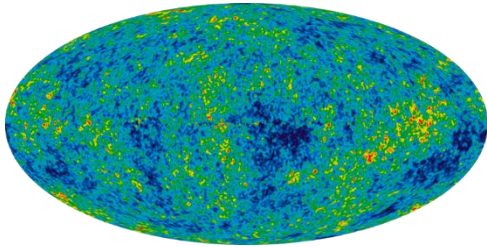
Opbouw conceptueel inzicht bij leerlingen

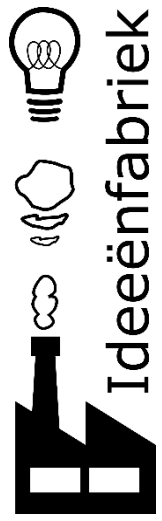


Misconzepten

↓

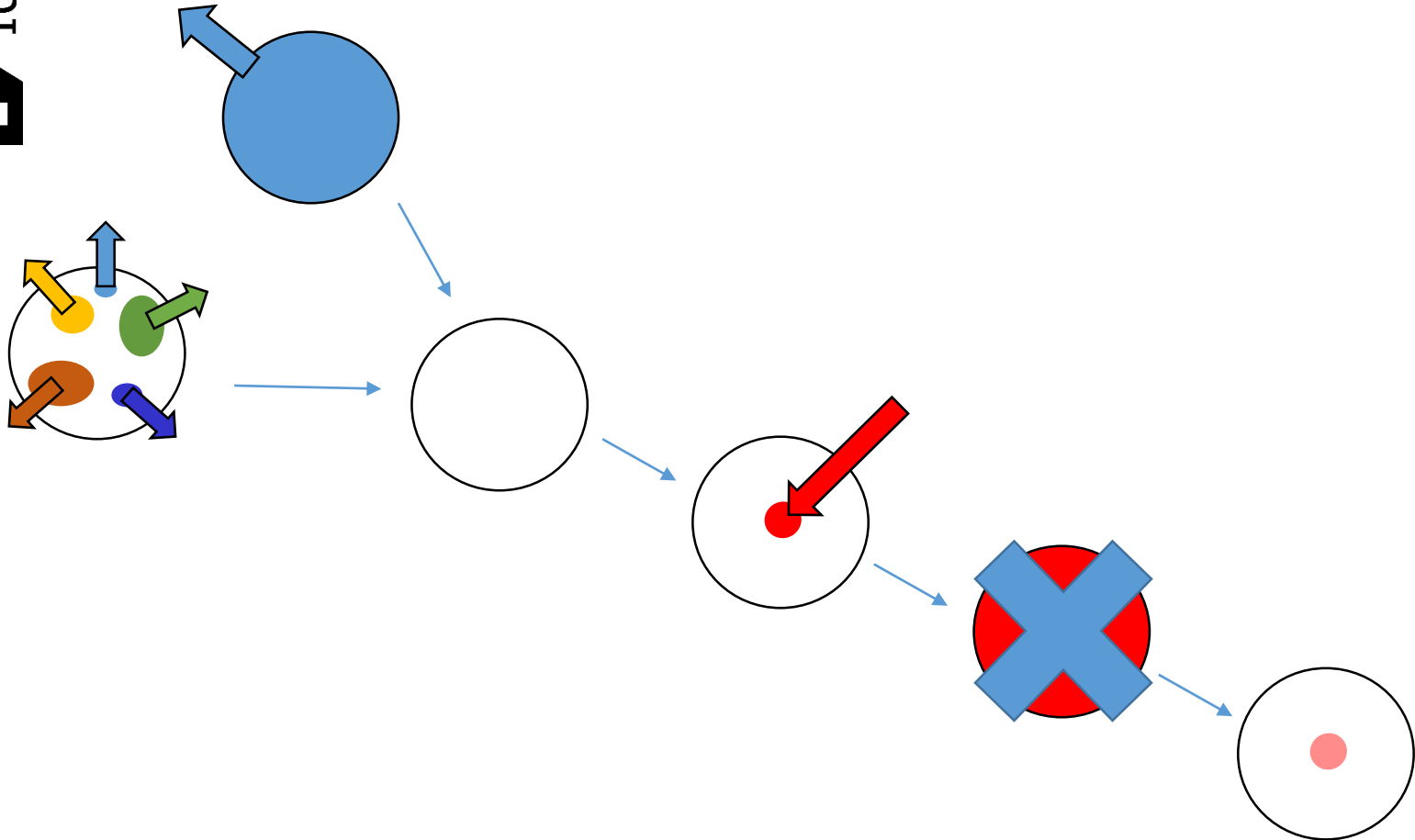
Preconzepten





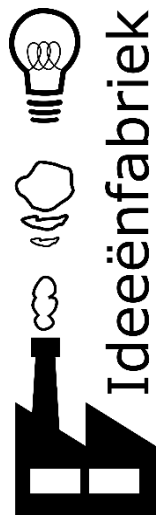
Ideeënfabriek

Opbouw conceptueel inzicht bij leerlingen



Opbouw les

CL	lesfase	contextualiseren	inleiden	vastzetten
	dialogoog	leerkracht gecenterd		
	inhoud	Mind setting. Het onderwerp wordt ingeleid, in context gezet.	Het wetenschappelijk concept aanbrengeen.	Het wetenschappelijk concept gebruiken en toepassen in oefeningen, experimenten en vragen.



Probleemstelling

Vlaanderen

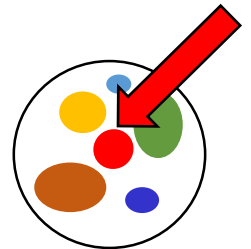
Organismen: 70% van de leerlingen haalt de minimumdoelstellingen

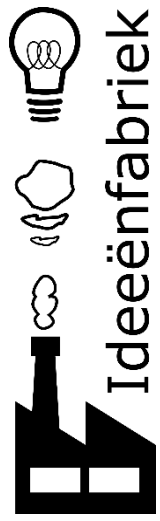
Energie: 30% van de leerlingen haalt de minimum doelstellingen

Andere concepten natuurwetenschappen: 50%

<http://www.ond.vlaanderen.be/curriculum/peilingen>

<http://www.vlaanderen.be/nl/publicaties>





Onderzoeksvragen

- Hoe moet een methodiek worden vormgegeven om, aan de hand van dialoog, de ontwikkeling van concepten te stimuleren?
- Wat is de houding van de leerkrachten en leerlingen tov de methodiek?
- Welke factoren faciliteren of verhinderen de introductie van de methodologie?
- Wat is de impact van de methodologie op het conceptueel inzicht?

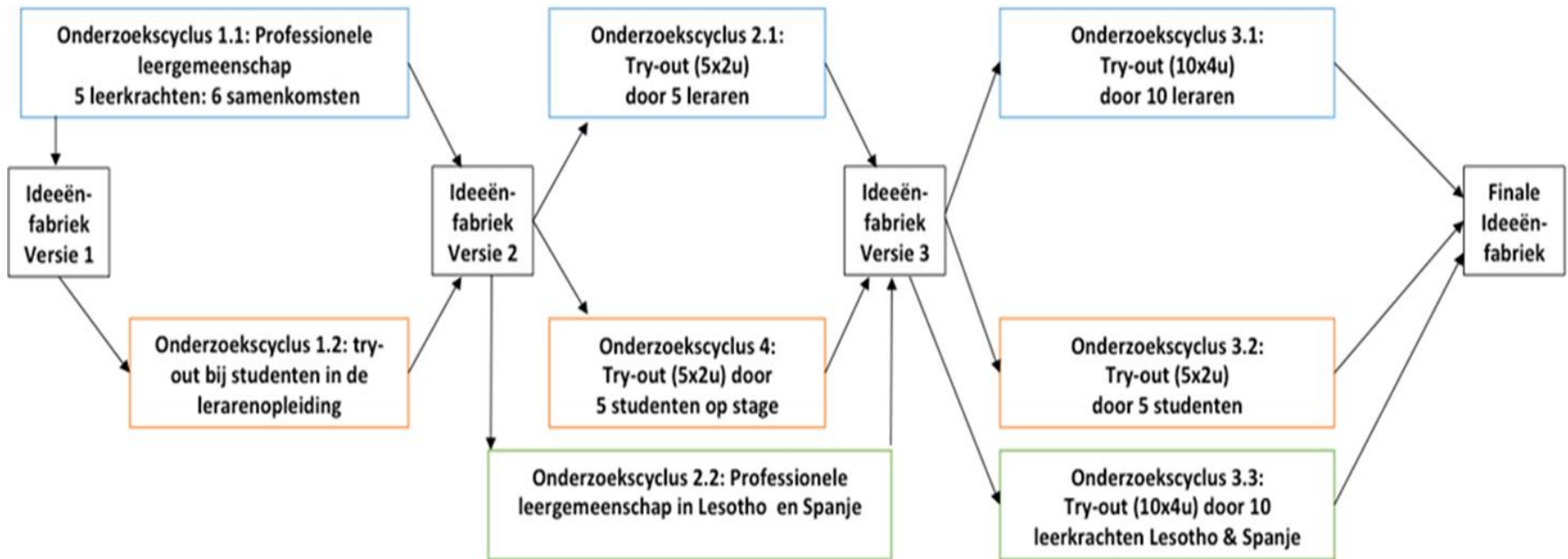


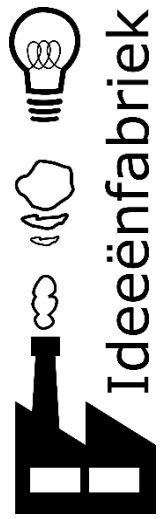
Design based research

WP 3: Ontwikkeling

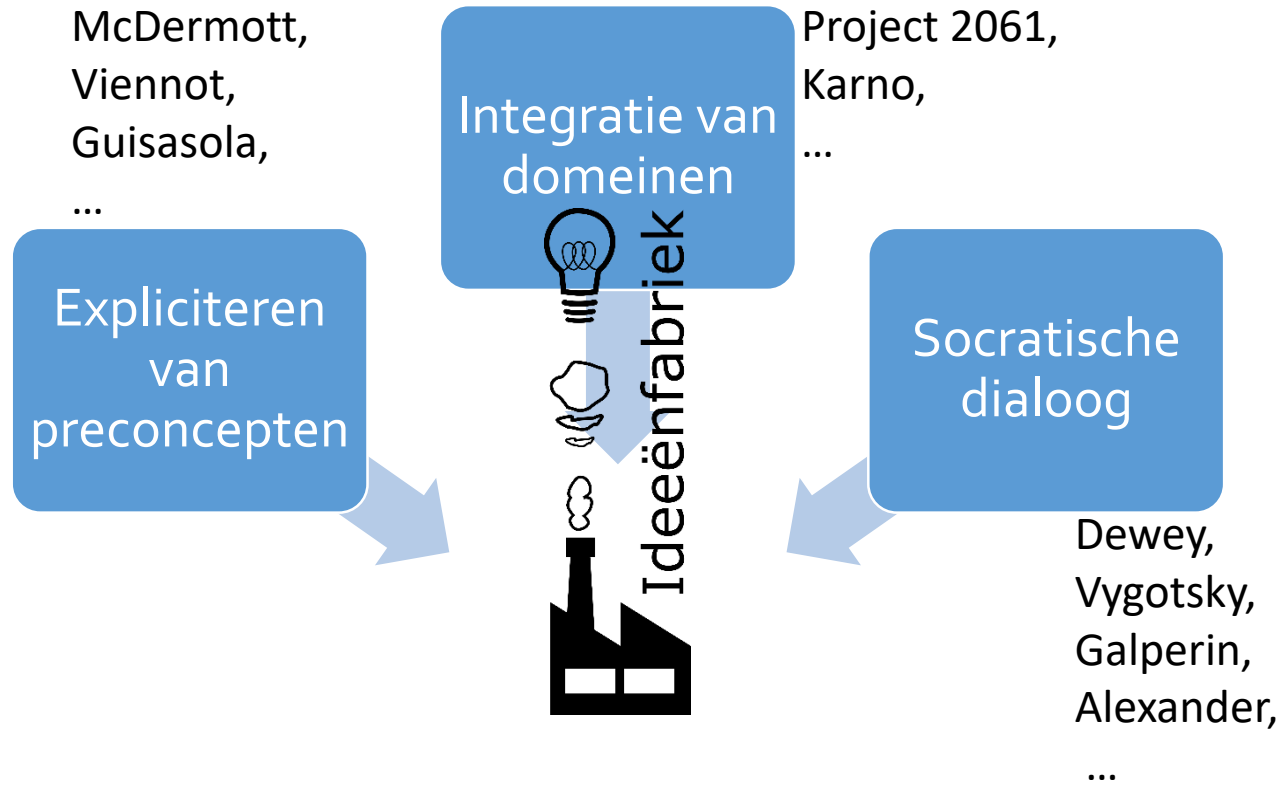
WP 4: Try-out

WP 5: Impact

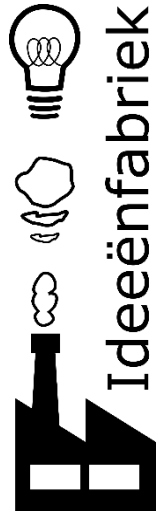




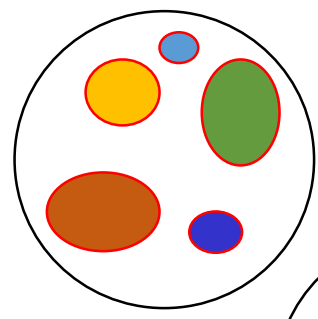
Aanpak



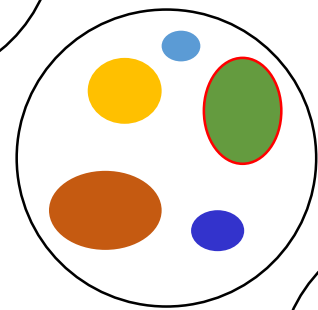
"Rather than replacing the preconception by the scientific concept, a science class should introduce the scientific conceptual framework as an alternative framework that can also reside in the students' mind."



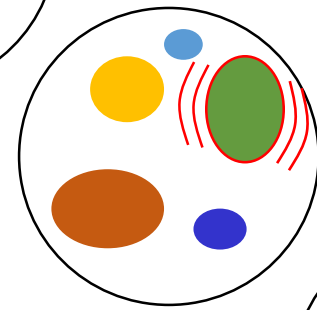
Ideeënfabriek



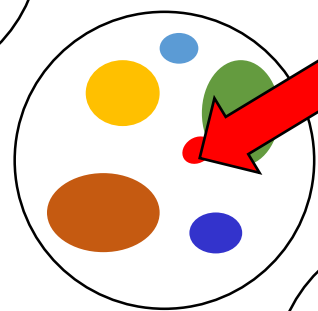
Wakker maken



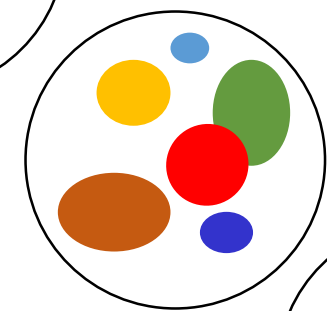
Identificeren



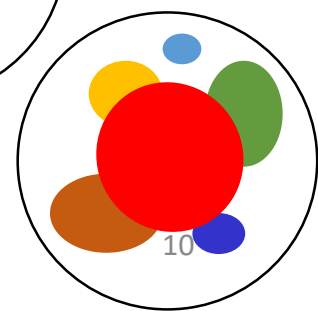
Schudden



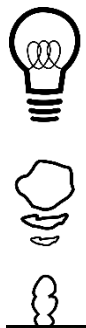
Introduceren



Vast zetten

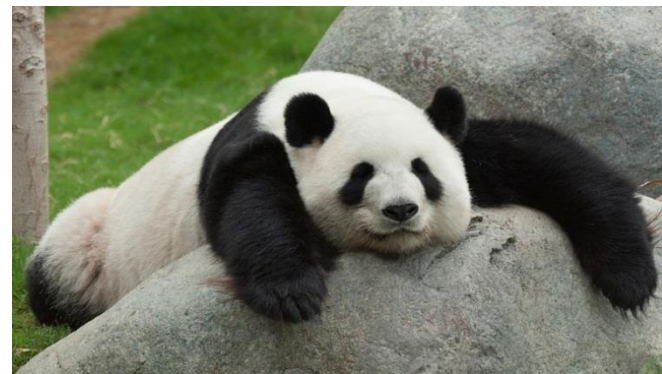
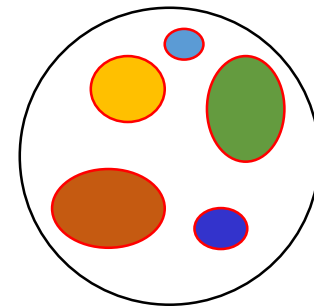


Gebruiken

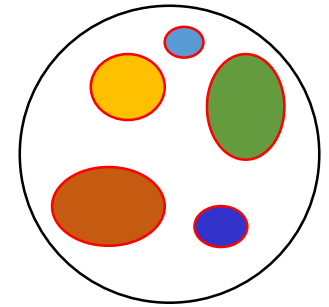


eeënfabriek

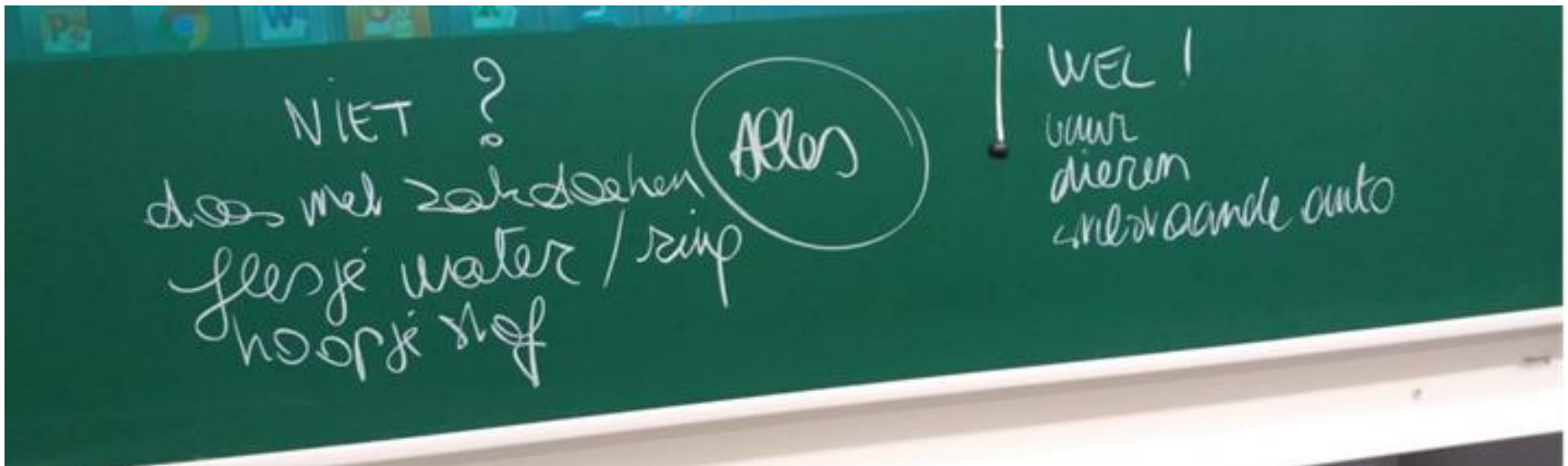
Wakker maken



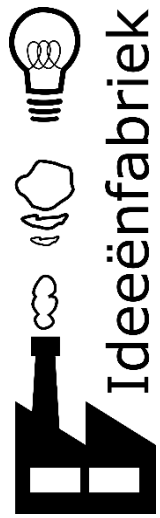
Wakker maken



Ik wil weten wat jullie idee is over Wat betekent ... voor jullie? Waarom denk je dat? Wil je nog iets toevoegen? Begrijp ik het zo goed? Bedoel je dat? Weet je dat of denk je dat? Denkt iedereen hetzelfde? Hoe zie je het anders?



“Sommige denken dat alleen bewegende dingen energie hebben, sommige denken dat alleen levende dingen energie hebben, sommige denken dat alles energie heeft.”



Ideeënfabriek

Onderzoeksluik

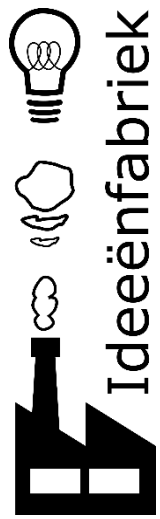
$N = 148$ ($N_{\text{exp}} = 90$, $N_{\text{contr}} = 58$)
3 schools, 9 classes, 12-13 y

$N = 60$ ($N_{\text{exp}} = 35$, $N_{\text{contr}} = 25$)
1 universiteit, 3 klassen, 19-21 y

$N = 192$ ($N_{\text{exp}} = 98$, $N_{\text{contr}} = 94$)
2 schools, 4 classes, 12-13 y

Quasi-experimenteel: Pre-post energie concept test
Convenience sample
4u experimentele groep IF
4u controle groep goede klassieke les





Ideeënfabriek

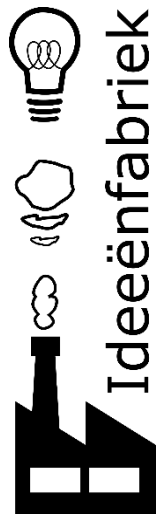
Kwalitatieve resultaten

Ervaringen PLG

- Het problem is herkenbaar
- Aanpak werd positief onthaald
- Realisatie verliep vlot

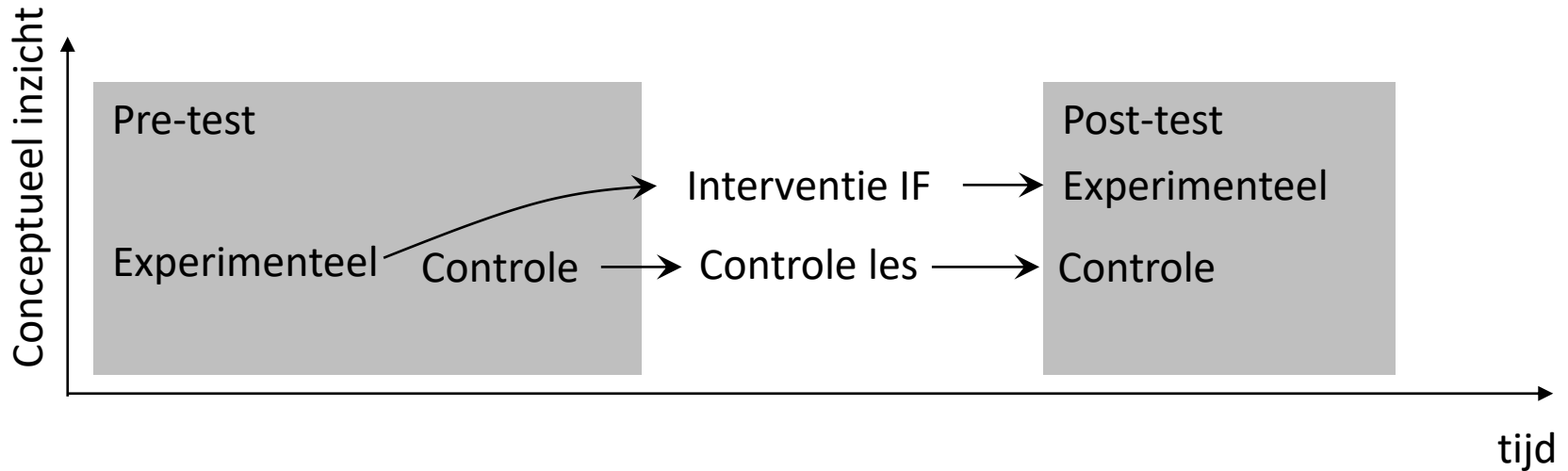
Zorgen en oplossingen

Onvoorspelbaar?		Voorspelde preconcepten
Timing?		EL en CL zelfde duur
Klasmanagement?		motivatie, <u>ownership</u> , zelfsturend
Socratische dialoog?		template (<i>wat doen, zeggen, te verwachten</i>)
Vrij experimenteren?		creatief, inventief, van nature



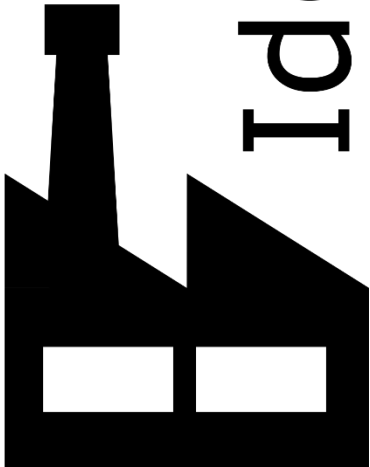
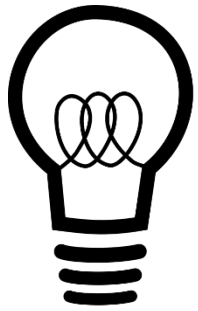
Ideeënfabriek

Kwantitatieve resultaten



Lineair model	Alles heeft energie	Energie kan gecreëerd worden
1 foto (ja/nee)	$p=3,2 \cdot 10^{-4}$ $d_{Cohen}=0,51$	$p=0.29$
2 foto (open antwoorden)	$p=2,5 \cdot 10^{-4}$ $d_{Cohen}=0,70$	$p=0.092$
3 Heron, 2008	$p=5,0 \cdot 10^{-6}$ $d_{Cohen}=0,76$	$p=0.60^*$

* Voorwaarden lineair model niet voldaan



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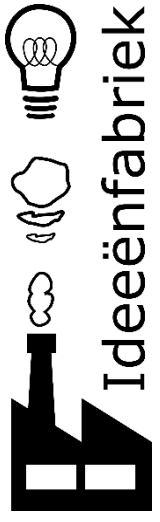
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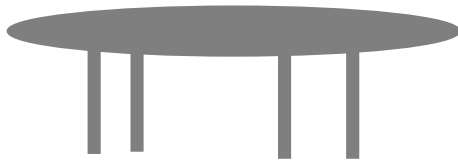
Jan.Sermeus@odisee.be



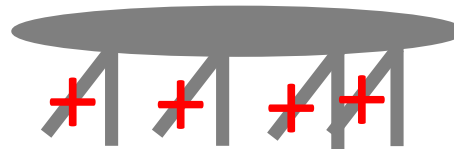
Ideeënfabrik

Conceptueel inzicht adhv een metafoor

beginsituatie



beginsituatie



beginsituatie



Uitleggen van de wereld
adhv preconcepten

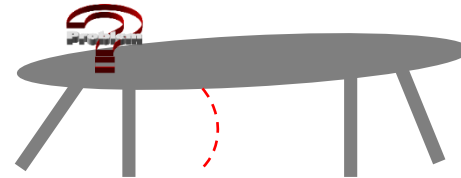
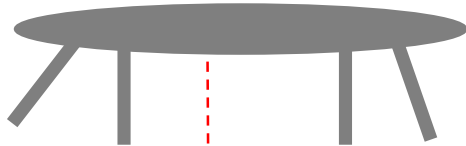
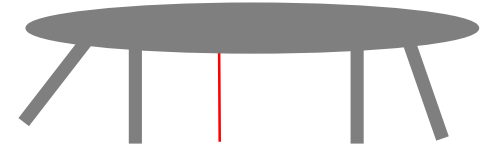
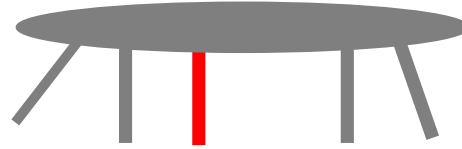
gewenst

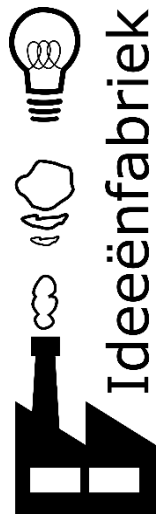


Uitleggen van de wereld
adhv wetenschappelijke
theorieën

“klassieke les wetenschappen”

beginsituatie





“Ideeënfabriek les wetenschappen”

Faze 1: het preconcept

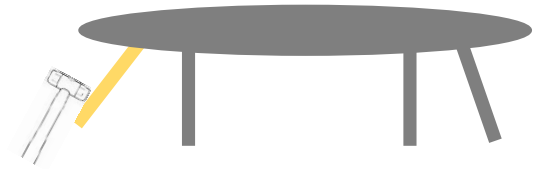
Wakker maken



Identificeren



Schudden



Faze 2: Het wetenschappelijk concept

Introduceren



Vast zetten



Gebruiken



www.ideeenfabriek-wetenschappen.be

Wakker maken

Wat denken jullie?

Identificeren

Waarover zijn jullie het eens?

Schudden

Hoe verklaren jullie dit?

Introduceren

Dit zegt de wetenschapper.

Vastzetten

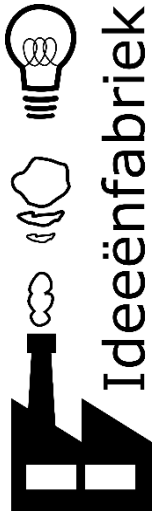
Hoe verklaar je dit best?

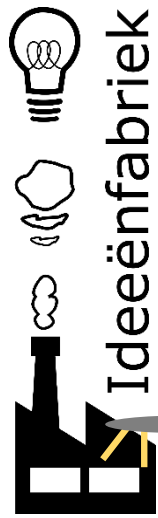
Gebruiken

Kan je veel verklaren?

Onderzoekskern
ExploRatio
www.exploratio.be

Odisee
www.odisee.be





Dialogoog: coach en tolk

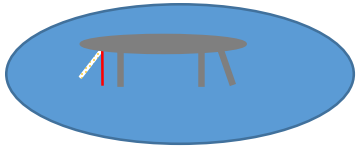
Ik wil weten wat jullie idee is over Wat betekent ... voor jullie? Waarom denk je dat? Wil je nog iets toevoegen? Begrijp ik het zo goed? Bedoel je dat? Weet je dat of denk je dat? Denkt iedereen hetzelfde? Hoe zie je het anders?



Waarover is er verwarring? Waarover bestaan er verschillende meningen?



Hoe kan dat? Kan je dat verklaren?

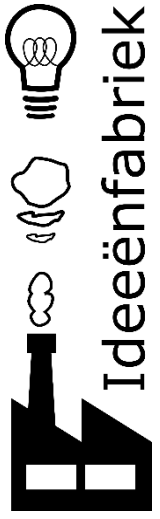


Zo denkt de wetenschapper erover. Zo begrijpt hij/ zij het.

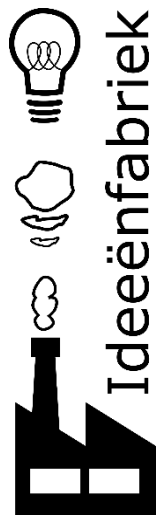


Wat willen jullie onderzoeken? Hoe heb je de opstelling gemaakt? Wat zie je in de proef/ simulatie? Begrijp ik het zo goed? Wat heeft de andere groep gevonden? Ik zie niet wat je bedoelt. Hoe kan je de opstelling veranderen om de onderzoeksvraag toch te beantwoorden?





Ideeënfabrik



Wake-up



What?

Different ideas exist!

How?

Concept cartoon, classify, odd one out,...

What did we observe?

Dialogue

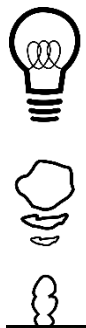
What does mean to you? What do you mean by that? Do you think this or do you know this? Do I understand correctly that Does everybody think the same? Is what way is your idea different?

“You can not say what ideas of students are good or bad. A teacher said that one thing was correct and I immediately saw the reaction of the other students. They took over that answer or withdrew their opinion.”

Translated from a student second year teacher training

Experiment

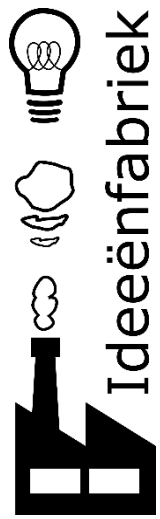
Example



eeënfabriek

Wakker maken





Identify



What?

Which idea to target?

How?

Dialogue, concept-tests, demo-experiment to clarify

What did we observe?

Dialogue

What do we disagree on? What topic needs further investigation? Does the whole class agree that is unclear?

Experiment

Example

Identify



Item NG045002: Both a light bulb and an ice cream cone radiate energy because all objects radiate energy.

« Previous Item: NG022003

Consider a light bulb and an ice cream cone.



Light bulb



Ice cream

Which gives off energy by radiation and why?

A. Both a light bulb and an ice cream cone because all objects radiate energy

B. Neither a light bulb nor an ice cream cone because only the sun radiates energy

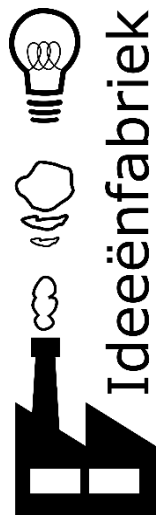
C. Only a light bulb when it is glowing because only glowing objects radiate energy

D. Only a light bulb when it is hot because only hot objects radiate energy

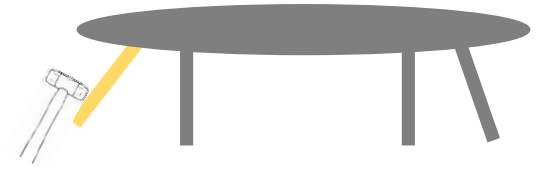
“Some of us think that all objects have energy, some of us think that only glowing objects have energy, some of us think that only hot objects have energy.”

<http://assessment.aaas.org/topics/>

Item Details	Student Performance
TOPIC	
Energy: Forms, Transformation, Transfer, and Conservation	
CORRECT ANSWER	
A	
MISCONCEPTIONS	
ANSWER CHOICE: B	
<p>NGM036: Only the sun transfers energy in the form of electromagnetic radiation (AAAS Project 2061, n.d.).</p>	
ANSWER CHOICE: C	
<p>NGM031: Only objects that are glowing can transfer energy in the form of electromagnetic radiation (AAAS Project 2061, n.d.).</p>	
ANSWER CHOICE: D	
<p>NGM032: Only hot objects can transfer energy in the form of electromagnetic radiation (AAAS Project 2061, n.d.).</p>	



Shake



What?

Discrepant event

How?

Demo-experiment, laboratory exercises, “magic”, ...

What did we observe?

Dialogue

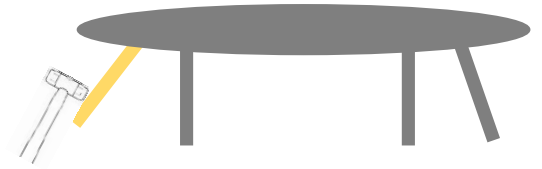
Does this test what we are trying to examine? Does this show what you are saying?

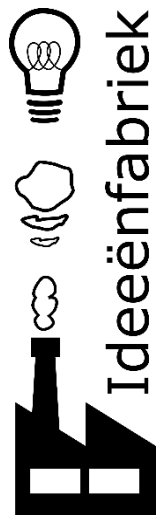
How is this possible? How does this work? Can you explain what is going on?

Experiment

Example

Shake





Introduce

What?

present scientific view

How?

simulation , Lecture

What did we observe?

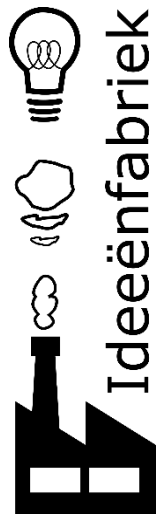
Dialogue

This is the scientists opinion.

Experiment

Example





Secure



What?

Students experiment to check the science

How?

Through laboratory experiments

if possible: experiments devised by the students

What did we observe?

Dialogue

Does this test what we are trying to examine? Does this show what you are saying?

How is this possible? How does this work? Can you explain what is going on?

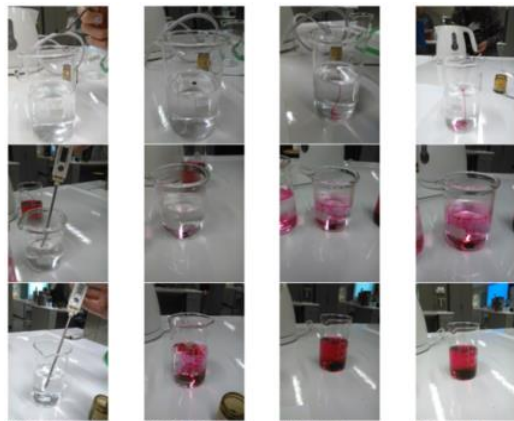
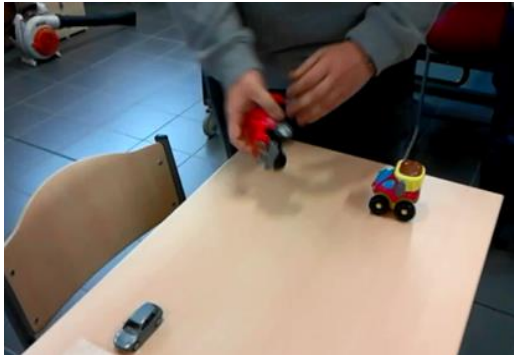
Experiment

Example

Secure

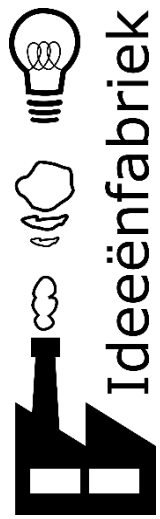
What properties might contribute to the energy of an object?

Can you show me in an experiment?



Start experiment Direct na toevoeging Na 1 minuut Na 2 minuten





Use



What?

Apply in a new situation

How?

Different experiment, true or false (discuss), what if, activity,...

What did we observe?

Dialogue

Does this test what we are trying to examine? Does this show what you are saying?

How is this possible? How does this work? Can you explain what is going on?

Experiment

Example

Use



What if humans could perform photosynthesis all of a sudden?
What if we could not store energy?

...





Design-based research

WP 3: Ontwikkeling

WP 4: Try-out

WP 5: Impact

RC 1

RC 2

Data collection

Development(BE)

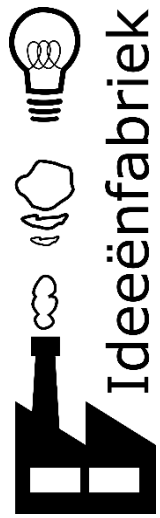
- 3 Teacher Training sessions
- 2 High school classes
- Qualitative

Try out

- Lesotho (3 SE T)
- Spain (1 TT + TTS)
- Belgium (3 TT + TTS + 5 SE T)
- Qualitative
- Development and tryout of tests for quantitative approach

Impact?

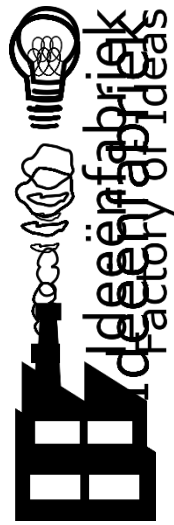
- Lesotho (3 SE T)
- Spain (1 TT + TTS)
- Belgium (3 TT + TTS + 5 SE T)
- Quantitative
- Control classes



Discussion

WG₄ (tomorrow)

- ...
- Use of dialogue in science education
- Role of the teacher (during laboratory work)
- ...



CONCEPTUAL UNDERSTANDING OF SCIENTIFIC IDEAS THROUGH DIALOGUE AND EXPERIMENT



GIREP 2016

Facilitating concept building in natural sciences for first grade secondary school pupils in a laboratory setting

- Jan Sermeus, Wim Temmerman, Jelle De Schrijver, Christel Balck (Odisee university college, Belgium)



- Tsepo Mokuku (National university of Lesotho, Lesotho)



- Beatriz García Fernández (University of Castilla-La Mancha, Spain)

