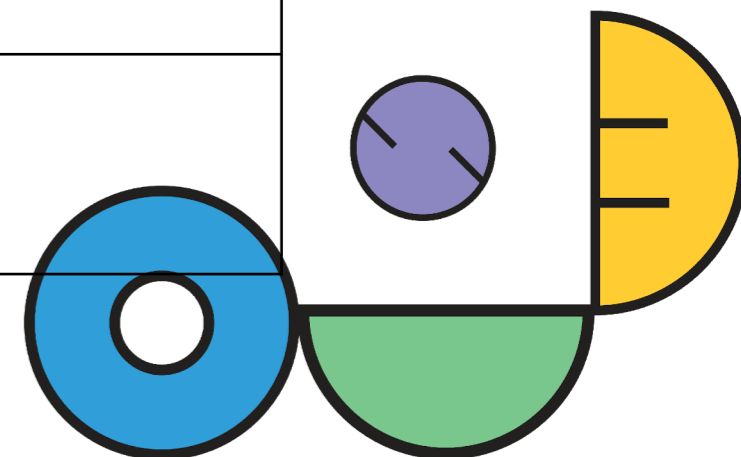


Workshop Citizenship & SSI

Description of the activity:	The activity explores lesson activities fostering skills for 'informed decision making' as part of citizenship education. The instructor presents the examples and explains the pedagogical background, in particular the 5E model. Then participants are given pointers to other materials (e.g., from ENGAGE) and discuss integration into their own subject/lesson practice.
Target group(s):	Secondary school teachers in STEM subjects
Keywords:	Citizenship, socio-scientific issues, informed decision making, 5E instructional model
Duration of activity:	2-3 hours
Description of activity environment and materials needed:	Powerpoint; additional example materials on ENGAGE website



Workshop Citizenship & SSI

Erik Barendsen, Radboud University
ERASMUS+ DOSE, May 2021

STEAM Example: Citizenship lessons in STEM

- Focus on socio-scientific issues (SSI)
 - *societal questions or dilemmas with STEM background*
- Citizenship component: informed decision making
- Context: Secondary education in the Netherlands
- Subjects: biology, physics, chemistry



Lesson 1: Should laughing gas be forbidden?



5E Stage	Work Form	Description	Worksheet
1. Engage	<ul style="list-style-type: none"> YouTube videos 	<ul style="list-style-type: none"> Introduction of the theme Checking the students' prior knowledge (the students articulate their own opinion) Attracting attention (videos) Introducing various perspectives through the videos 	<ul style="list-style-type: none"> Worksheet 0 Worksheet 1
2. Explore (Expert method)	<ul style="list-style-type: none"> Information cards <ul style="list-style-type: none"> Card 1: Scientist Card 2: Seller/Vendor Card 3: Young people 	<ul style="list-style-type: none"> Students read the information cards (deep learning phase) 	<ul style="list-style-type: none"> Worksheet 2
3. Explain (Expert method)	<ul style="list-style-type: none"> Group interaction 	<ul style="list-style-type: none"> Students exchange the information within the group 	
4. Elaborate	<ul style="list-style-type: none"> Group discussion 	<ul style="list-style-type: none"> Students discuss the problem/question in their group 	
5. Evaluate	<ul style="list-style-type: none"> Group presentation 	<ul style="list-style-type: none"> Students achieve a group consensus and present it 	<ul style="list-style-type: none"> Worksheet 3
After the lesson			
Reflect & Evaluate		<ul style="list-style-type: none"> Students evaluate the lesson by responding to the questionnaire individually 	<ul style="list-style-type: none"> Questionnaire

Lesson 2: What to do with nuclear waste?



Lesson 1	What is the best way to handle nuclear waste on earth?		
Phase	Time	Activity	Materials and tools
Engagement	10 min.	Introduction by the teacher; explanation of the learning objectives of the lesson series.	<i>YouTube video:</i> Informative video about perspectives and personas (les 2)
Evaluation	5 min.	Students are given a 'perspective' and choose a first solution for this perspective without consulting any information.	<i>Assignments booklet:</i> <i>Question:</i> what solution would you choose without consulting any information? And a frame to fill in the answer.
Exploration	35 min.	Students find two advantages and two disadvantages for each of the given solutions, based on literature.	<i>Cards:</i> Solutions to the question <i>Assignments booklet:</i> <i>Assignment:</i> Write down 2 advantages and 2 disadvantages for each solution. And a table with two columns (advantages, disadvantages) to write down the answers.
Explanation and Evaluation		Students weigh advantages and disadvantages and formulate a reasoned solution for the perspective.	<i>Assignments booklet:</i> <i>Question:</i> Which solution did you choose for this perspective, and why? And a frame to write down the answer. <i>Question:</i> what additional information did you find, and where did you find it?

Lesson 3: Should we invest in space travel?



Lesson 2 Too much money is spent on space travel			
Phase	Time	Activity	Materials and tools
Evaluation	15 min.	Formative evaluation of first lesson by the teacher. Recap (explanations) when needed before starting the second part.	<i>Assignments booklet:</i> Completed assignments of Lesson 1
Elaboration	35 min.	Students create a persona (cf. 'perspective' Lesson 1).	<i>Assignments booklet:</i> <i>Assignment:</i> Devise and draw a persona. Empty profile with drawing to complete.
Evaluation		Students construct, based on resources, two arguments in favour and two arguments against the statement, from the perspective of their persona	<i>Assignments booklet:</i> Frame for filling in 2 arguments in favour and 2 arguments against the statement <i>Assignment:</i> Make a list of resources. A frame to fill in.

Profiel Sofie Leeftijd: 32 Partner: Max (man) Hobby's: fotografie Beroep: architect		Persoonlijkheid Zacht Introvers Voelen Overtuigen
Achtergrond Houdt van: bakken Op internet: life hacks kijken Hekel aan: haar baas Functie: interieur ontwerpen		Extra info twijfels: Sofie weet niet of ze zo'n grote klus wel aan kan zorgen: Sofie weet niet of ze een goede moeder zal zijn
Doelen: een klus in München kijken		

Stelling: Er gaat teveel geld naar de ruimtevaart.

Argument 2 voor de stelling

Sofie vindt wel dat de aarde op de eerste plek komt. Ze denkt dat we beter meer geld kunnen uitgeven aan onderzoeken om de aarde te onderhouden en oplossingen voor de opwarming van de aarde. Ze zegt dat de volgende generaties niet op Mars leven maar op de aarde en dat we moeten zorgen dat we deze planeet netjes achterlaten.

Argument 2 tegen de stelling

Sofie vindt het heel belangrijk dat er experimenten worden gedaan in de ruimte en Sofie vindt het concept dat er misschien wel leven mogelijk is op Mars heel interessant. Sofie vindt het fijn om gebruik te maken van haar telefoon om life hacks te kijken. Dat is natuurlijk allemaal mogelijk door ontdekkingen in de ruimte. Sofie luistert met haar man ook vaak naar Ed Sheeran op de radio en dat is natuurlijk ook voortgekomen uit ontdekkingen in de ruimte. Ze hoopt dat er nog veel ontdekkingen komen in de toekomst.

Can we make an environmentally friendly **ecophone?**

NEW

Teach **Earth Resources**

...with an **ENGAGE** project

...and tackle a real world challenge



Vitamin D

Skill: Analyse patterns topic: Digestion

This activity is designed to engage a wider range of students. Using the principles of 'science capital', it



Exterminate

Skill: Multiple topic: Ecosystem

Mosquitoes are the world's most dangerous killer. The diseases they transmit, malaria, Zika and dengue



Eco-phone

Skill: Multiple Topic: Earth resources

As the number of smartphone users worldwide exceeds 2 billion, and as users update their devices

Big Stuff Blog:

An inspiring conference, say science educators.

The second International conference on Engaging Science for teachers coordinated by Dr. Ale Okada, at the Open University on March 23rd of 2019, presented evidence that the project is sustainable. Some of the key topics discussed by Science teachers were practices and strategies developed to address the key issues raised by the ENGAGE community in the previous conference:

- *What are the benefits and challenges to promote open schooling through Engaging Science?*
- How can science curriculum be more inclusive and unbiased about gender?
- How can the Science Education curriculum be reshaped so that it's more fit for purpose?

STEAM content background: Citizenship skills

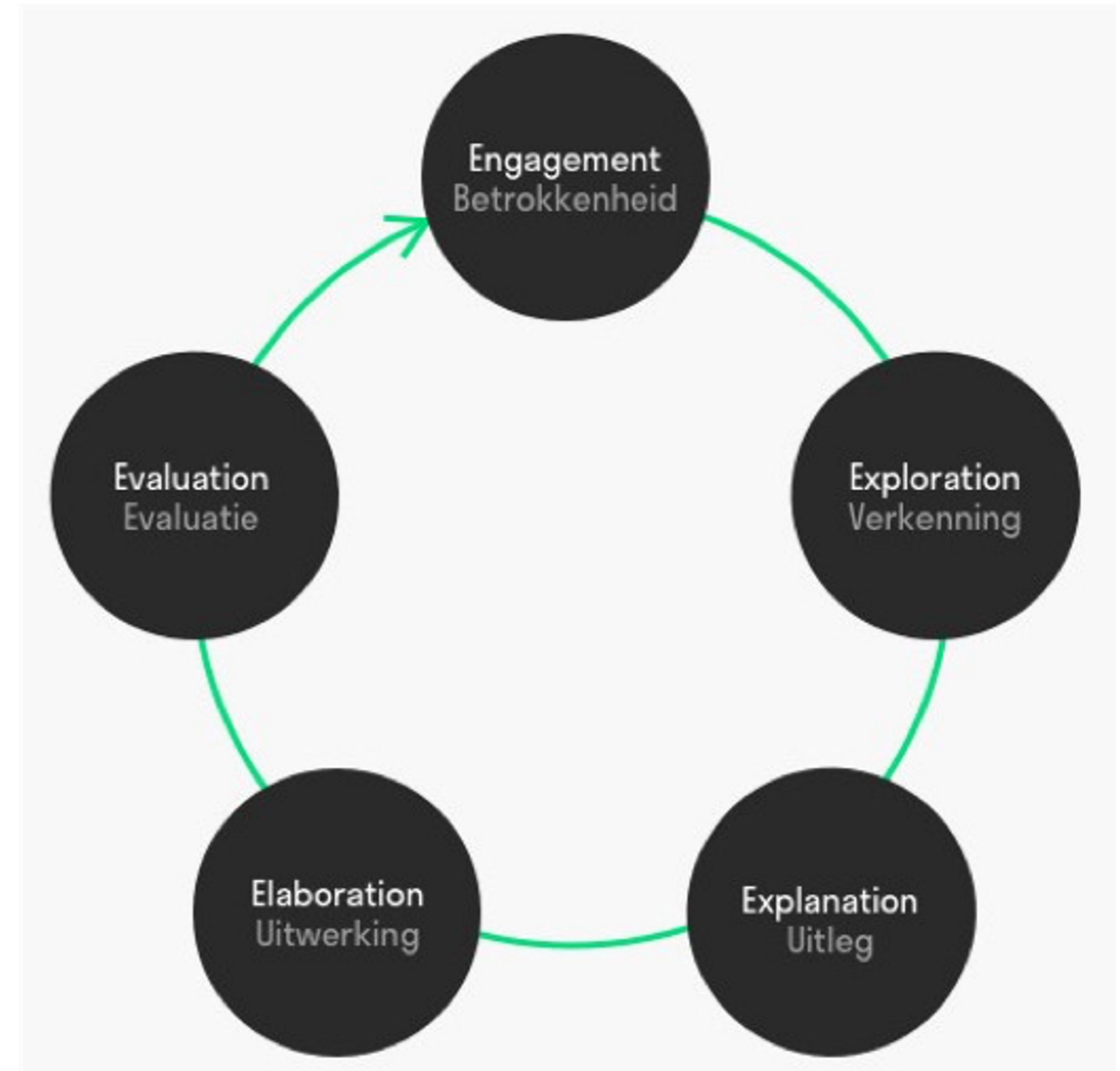
- Making personal and societal *choices* in the context of (controversial) questions and dilemmas with a scientific component
- Fundamental skill: *informed decision making*
- Cognitive and practical subskills:
 1. *interpreting scientific information*
 2. *dealing with conflicting information*
 3. *distinguishing various perspectives*
 4. *weighing probabilities and risks*
 5. *(moral) reasoning*
 6. *dialogue skills and reflection on personal values*



STEAM pedagogical background: 5E instructional model

- cyclic model
- interactions are possible

5E Stage	Work Form	Description	Worksheet
1. Engage	<ul style="list-style-type: none"> YouTube videos 	<ul style="list-style-type: none"> Introduction of the theme Checking the students' prior knowledge (the students articulate their own opinion) Attracting attention (videos) Introducing various perspectives through the videos 	<ul style="list-style-type: none"> Worksheet 0 Worksheet 1
2. Explore (Expert method)	<ul style="list-style-type: none"> Information cards Card 1: Scientist Card 2: Seller/Vendor Card 3: Young people 	<ul style="list-style-type: none"> Students read the information cards (deep learning phase) 	<ul style="list-style-type: none"> Worksheet 2
3. Explain (Expert method)	<ul style="list-style-type: none"> Group interaction 	<ul style="list-style-type: none"> Students exchange the information within the group 	
4. Elaborate	<ul style="list-style-type: none"> Group discussion 	<ul style="list-style-type: none"> Students discuss the problem/question in their group 	
5. Evaluate	<ul style="list-style-type: none"> Group presentation 	<ul style="list-style-type: none"> Students achieve a group consensus and present it 	<ul style="list-style-type: none"> Worksheet 3
After the lesson			
Reflect & Evaluate		<ul style="list-style-type: none"> Students evaluate the lesson by responding to the questionnaire individually 	<ul style="list-style-type: none"> Questionnaire



STEAM pedagogical background: tools

- workbook with tables facilitating decision making
 - perspectives
 - arguments
 - reliability of resources
- perspective cards
- personas

