

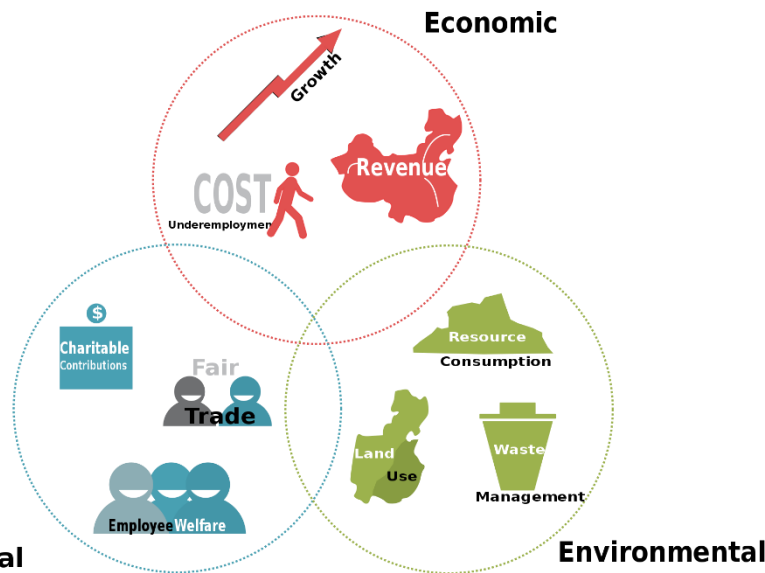
Teaching Sustainability





What within
sustainability shall
we teach?

What to teach?



Courtesy: Clonewayx ([CC license](#))

Planetary Boundaries

after Johan Rockström, Stockholm Resilience Centre et al., 2009

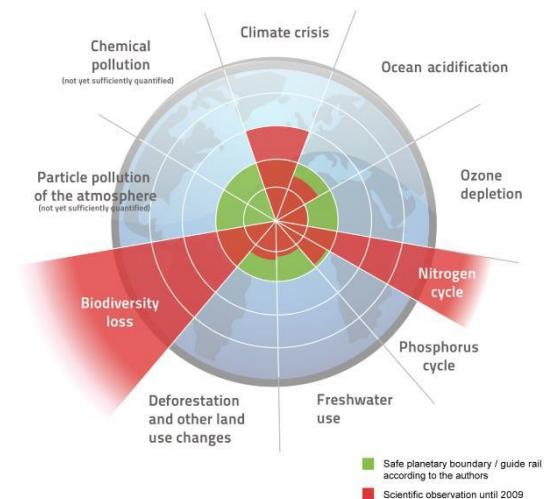
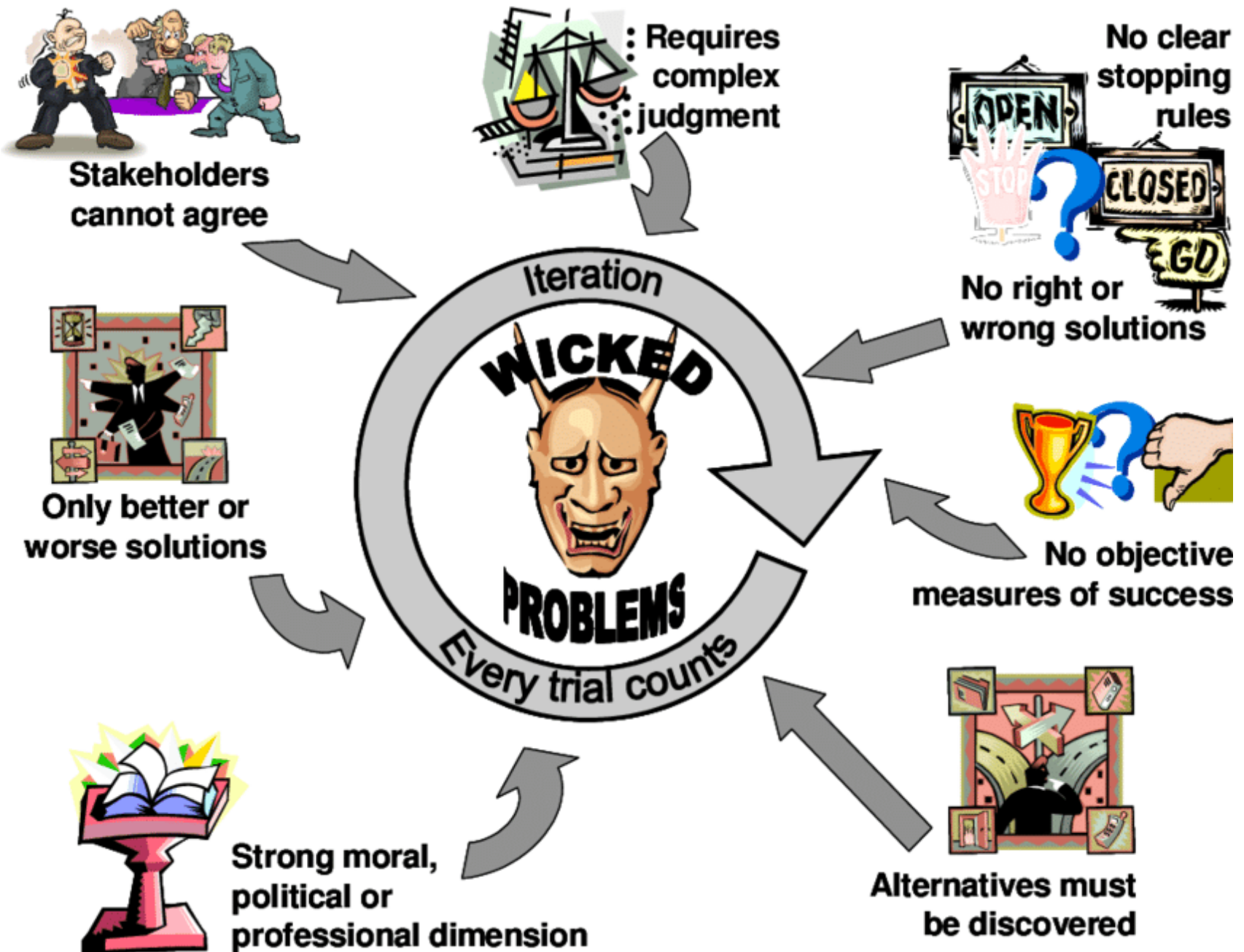


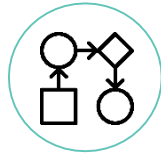
Illustration: Felix Müller (www.okuw.de/wilhelmshende) License: CC BY-SA 4.0

Courtesy: Felix Mueller ([CC license](#))



Maqsood, Tayyab & Finegan, Andrew & Walker, Derek. (2003). A soft approach to solving hard problems in construction project management. [Weblink](#).

Key competences for sustainable development



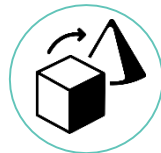
Systems Thinking Competence



Futures Thinking Competence



Values Thinking Competence



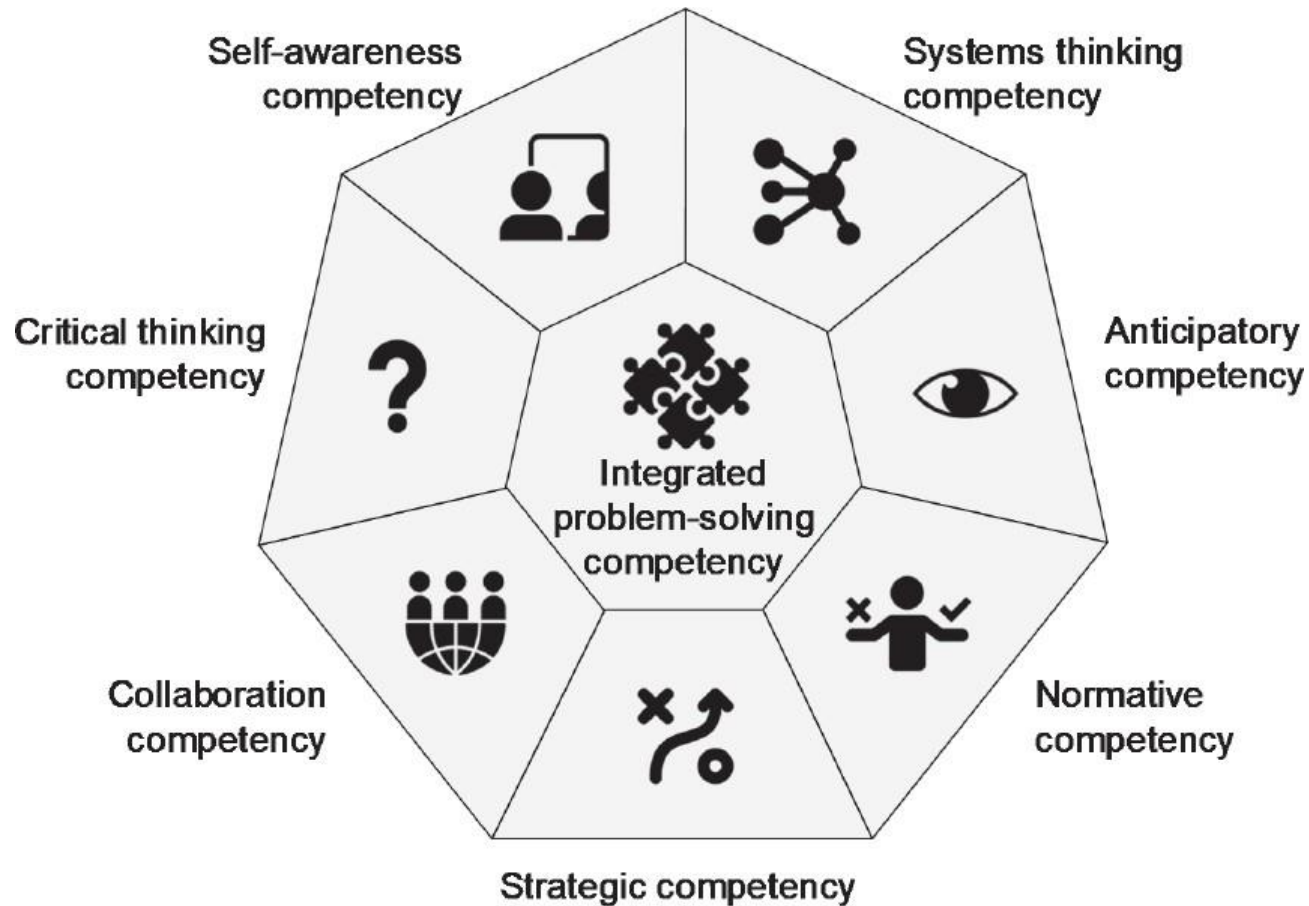
Strategic Thinking Competence



Interpersonal Competence

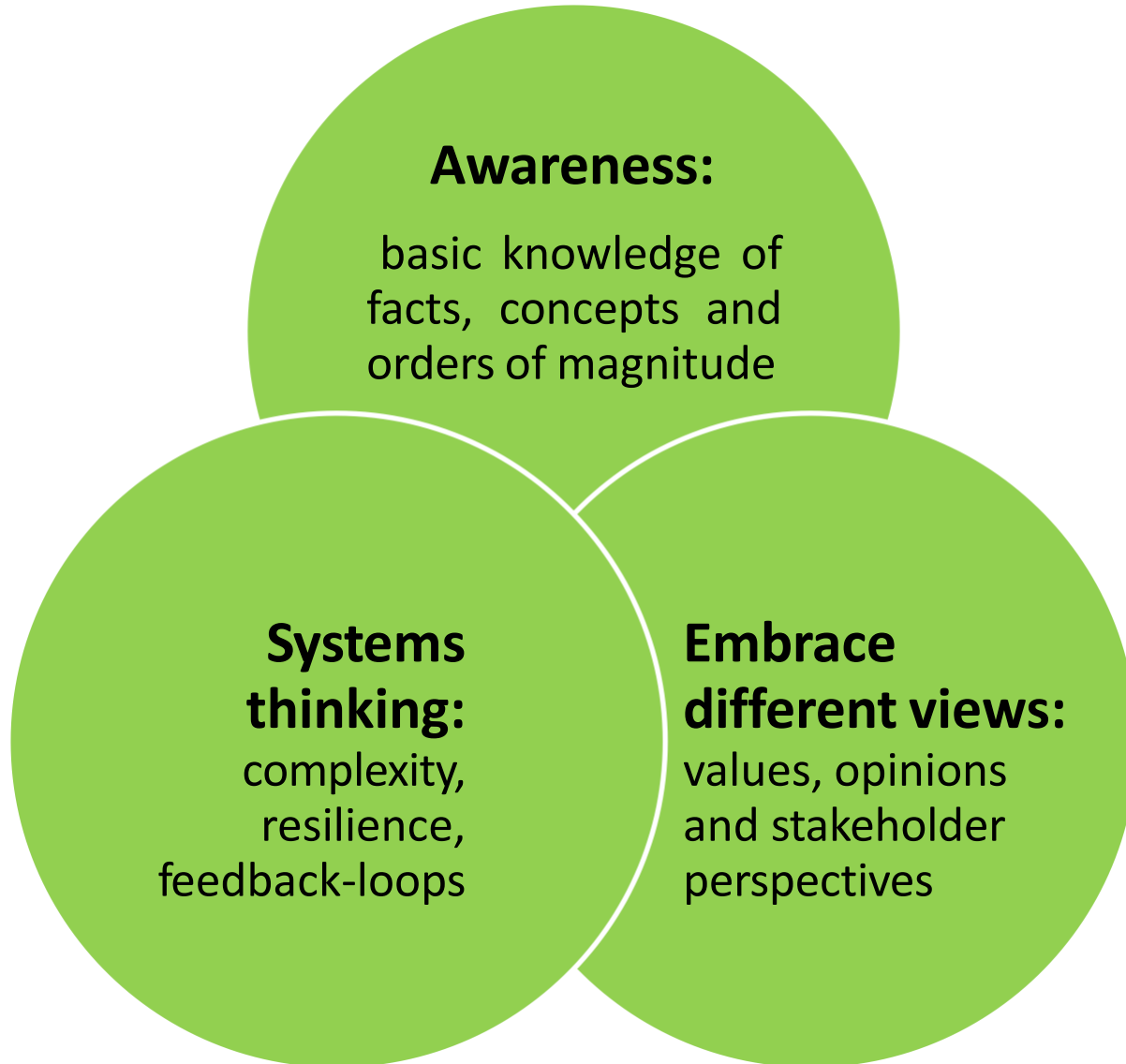
Wiek, A., Withycombe, L., & Redman, C. (2011). Key competencies in sustainability: a reference framework for academic program development. *Sustainability Science*, 6(2), 203–218.

Key competences for sustainable development



Rosén A., et al (2019). Mapping the CDIO Syllabus to the UNESCO Key Competencies for Sustainability. 15th International CDIO Conference at Aarhus University

Key competences for sustainable development



Key competences for sustainable development



One goal with sustainability education may be to train students to lead change in the profession in which they are educated – to become **change agents**

Flipped classroom and active learning

Flipped Classroom:

- A teaching method and a type of so-called 'blended learning', with a focus on student engagement and often also on active learning
- Moves some learning activities from the classroom to preparatory homework, and others from homework to the classroom
- For example, students may watch online lectures, collaborate and discuss online or conduct research at home and then participate in classroom activities under the guidance of a mentor

Flipped classroom and active learning

Flipped Classroom:

- Instead of conventional lectures, a more learning-centred model is used
- The classroom is used to explore the subject more deeply and create meaningful learning activities while students are introduced to new content outside the classroom
- ‘Content delivery’ can take various forms: video lessons are often used to deliver content; online collaborations or discussions, and book/article readings may also be used
- Class activities may include: laboratory experiments, debate or negotiation, games and role-plays, discussions about current events, peer review, project-based learning and skills development or concept exercise

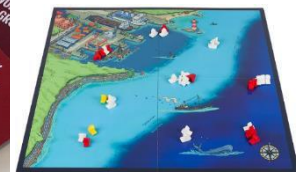
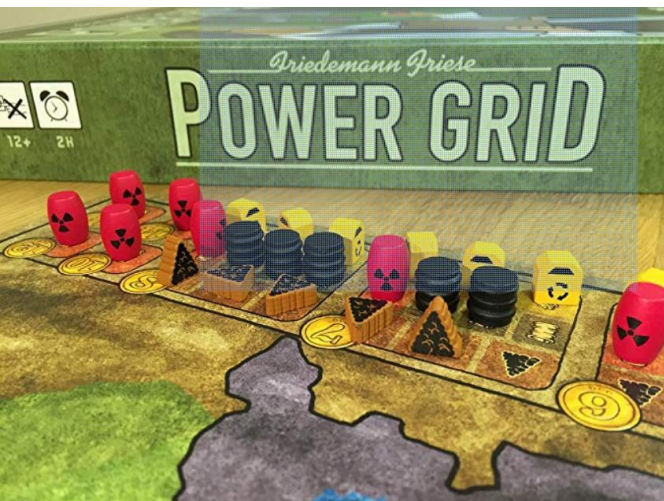
Flipped classroom and active learning

Active learning:

- A learning method where students are **active** and build their own **experiences** during the learning process
- Students participate in active learning when they do something besides passive listening
- Each student's active participation is a necessary aspect of active learning
- In active learning, students must **DO** things and at the same time reflect on the work done and the purpose behind it
- There is a large body of research that supports that active learning promotes higher achievement and deeper learning

Games in Sustainability Education





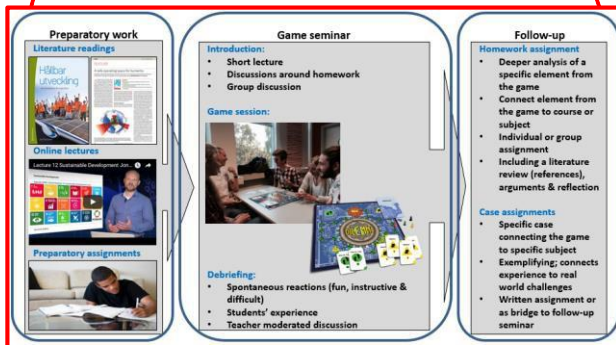
Administered via web platform (integrated in LMS)

Learning package 1

Learning package 2

Learning package 3

Assessment: homework assignments and exam



Sustainability learning package

Preparatory work

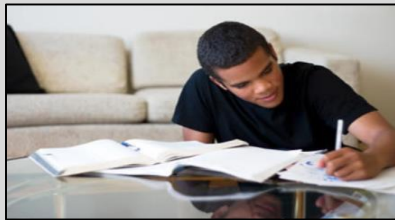
Literature readings



Online lectures



Preparatory assignments



Game seminar (one or several lectures)

Introduction:

- Short lecture
- Discussions around homework
- Group discussion

Game session:



Debriefing:

- Spontaneous reactions (fun, instructive & difficult)
- Students' experience
- Teacher moderated discussion

Follow-up

Homework assignment

- Deeper analysis of a specific element from the game
- Connect element from the game to course or subject
- Individual or group assignment
- Including a literature review (references), arguments & reflection

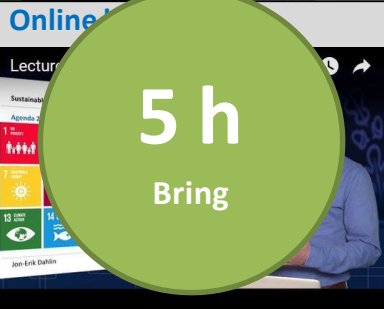
Case assignments

- Specific case connecting the game to specific subject
- Exemplifying; connects experience to real world challenges
- Written assignment or as bridge to follow-up seminar

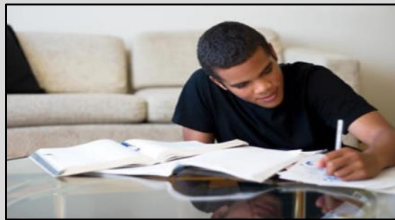
Sustainability learning package

Preparatory work

Literature readings



Preparatory assignments



Game seminar (one or several lectures)

Introduction:

- Short lecture
- Discussions around homework
- Group discussion

Game session:



Debriefing:

- Spontaneous reactions (fun, instructive & difficult)
- Students' experience
- Teacher moderated discussion

Follow-up

Homework assignment

- Deeper analysis of a specific element from the game
- Connect element from the game to course or subject
- Individual or group assignment
- In-classure

Case

- Specific case connecting the game to specific subject
- Exemplifying; connects experience to real world challenges
- Written assignment or as bridge to follow-up seminar

Snowflake Education Toolkit


✓ Ready-to use learning packages – each based on a game

snowflakeeducation.com

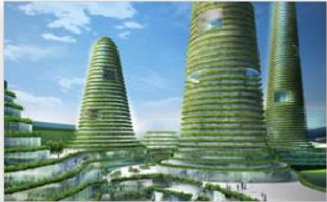
https://toolkit.snowflakeeducation.com/modules/2/package_templates

Back


Package templates




Introduction to Sustainable...
Introducing the concept, common definitions, a systems thinking approach, historical milestones, important numbers, A...




Sustainable communities
Cities is where most challenges and solutions to sustainability may be found. Urbanization is one of the dominating f...

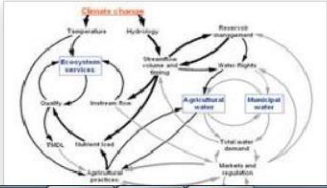



Polarities in values and pe...
Discussions and debate around ethical dilemmas in sustainability and the introduction of the concept of polarity thin...




Climate change
Introduction to Earth's fascinating climate system, the natural greenhouse effect and anthropogenic climate change





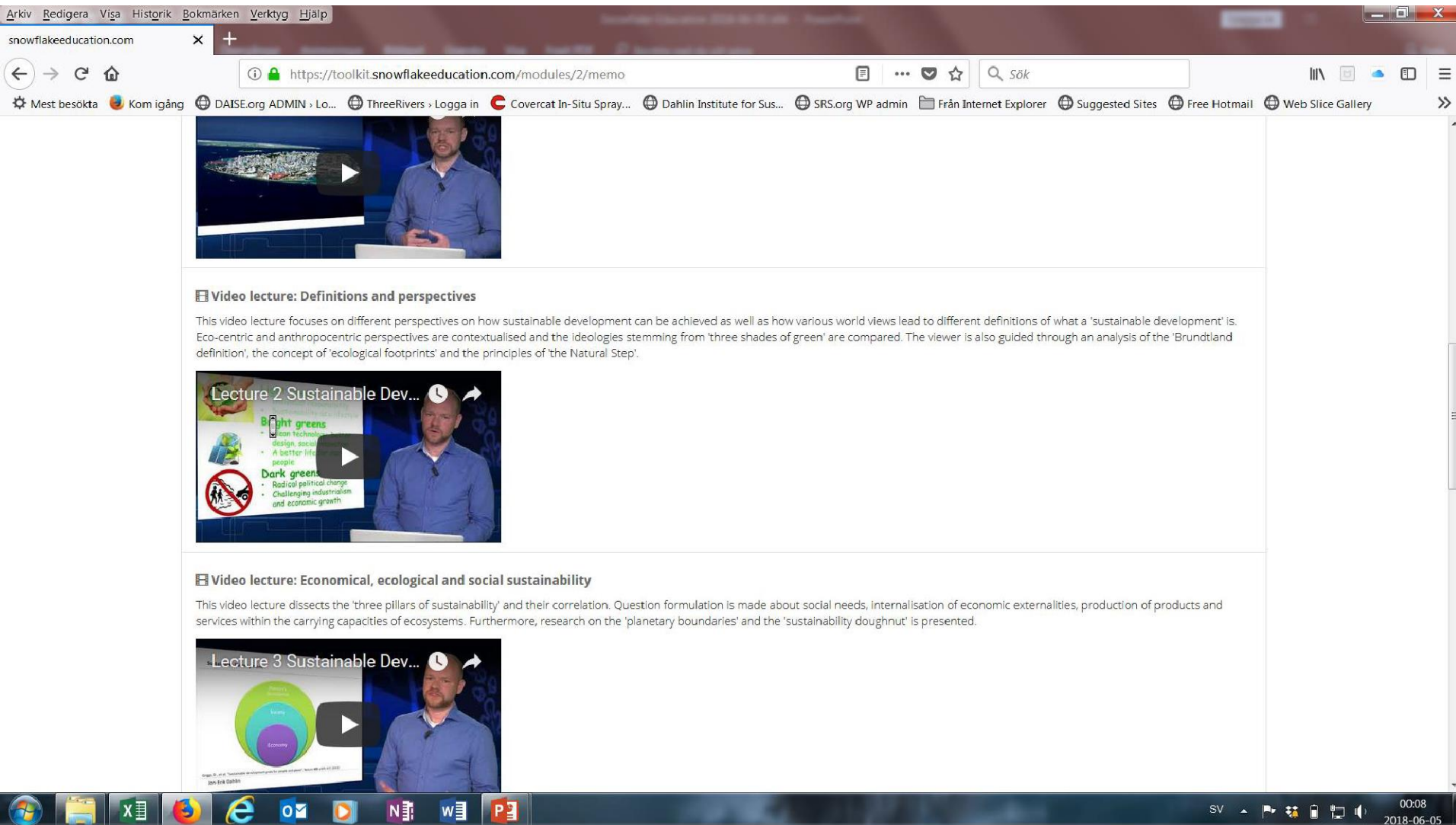




11:23
2018-06-03

Snowflake Education Toolkit

✓ Each learning package: online lectures, assignments, etc.



Arkiv Redigera Visa Historik Bokmärken Verktyg Hjälp

snowflakeeducation.com

https://toolkit.snowflakeeducation.com/modules/2/memo

Sök

Mest besökta Kom igång DAISE.org ADMIN > Lo... ThreeRivers > Logga in Covercat In-Situ Spray... Dahlin Institute for Sus... SRS.org WP admin Från Internet Explorer Suggested Sites Free Hotmail Web Slice Gallery

Video lecture: Definitions and perspectives

This video lecture focuses on different perspectives on how sustainable development can be achieved as well as how various world views lead to different definitions of what a 'sustainable development' is. Eco-centric and anthropocentric perspectives are contextualised and the ideologies stemming from 'three shades of green' are compared. The viewer is also guided through an analysis of the 'Brundtland definition', the concept of 'ecological footprints' and the principles of 'the Natural Step'.

Lecture 2 Sustainable Dev...

- Bright greens**
 - Lean Technology
 - Design, social
 - A better life for people
- Dark greens**
 - Radical political change
 - Challenging industrialism and economic growth

Video lecture: Economical, ecological and social sustainability

This video lecture dissects the 'three pillars of sustainability' and their correlation. Question formulation is made about social needs, internalisation of economic externalities, production of products and services within the carrying capacities of ecosystems. Furthermore, research on the 'planetary boundaries' and the 'sustainability doughnut' is presented.

Lecture 3 Sustainable Dev...

Planetary boundaries
Society
Economy

00:08
2018-06-05

Snowflake Education Toolkit

✓ Results are accumulated along the way and summarized

snowflakeeducation.com Admin - Hållbar utvecklin... PM Föreläsningar Dokument Inlämningsuppgifter Prov Resultat

Alla resultat - Hållbar utveckling för MJ1103 (2018)

Moment markerade med * nedan är obligatoriska. Moment markerade med + nedan används vid betygsättning. Provet är obligatoriskt på denna modul. Provet används också vid betygsättning av denna modul.

Dra kolumnrubrikerna för att ändra ordningen.

Välj alla Välj ingen

| Förnamn | Efternamn | Betyg Andra synlighet | Seminarium Systemtänkande * + Redigera närvaro | Seminarium Perspektiv och värderingar ** + Redigera närvaro | Seminarium Klimatförändringar ** Redigera närvaro | Seminarium: Kritiska material och cirkulär ekonomi * + Redigera närvaro | Förberedelseuppgift: Systemtänkande * (2018-11-09) Andra synlighet | Uppföljningsuppgift: Introduktion till hållbar utveckling * (2018-11-12) Andra synlighet | Förberedelseuppgift: Perspektiv och värderingar * (2018-11-13) Andra synlighet | Uppföljningsuppgift: Systemtänkande + (2018-11-15) Andra synlighet | Förberedelseuppgift: Klimatförändringar + (2018-11-22) Andra synlighet | Uppföljningsuppgift: Perspektiv och värderingar + (2018-11-23) Andra synlighet | Förberedelseuppgift: Kritiska material och cirkulär ekonomi * (2018-11-25) Andra synlighet |
|---------|-----------|--------------------------|--|---|---|---|--|--|--|--|--|--|--|
| | | Ofullständigt | X | X | X | X | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd | Inte inlämnad (Lägg till) | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt |
| | | Ofullständigt | X | X | X | X | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Inte inlämnad (Lägg till) | Godkänd - Utmärkt |
| | | Incomplete (58.0) | X | X | X | X | Godkänd | Godkänd | Godkänd - Utmärkt | Inte inlämnad (Lägg till) | Godkänd - Utmärkt | Inte inlämnad (Lägg till) | Godkänd - Utmärkt |
| | | C (87.5) | X | X | X | X | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd | Godkänd | Godkänd | Godkänd - Utmärkt | Godkänd - Utmärkt |
| | | C (87.5) | X | X | X | X | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt |
| | | Ofullständigt | O | O | O | O | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) |
| | | C (84.5) | X | X | X | X | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Inte inlämnad (Lägg till) | Godkänd - Utmärkt |
| | | Incomplete (62.0) | X | X | X | X | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Inte inlämnad (Lägg till) | Godkänd - Utmärkt | Inte inlämnad (Lägg till) | Godkänd - Utmärkt |
| | | Ofullständigt | O | O | O | O | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) | Inte inlämnad (Lägg till) |
| | | C (86.3) | X | X | X | X | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt |
| | | B (94.0) | X | X | X | X | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt |
| | | C (88.3) | X | X | X | X | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd | Godkänd - Utmärkt | Godkänd - Utmärkt | Godkänd - Utmärkt |

Snowflake Education Toolkit

The screenshot shows a web browser window with the URL `toolkit.snowflakeeducation.com/modules/240/memo`. The page has a blue navigation bar with the following items: `snowflakeeducation.com`, `Modules`, `Sustainable Devel...`, `Memo`, `Lectures`, `Documents`, `Assignments`, `Exams`, `Results`, a settings icon, a language icon, and `Exit`. The main content area starts with a welcome message: "Welcome to Sustainable Development / Kestävä kehitys". Below this is another welcome message: "Welcome to the Sustainable Development Master Course!". The section is titled "Packages" and contains a list of course modules, each with an "Edit" button and a pencil icon. The "Values thinking" package is circled in red.

| Package Name | Action |
|---|--------|
| Course info and introduction to sustainable development | Edit |
| Values thinking | Edit |
| Constructive Debate | Edit |
| Systems thinking | Edit |
| Climate Change | Edit |
| Critical material and circular economy | Edit |
| Sustainability reporting | Edit |

Values thinking



Dilemma (3-6 players):

- ✓ Introduction to sustainability
- ✓ The game includes fact-based quiz-like questions, and...
- ✓ Discussion-oriented sustainability dilemmas



Values thinking

Values thinking - Edit

In this learning package, you will learn to problematize various "sustainable solutions". You will practice identifying the underlying values of different opinions and further develop your argumentative skills.

Expected learning outcomes

After completing the learning package the student should be able to:

- make reasonable estimates on the order of magnitude to questions about global development.
- critically review arguments and show respect to people with opposing opinions.
- formulate well supported arguments for various viewpoints.
- define, explain and be able to use sustainability vocabulary and relevant facts in writing and conversation.

Preparation -

Preparatory assignment

The preparatory assignment is supposed to take about four hours to complete. The assignment consists of several sub-tasks. The black text provides background information and guides you to relevant web content. *Gray, italicized text indicates that the sub-task contains a written submission.*


Write all submission texts in a document and upload it as a PDF file. Please cite sources according to the Harvard referencing style. The document may contain a maximum of 500 words (excluding references). Please note that submissions will not be assessed if they lack references for statements and facts, since we want to emphasize the importance of a scientific approach and the ability to write trustworthy texts. Below you will find one of the many guides to the Harvard system, available on the internet.

■ Preparatory assignment: Values thinking
The assignment is submitted individually
To assignment submission details
■ Guide to Harvard referencing (Angela Ruskin University, 2017)

Sub-task 1

Watch the following video lectures:

Definitions and perspectives (20:43)



Sub-task 2

In order to strategically mobilize efforts for a transition towards a sustainable society, the UN member states have defined 17 global goals with priorities and ambitions for the year 2030.

Pick out three of these 17 Sustainable development goals (UN, n.d.), covering topics that engage you the most on a personal level. Take a closer look at the targets and indicators that has been set for the respective goals. You can also find visualizations of tracked indicators at the web page SDG-Tracker (Ritchie et al., 2018).


Write a brief description of the three goals you have chosen. Also write a short reflection of why you think that these goals engage you the most.

Sub-task 3

Watch Hans Rosling's explainer video about how income relates to life expectancy. After having watched the video, you should compare the two graphs describing the relation between life expectancy and income (Gapminder, n.d.-b), and the relation between greenhouse gas emissions and income (Gapminder, n.d.-c). Press the play button to see how the conditions change over time.

Write a short reflective text, based upon your interpretation of the graphs and how you think that they relate to the subject of "sustainable development".

How does income relate to life expectancy (Gapminder, n.d.-a) [01:48]



Sub-task 4

During the seminar we will play a board game in which you will be both challenging your sustainability fact knowledge as well as practicing your debating skills. In order for the debates to be extra interesting, all participants will research different topics and share their research with the others, in small groups.

In order to divide the debate topics among the participants, you are asked to do research on the topic that is correlated to the day of the month you were born (see table below), for example, someone born on April 5th, will do research on topic 1, whereas someone born on October 12th will explore topic 3. You may want to bring notes to the seminar, but you do not need to submit a written part to this sub-task. See information about the debate topics in the pdf below.

| Number of debate topic | 1 | 2 | 3 | 4 | 5 | 6 |
|------------------------|-----|------|-------|-------|-------|-------|
| Day of birth | 1-5 | 6-10 | 11-15 | 16-20 | 21-25 | 26-31 |

Dilemma (3-6 players):

- ✓ Introduction to sustainability
- ✓ The game includes fact-based quiz-like questions, and...
- ✓ Discussion-oriented sustainability dilemmas

In the associated online material:

- ✓ Learning package around values, opinions and conflicting goals
- ✓ Learning package around constructive debate and polarities

Exercise: Play Dilemma



Groups of about 3-5 players

1. I'll go through the rules shortly
2. You'll have the opportunity to try out the game for ~20 minutes
3. As you play, make sure to go through a few **step-by-step cards**; discuss them also from an educator's perspective
4. Try out at least one discussion from the **dilemma cards**, go through a few more and discuss the game from an educator's perspective

Start with the green cards – and after ~10 minutes, go to the yellow cards

Exercise: Play Dilemma

miro

Dilemma Board (group 1) ☆



Share



Download me and start by reading me.



I am a deck with 50 cards. Move us one at the time to read us. We suggest you move us out of sight of the other players, so only you can see the clues and correct answer.



We are game pieces. If you cannot move us, perhaps you need to click on the 'arrow' in the menu to the left...

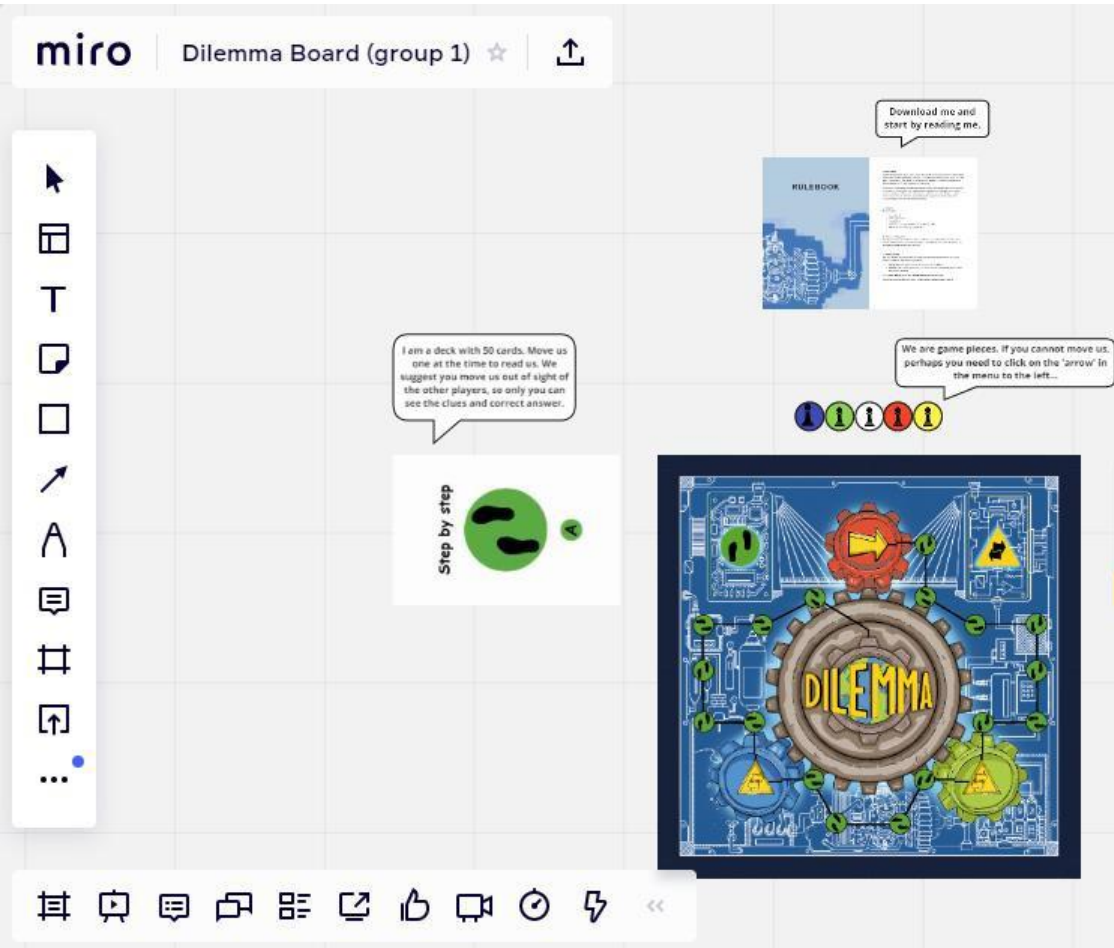


I am a deck with 12 cards. Move us one at the time to read us.



20%

Exercise: Play Dilemma



GAME RULES (short version):

- When it is your turn: the player next in turn will read one step-by-step card to you and if you can answer the question correctly you will move your piece 3 steps
- If your answer is incorrect, you get one (2 steps) or two (1 step) clues
- When you enter a dilemma area you will be the moderator of a debate between the player next in turn (position 1) and the player after your turn (position 2)
- The one that gets into the centre first WINS! 😊
- Note: read cards by moving them
- Note: move away the card that you are reading

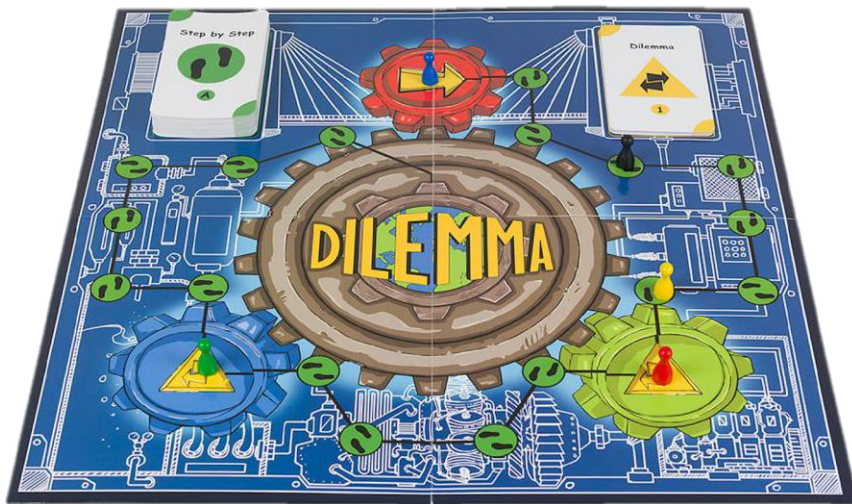
Zoom breakout rooms:

**note your room number and
access the correct Dilemma board
be prepared to reflect on...**

When you get back:

Groups of about 3-5 players

1. I'll go through the rules shortly
2. You'll have the opportunity to try out the game for ~20 minutes
3. As you play, make sure to go through a few **step-by-step cards**; discuss them also from an educator's perspective
4. Try out at least one discussion from the **dilemma cards**, go through a few more and discuss the game from an educator's perspective



Start with the green cards – and after ~10 minutes, go to the yellow cards

Dilemma in the classroom

The typical Dilemma seminar:

1. Encouraging introduction/exercise [45 min]
2. Dilemma game [90 min]
3. Debriefing [30 min]

...but we have seen educators use it in many different ways, for example:

- 45 min lecture, embedded in a series of lectures
- Centrepiece for a theme day about sustainability
- Lend-home games for students, discussions in class

The debriefing

- Start by asking students: “what did you think about this exercise?”
- Generally, they answer three things:
 1. “It was FUN!”
 2. “And we LEARNED stuff!”
 3. (after a short paus, with wrinkled foreheads) “and it was actually DIFFICULT!”
- When appropriate, let the discussion follow with what students spontaneously reflect on
- But you can also ask specifically:
 - “What did you think about the green cards (step-by-step)?”
 - “What did you think about the yellow cards (dilemma)?”
- Select a few cards on beforehand, that you have chosen for discussion (you can put them on slides)
- The debriefing should cover what you have on your checklist, for example:
 - There is no right or wrong answer to these dilemmas, but many different opinions
 - Debates can be really constructive, when debaters are respectful and honest
 - Make sure students understand the importance of learning basic facts

Teaching Sustainability using Games



AGENDA

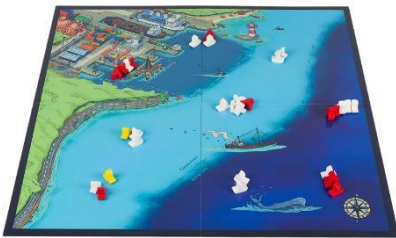
- *Games & key competences*
- *Pedagogical motivation*
- *Games in ESD*
- *Practical trial*
- Range of games
- How to start?

Systems thinking



FishBanks (4-40 players):

- ✓ Introduction to system dynamics, ecosystem services, the tragedy of the commons, (renewable) resource economy and decision making with limited access to information



Systems thinking

Systems thinking - Redigera

In this learning package, you will get to experience the principles of system dynamics – a system analysis technique that can be used to better understand sustainability issues. Through a roleplay, you will practice management of a renewable resource, while being part of a complex system of multiple stakeholders and information overload.

Lärandemål

Efter avslutad lärandepaket ska studenten kunna:

- describe the phenomenon 'the tragedy of the commons', ecosystem services and key concepts in system dynamics.
- propose strategies to manage or reduce the risk of system collapse.
- identify feedback loops in complex systems and be able to describe their course of events using words and expressions from system dynamics.

Preparation

Preparatory assignment

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Preparatory assignment: Systems thinking
Uppgiften lämnas in individuellt.
Till detaljer för inlämningen:
Guide to Harvard referencing (Angela Ruskin University, 2017)


Sub-task 1

Watch the following video lectures:

Complex systems (23:30)



Economic externalities (12:46)



Sub-task 2

The concept of ecosystem services is mentioned in the video lecture *Economic Externalities*. Browse through [these lists of examples](#) (FAO, 2018) of provisioning, regulating, supporting and cultural ecosystem services to deepen your understanding of the concept.

State three examples of ecosystem services that you have "used" today.

Sub-task 3

"The tragedy of the commons" is used as an example of a system collapse in the video lecture *Complex systems*. Read more real-life examples of the tragedy of the commons in [this list](#) (Spooner, 2012).

Describe with your own words what is meant with the concept "the tragedy of the commons".

Sub-task 4

Read this blog post about a comparison between disposable and reusable cups (Correa, 2018). The blog post introduces LCA – Life-cycle assessment. This is a tool commonly used to analyze and compare products or services – with a systems thinking approach. Depending on the aspects which are included inside the "system boundaries" of the studied model, different answers for the comparison could be given.

Your task is to identify the various aspects with direct or indirect effects on the environment, which are mentioned in the blog post. For example, energy use per produced cup (implicitly) leading to environmental effects such as greenhouse gas emissions.

Sub-task 5

At the seminar we will play a role play called FishBanks. Along with teammates, you will manage fishing companies and try to maintain your fishing fleets profitability so that your fishing enterprise may continue into the future. You will be charged with managing a fleet of fishing boats and making decisions about your fishing strategies. A physical board game will be used in combination with a system dynamic model on a computer; after each "year" of fishing, your company reports on decisions which get entered into the model.

Read the "Role description" below, to understand the game's system and to follow the seminar more easily. On page 6, you'll find a graph of the regeneration of fish. Focus on the blue graph, showing the regrowth of deep sea fish in this game. One of the feedback loops behind the graph's appearance is the production of new fish: the larger the fish population is, the more eggs are produced. As egg production increases, more eggs will survive. This, in turn,

FishBanks (4-40 players):

- ✓ Introduction to system dynamics, ecosystem services, the tragedy of the commons, (renewable) resource economy and decision making with limited access to information

In the associated online material:

- ✓ Learning package around systems thinking
- ✓ Introduction to concepts such as feedback-loops, resilience, tipping points etc.

Climate change



Clime Out (3-6 players):

- ✓ Introduction to Earth's climate and climate change
- ✓ The game includes fact-based quiz-like questions, ...
- ✓ ... interactive puzzles, and...
- ✓ ... glossary literacy duels



Climate change

Climate Change - Redigera

In this learning package you will get the chance to gain a deeper understanding of Earth's climate system and climate change. You will learn about the strategies by which climate change research can be communicated to the public, and will also practice explaining the natural science behind ongoing climate change.

Lärandemål

Efter avslutad lärandepaket ska studenten kunna:

- explain how global climate scenarios are used and describe predicted trajectories for a particular region.
- motivate why actions made by a particular actor contributes positively to managing climate change.
- use guidelines for climate communication to adapt language usage by situation and target group.
- state the main components and a number of feedback mechanisms in the Earth's climate system.

Preparation -

Preparatory assignment

The preparatory assignment is supposed to take about four hours to complete. The assignment consists of several sub-tasks. The black text provides background information and guides you to relevant web content. *Gray, italicized text indicates that the sub-task contains a written submission.*

Write all submission texts in a document and upload it as a PDF file. Please cite sources according to the Harvard referencing style. The document may contain a maximum of 500 words (excluding references). Please note that submissions will not be assessed if they lack references for statements and facts, since we want to emphasize the importance of a scientific approach and the ability to write trustworthy texts. Below you will find one of the many guides to the Harvard system, available on the Internet.

■ Preparatory assignment: Climate change

Uppgiften lämnas in individuellt.


Till detaljer för inlämningen.

■ Guide to Harvard referencing (Angela Ruskin University, 2017)


Sub-task 1

Watch the following video lectures:

■ Earth's climate (13:34)



■ Climate change (21:33)



Sub-task 2

Follow the four steps in this energy balance model (Ballantyne & Clark, n.d.). Make sure to read the texts and explanations of the underlined terms carefully since you could be asked to explain the model to a peer during the seminar. You can bring supporting notes to the seminar, but you do not need to submit a written text for this sub-task.

Sub-task 3

Watch the video How quantum mechanics explains global warming (Scheire, 2014).

Give a short, written description of why some gases act as greenhouse gases and others do not.

Sub-task 4

Often when the issue of a changing climate is addressed, we are thinking of something happening far away. In the distant future. But how do the climate projections actually look like for your home region? Have a look at the different scenarios at any of the following links: Europe, South America, Southwestern Asia, Africa or the U.S. (SMHI, n.d.; USGCRP, n.d.).

Answer the following questions briefly in your preparatory assignment:

1. Which region have you studied?
2. What changes in precipitation and temperature are expected to occur during the next decades?

Clime Out (3-6 players):

- ✓ Introduction to Earth's climate and climate change
- ✓ The game includes fact-based quiz-like questions, ...
- ✓ ... interactive puzzles, and...
- ✓ ... glossary literacy duels

In the associated online material:

- ✓ Learning package around basic climate knowledge
- ✓ Introduction to concepts such as energy balance, the greenhouse effect, global warming etc.

Critical materials, material flows and life cycle thinking



In the Loop (3-6 players or 3-6 teams of 2):

- ✓ Introduction to critical materials, material flows & circular economy
- ✓ Strategy type game
- ✓ Each team takes on the role of a production company, trying to find the resources for their products



Critical materials, material flows and life cycle thinking

In the Loop (3-6 players or 3-6 teams of 2):

- ✓ Introduction to critical materials, material flows & circular economy
- ✓ Strategy type game
- ✓ Each team takes on the role of a production company, trying to find the resources for their products

In the associated online material:

- ✓ Material flows and criticality
- ✓ Subtask around product life-cycles
- ✓ Subtask around circular business models

Kritiska material och cirkulär ekonomi - Edit

I det här lärandepaketet kommer du att få fundera över materialhantering i dagens samhälle. Fokus ligger på koncept såsom kritiska material, resurshantering och cirkulär ekonomi, snarare än att specifika materialvetenskap. Vad finns i en smartphone? I vilka länder sker största produktionen av kritiska material? Och hur kan ett företags strategier bidra till minskad resursanvändning? I försörjningskedjan? I bränslet i the Loop får du testa att producera produkter och utforska komplexiteten i verkligens resurshantering, lyckas ditt företag producera de produkter ni tänkt i en värld full av överraskande händelser?

Expected learning outcomes

After completing the learning package the student should be able to:

- redogöra för möjliga förändringar i företags affärsmässiga strategier eller affärsmodeller som skulle kunna bidra till minskad resursanvändning.
- ge exempel på affärsstrategier som är i enlighet med cirkulära ekonomiska modeller.
- ge exempel på några kritiska material, härkomsten av dessa och vanliga användningsområden.
- förklara innebörden av termerna kritiska material och cirkulär ekonomi.

Förberedelseuppgift -

Förberedelseuppgift: Kritiska material och cirkulär ekonomi

Förberedelseuppgiften är tänkt att ta cirka fyra timmar att genomföra. Uppgiften består av ett antal deluppgifter som beskrivs steg för steg i nedan text. Svart text ger bakgrundsinformation och guidar dig till relevant webbmateriäl. Grön kursiverad text indikerar att deluppgiften även innehåller en skriftlig inlämningsuppgift. Se till att avsätta tillräckligt med tid och samarbeta gärna med en klasskompis, även om den skriftliga delen skrivs individuellt. Den skriftliga delen skrivs i ett dokument och laddas upp i [ggf-format](#) via länken nedan. Dokumentet får maximalt innehålla ca. 500 ord (exklusive referenser).

Kom ihåg att alltid ange källor enligt Harvard. Inlämningsuppgifter som helt saknar referenser för påståenden och fakta kommer [inte att godkännas](#). Anledningen till detta är att vi uteslutligen vill se av ett vederstygligaste vetenskapligt förhållningssätt och förmågan att skriva förordningande texter. *Guide till Harvardstyxmetern* (Högskolan i Borås, 2015) är en av många vägledningar som kan underlätta referenshanteringen när du skriver dina inlämningsuppgifter. Notera att akademiska texter både ska ange referenser (öppande i texten [ex. Andersson, 2011]) och att det ska finnas referenslista i slutet av texten (se exempel längst ned i denna uppgiftsbeskrivning).

Notera att:

Deadline: 2018-11-25 23:59

The assignment is submitted individually


The assignment is mandatory

To assignment submission details

Deluppgift 1

Titta på följande videomaterial:

Materialhushållning och cirkulär ekonomi (20:03)



Deluppgift 2

I videoföreläsningen *Materialhushållning och cirkulär ekonomi* omnämns att ett företags hållbarhetsrapportering bl.a. kan innehålla redovisning av åtgärder som vidtagits för att minska risker för underminering av mänskliga rättigheter i sin försörjningskedja.

I januari år 2016 gick Amnesty ut med information kring hur utvinningen av kobolt ofta kunde kopplas till barnarbete i Kongo-Kinshasa, se artikel (Ny Teknik, 2016) om detta. I följande artikel (Ny Teknik, 2017) sammanfattas en uppföljning av hur elektronikföretag hanterat risken när två år gått. Läs artiklarna och fundera över vad du själv tror kan göras för att minska förekomsten av sådan typ av materialutvinning.

Sammanfatta dina tankar med en kort, skriftlig reflektion.

Deluppgift 3

På senaste år har ett flertal organisationer och länder gjort studier för att identifiera vilka material som är kritiska för dem. Vilka material som anses ingå i gruppen "kritiska material" beror på studiens geografiska plats och tid, samt vilka kriterier som väljs ut för studien. Tillgänglig (politisk stabilitet, ersättningsmöjlighet, grad av återvinning), miljörisker och ekonomisk betydelse är tre kriterier som använts i EU:s analyser av vilka resurser som är kritiska.


Ta en titt på periodiska systemet i nedan pdf som jämför olikheterna mellan EU:s och ett par länders definitioner av kritiska material. (Notera att det även finns kritiska material som ej finns representerade via periodiska tabellen, t.ex. naturgummi och koks. Sedan tabellen sammanställs har EU:s lista uppdaterats och innehåller numera 27 kritiska material (totalt för 14).

[Periodic table of critical elements](#)

Deluppgift 4

Vad består en smartphone av? Titta på följande video från TED Education.

What is a smartphone made of? (4:58) (Preshoff, 2018)





Teaching Sustainability using Games



AGENDA

- *Games & key competences*
- *Pedagogical motivation*
- *Games in ESD*
- *Practical trial*
- *Range of games*
- **How to start?**