Climate and sustainability board games for university teaching

Meeri Karvinen, John Millar (Aalto University) and Jon-Erik Dahlin, (Snowflake Education)

Agenda for the session

Board games as a pedagogical tool & experiences from Aalto

Trying out the games Dilemma and ClimeOut

Presenting other games and training available for faculty

Q&A, time to check the other games

PAIR BUBBLE!

- What is your experience in different methods in teaching sustainability?
- Do you have experience in board games?

Anthropocene

As of 2020…

…the Earth **has lost 58%** of all animal species since 1970

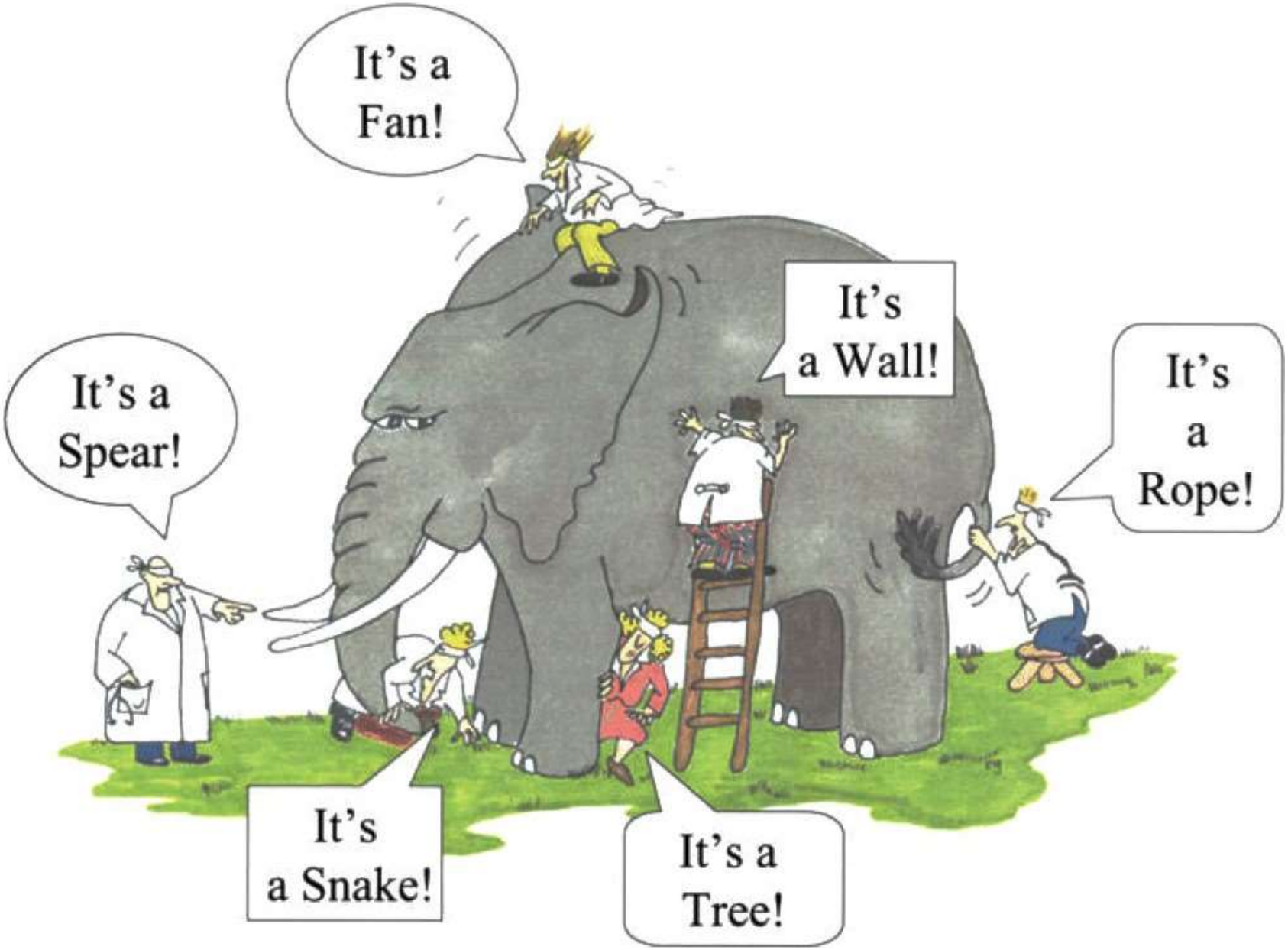
…climate change is now **unavoidable** – but consequences can be eased

…young people across the world have realized this and **gone on strike**

The human civilization has become the dominating geophysical force on Earth

More and more countries and accreditation boards force schools to make ***sustainable development*** *an integrate part of curricula*

Many educators find it **difficult** to integrate sustainability in courses and programmes


It's a Fan!
It's a Spear!
It's a Wall!
It's a Rope!
It's a Snake!
It's a Tree!

Key competences by Wiek et al. (2011)

Systems Thinking Competence

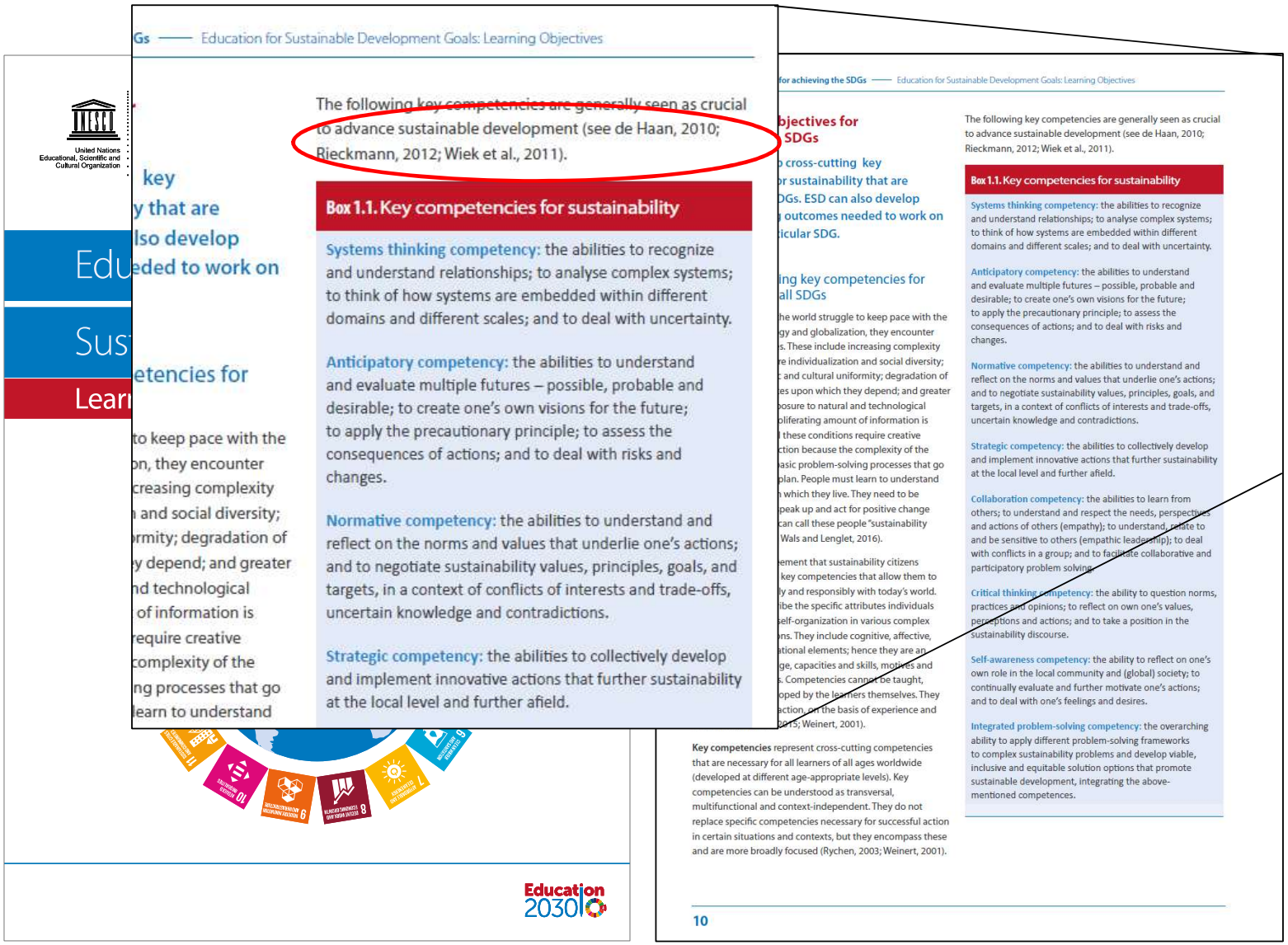
Futures Thinking Competence

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.



Gs —— Education for Sustainable Development Goals: Learning Objectives

The following key competencies are generally seen as crucial to advance sustainable development (see de Haan, 2010; Rieckmann, 2012; Wiek et al., 2011).

Box 1.1. Key competencies for sustainability

Systems thinking competency: the abilities to recognize and understand relationships; to analyse complex systems; to think of how systems are embedded within different domains and different scales; and to deal with uncertainty.

Anticipatory competency: the abilities to understand and evaluate multiple futures – possible, probable and desirable; to create one's own visions for the future; to apply the precautionary principle; to assess the consequences of actions; and to deal with risks and changes.

Normative competency: the abilities to understand and reflect on the norms and values that underlie one's actions; and to negotiate sustainability values, principles, goals, and targets, in a context of conflicts of interests and trade-offs, uncertain knowledge and contradictions.

Strategic competency: the abilities to collectively develop and implement innovative actions that further sustainability at the local level and further afield.

United Nations Educational, Scientific and Cultural Organization

Education 2030

for achieving the SDGs —— Education for Sustainable Development Goals: Learning Objectives

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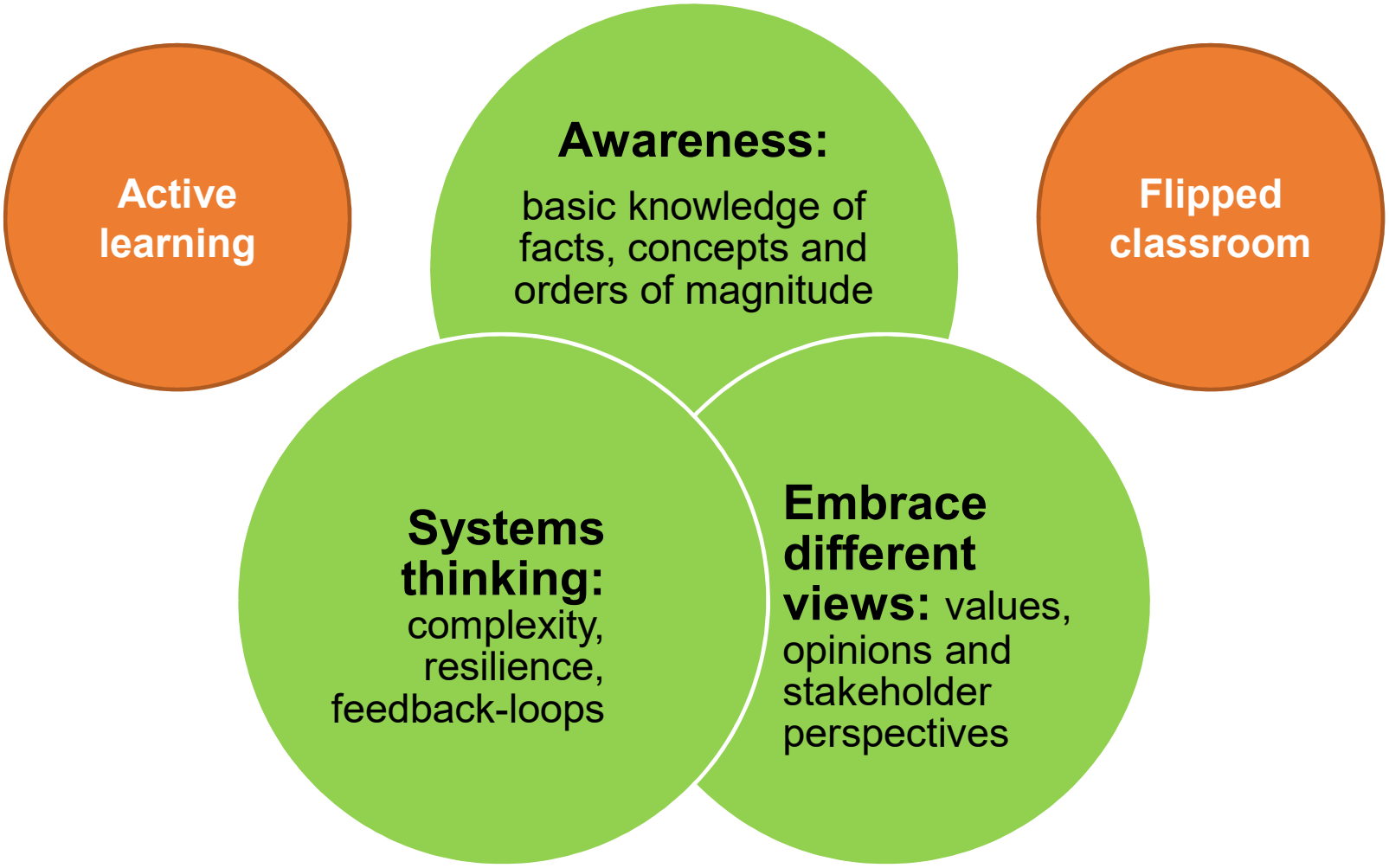
Snowflake Education

- **Snowflake Education** is a small **start-up** grown from **KTH**
- We have developed a new method for **teaching sustainability**
- Our concept is based on:
  - ❑ **active learning** with **educational games**, and
  - ❑ **flipped classroom** with our **online toolkit**
- The whole point is that it should be **straightforward** to **teach sustainability**!

Blended learning for sustainability



Sustainability learning package

Preparatory work

Literature readings

Online lectures

Preparatory

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

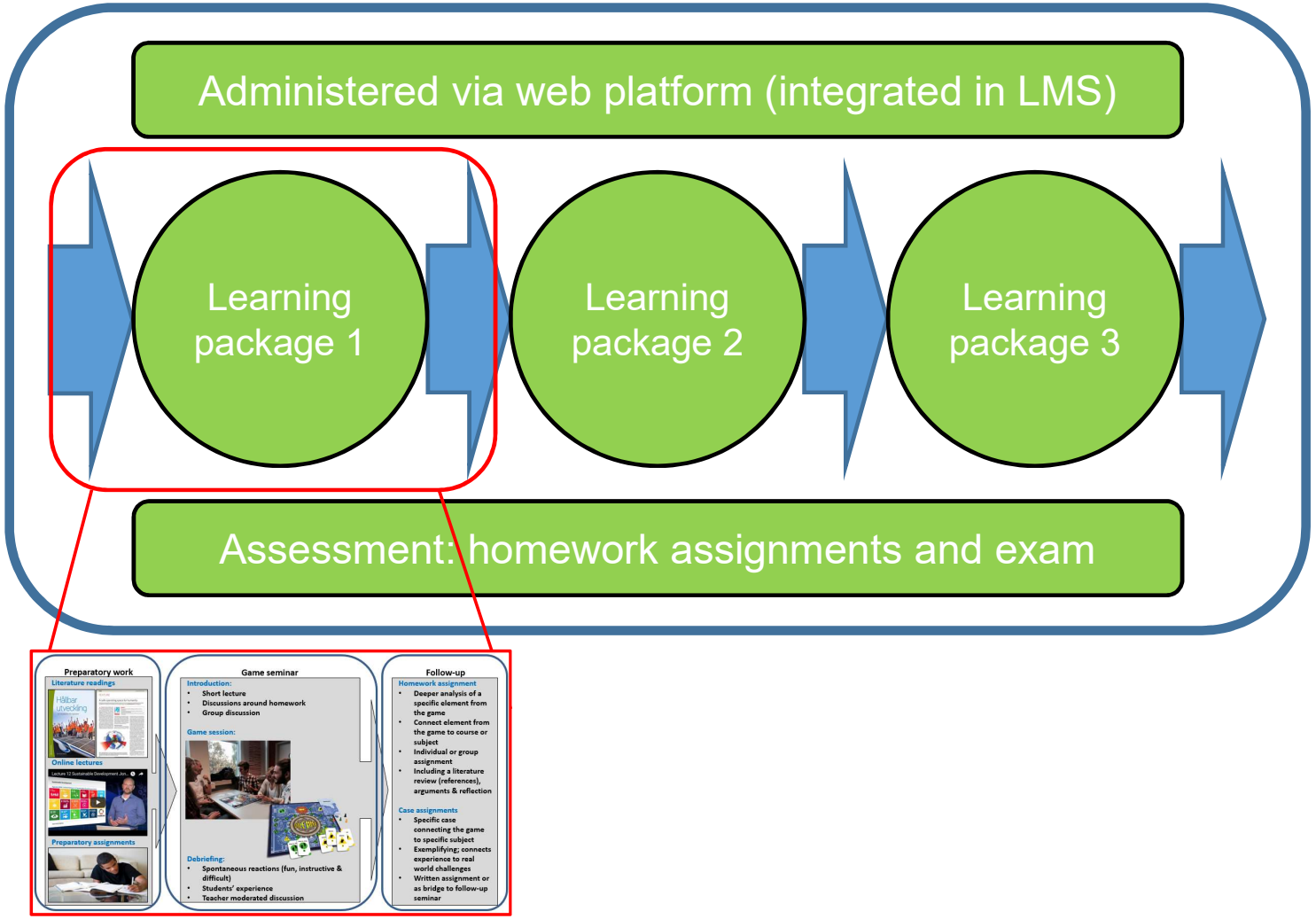
Follow-up

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


Administered via web platform (integrated in LMS)
Learning package 1
Learning package 2
Learning package 3
Assessment: homework assignments and exam
Preparatory work
Literature readings
Online lectures
Preparatory assignments
Game seminar
Introduction:
Short lecture
Discussions around homework
Group discussion
Game session:
Debriefing:
Spontaneous reactions (fun, instructive & difficult)
Students' experience
Teacher moderated discussion
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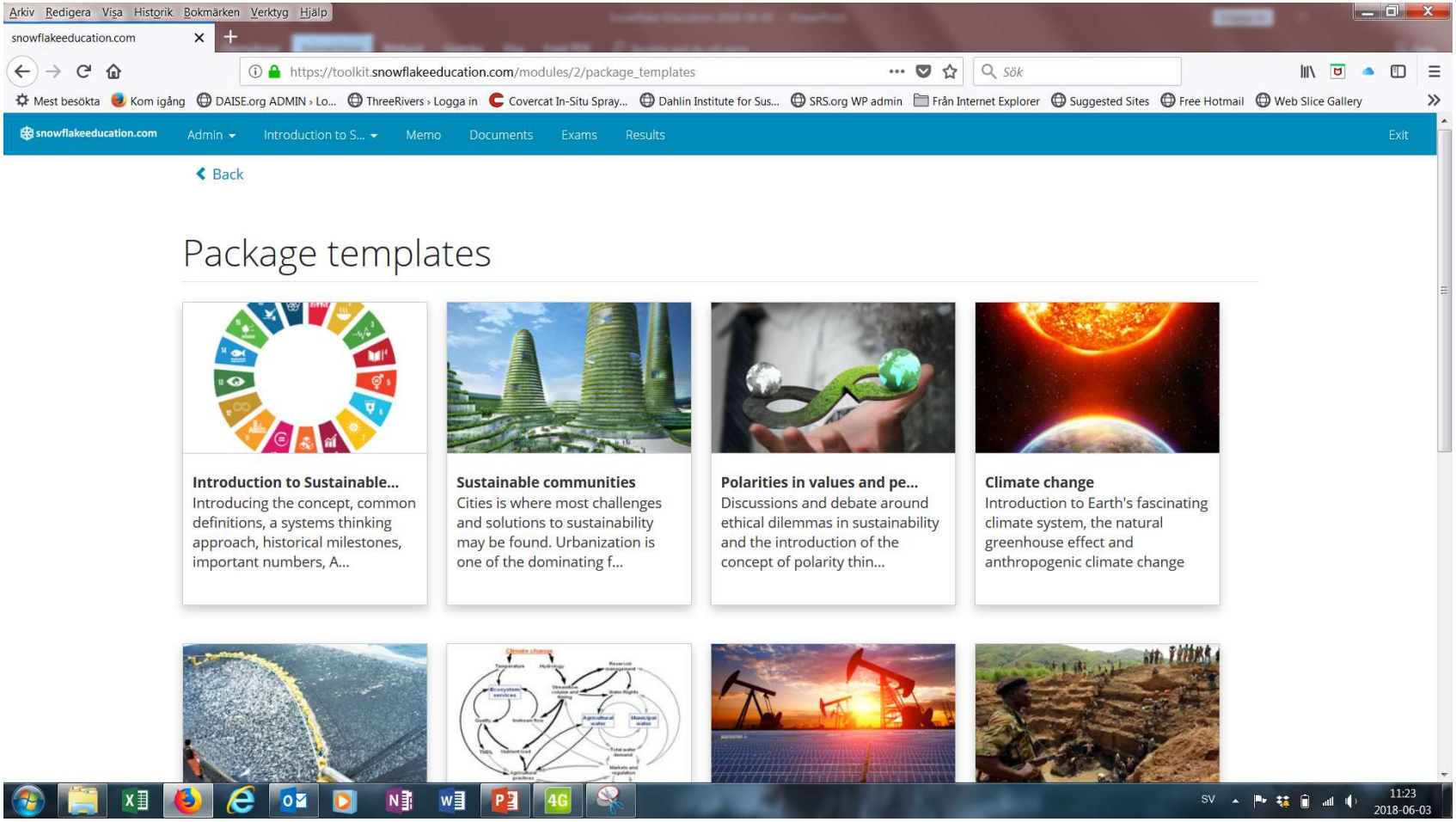
Written assignment or as bridge to follow-up seminar

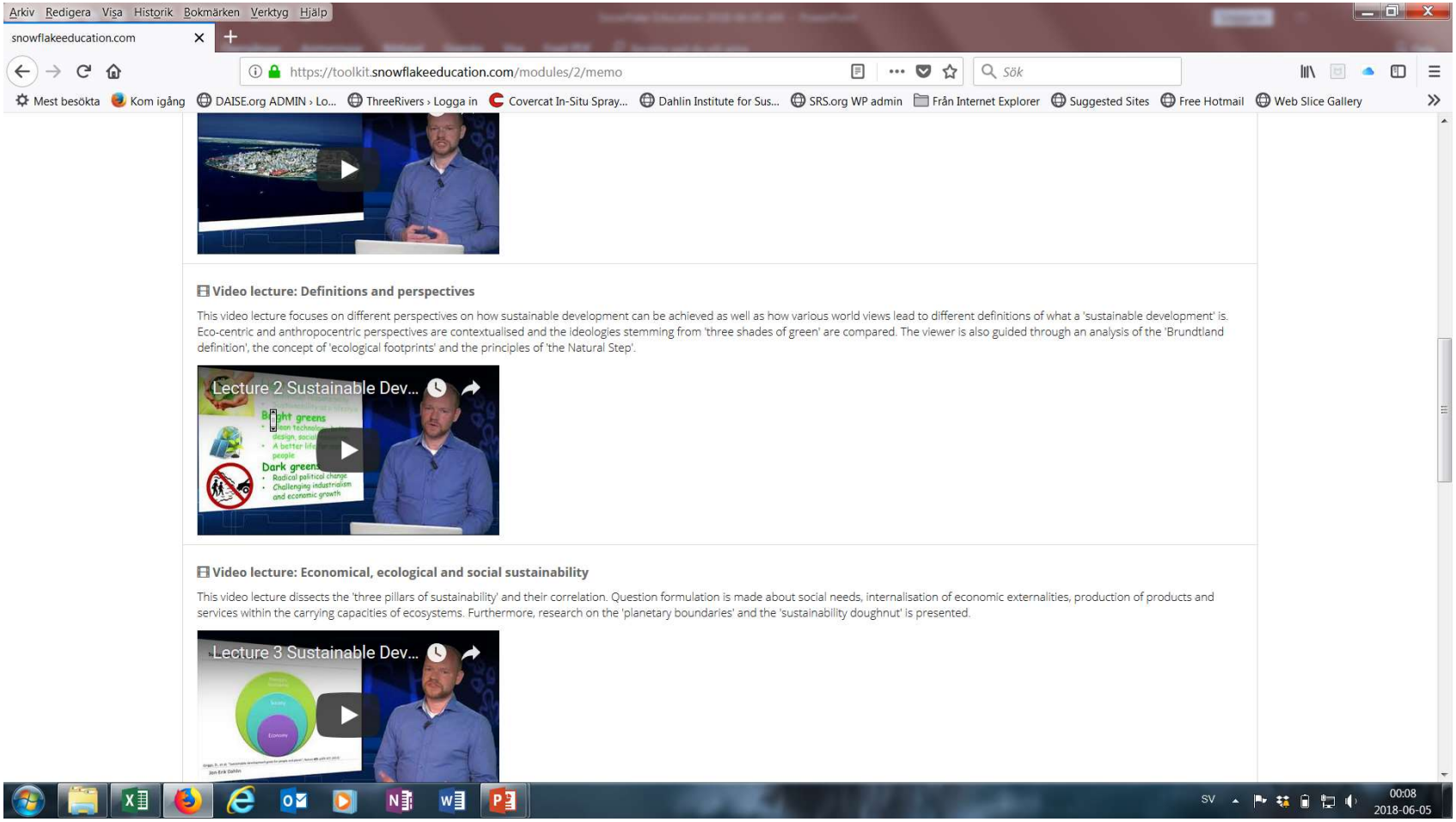
Snowflake Education Toolkit

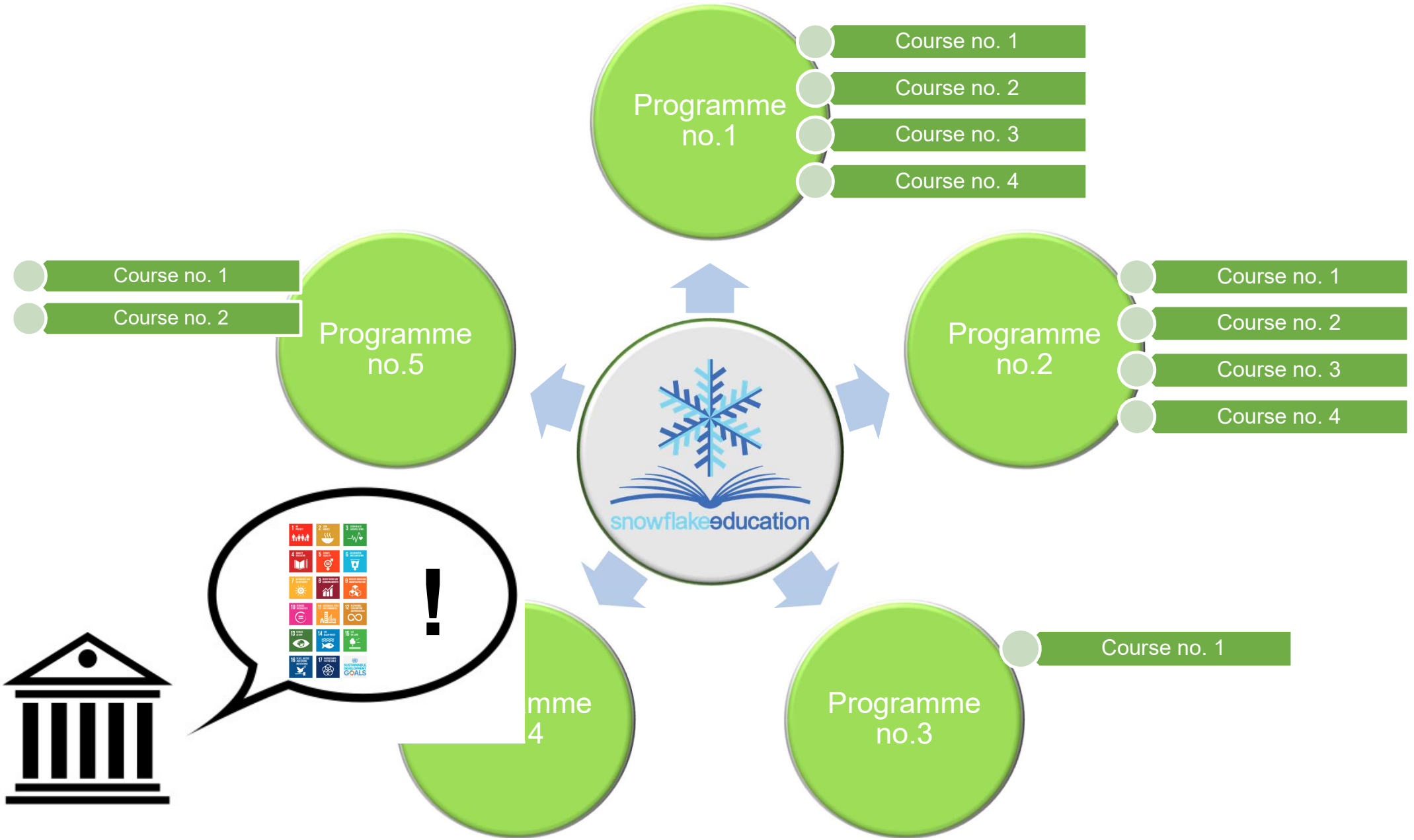
✓ Ready-to use learning packages – each based on a game



Snowflake Education Toolkit

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




Programme no.1
Course no. 1
Course no. 2
Course no. 3
Course no. 4
Programme no.2
Course no. 1
Course no. 2
Course no. 3
Course no. 4
Programme no.3
Course no. 1
mme 4
Programme no.5
Course no. 1
Course no. 2
snowflakeeducation
!

“

The games are a great way for students to begin thinking about how to approach seemingly intractable problems

– Professor Richard Fenner, University of Cambridge (UK), user of DILEMMA, Fishbanks and Power Grid

Current customers include:

POLYTECHNIQUE MONTRÉAL

UNIVERSITY OF CAMBRIDGE

Den globala skolan

KTH VETENSKAP OCH KONST

A?

LINKÖPINGS UNIVERSITET

CHALMERS UNIVERSITY OF TECHNOLOGY

Alfaskolan EN DEL AV PYSSLINGEN SKOLOR

NEWTON SOUTH HIGH

HANKEN

Rudbeck

ÅVA GYMNASIUM

Reach Academy Feltham

nacka gymnasium

NORRA REAL ANNO 1890

Elizabethtown College

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

VÄRMDÖ GYMNASIUM

Experiences from Aalto

- Aalto purchased a package of 4 games & SDG cards + a license for 2019-2020 study year (unlimited amount of students)
- During Autumn 2019 Dilemma used in 2 courses
  - Creative Sustainability & Water and Environmental engineering

- Monthly informal game nights started just last week

→ piloted in Nov 2019 with students

→ every month a new game played together with students and teachers

- ClimeOut will be played in Climate.now course in April-May

Insights from teachers

- Ready-made, but editable material and learning outcomes: easy to start designing your teaching
- Easy to add content you wish to emphasise

- Possibility to embed the Snowflake platform in your own (Moodle/MyCourses) makes it smooth for students to use
- Students seemed to have a good time and the game helped them to move away from simple solutions and to build arguments
- A good alternative pedagogy amongst the lectures

Feedback from students

Dilemma, right after the board game seminar:

- Fun and engaging way to learn
- Reflection combined with academic content was good
- New perspectives about sustainability
- Playing with a pair reduced the stress (caused by debating)

After the course the students wrote formal feedback:

"I was skeptical about the board game. However the board-game turned out to be useful as a practice for debating and making sure that you question your own views."

"It was fun to have the board game and argument with the group. Would have been interesting to see the professors having a debate, hear their arguments, as they surely have more knowledge about the themes that were approached."

In The Loop: Informal game night for students (a pilot)

“I love that this was organized! I feel that the introductory part especially has a lot of potential to convey new information to the players. I don't have a strong background in rare earth minerals or material engineering, so hearing about rare earth minerals + what they are used for was especially useful for me!”

“Including these kind of games into courses would be interesting, because we can learn easier with interaction, and empathy.”

Let’s play some games!

Exercise no. 1: Play Dilemma

1. Sit in groups of (about) 6 people in each
2. Divide into 3 pairs of 2 at each board
3. Open the box and put the ‘stuff’ on the board on their appropriate places
4. “Read the rules for 5 minutes and start playing…”
5. Play the game for 15 minutes
6. As you play, make sure to go through about 5-10 **step-by-step cards**; also discuss those from an educator’s perspective
7. Go through about 2-3 **dilemma cards**, discuss those (after a few rounds, skip to the dilemma cards)

Exercise no. 2: Play ClimeOut

1. Sit in groups of (about) 6 people in each
2. Divide into 3 pairs of 2 at each board
3. Open the box and put the ‘stuff’ on the table
4. There are three mechanisms in the game, make sure to try all three:
   - The puzzle
   - The glossary
   - The quiz
5. For each ‘duel’: one team challenges one of the other teams and the third team act as judges
6. The hourglass is used as a time measuring device in the ‘glossary’ duel only

Debriefing


Step by Step
Dilemma
DILEMMA


CLIME OUT
Klimatet står på spel
CLIME OUT
CLIME OUT

Dilemma and ClimeOut in the classroom

The typical game seminar:

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

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

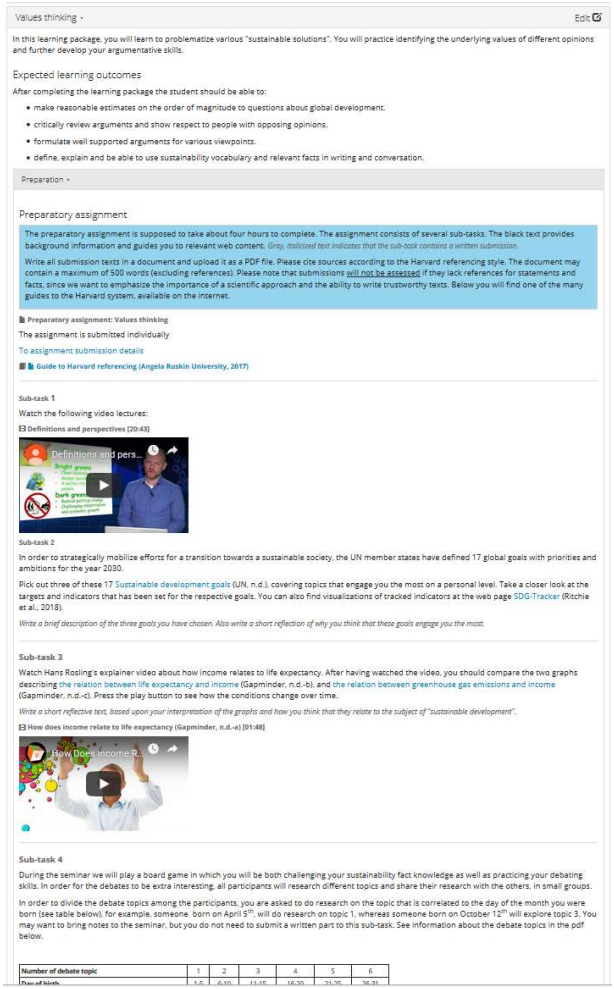
- 45 min lecture, embedded in a series of lectures
- Centrepiece for a theme day about sustainability
- Lend-home games for students, discussions in class

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

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

The debriefing

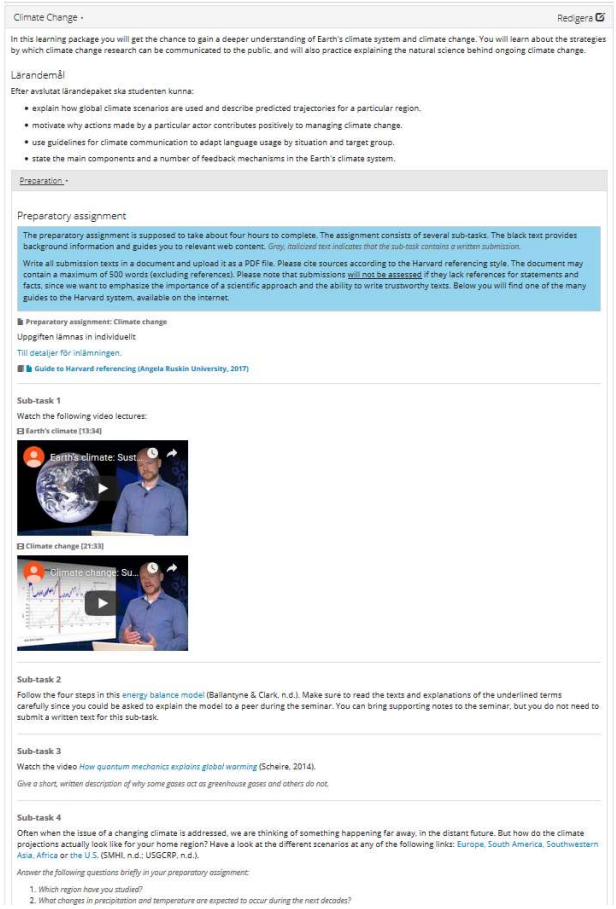
- Start by asking students: “what did you think about this exercise?”
- Generally, they answer three things:
    1. “It was FUN!”
    2. “And we LEARNED stuff!”
    3. (after a short paus, with wrinkled foreheads) “and it was actually DIFFICULT!”
- When appropriate, let the discussion follow with what 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

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

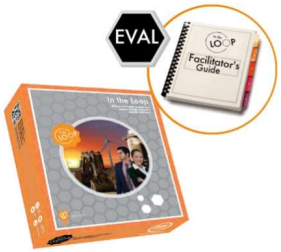


Clime Out (3-6 players):

- ✓ 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:

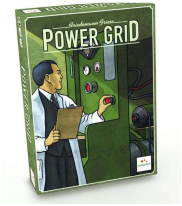
- ✓ Learning package around basic climate knowledge
- ✓ Introduction to concepts such as energy balance, the greenhouse effect, global warming etc.



In the Loop

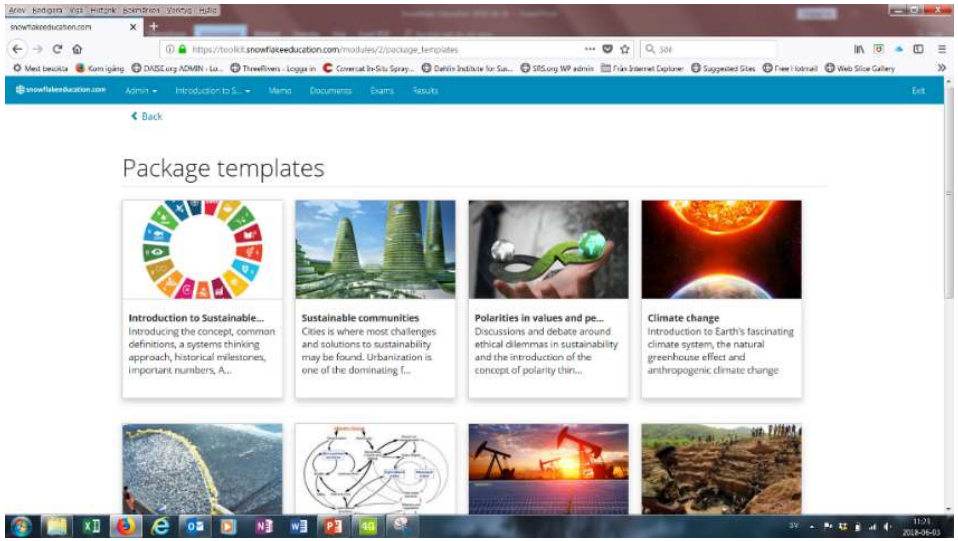
Clime Out

Fish Banks



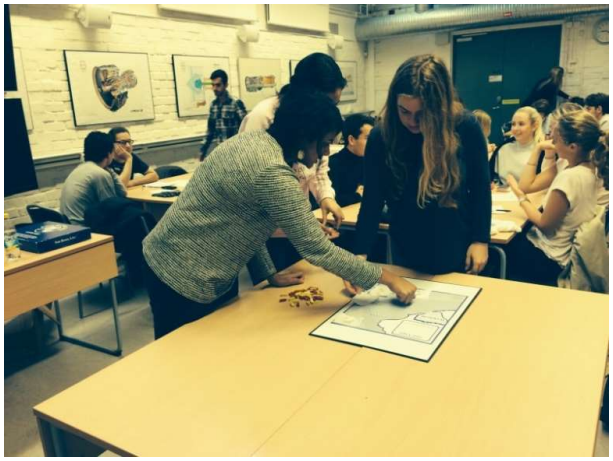
Power Grid

Sustainable Development Goal-cards



Snowflake Education Toolkit

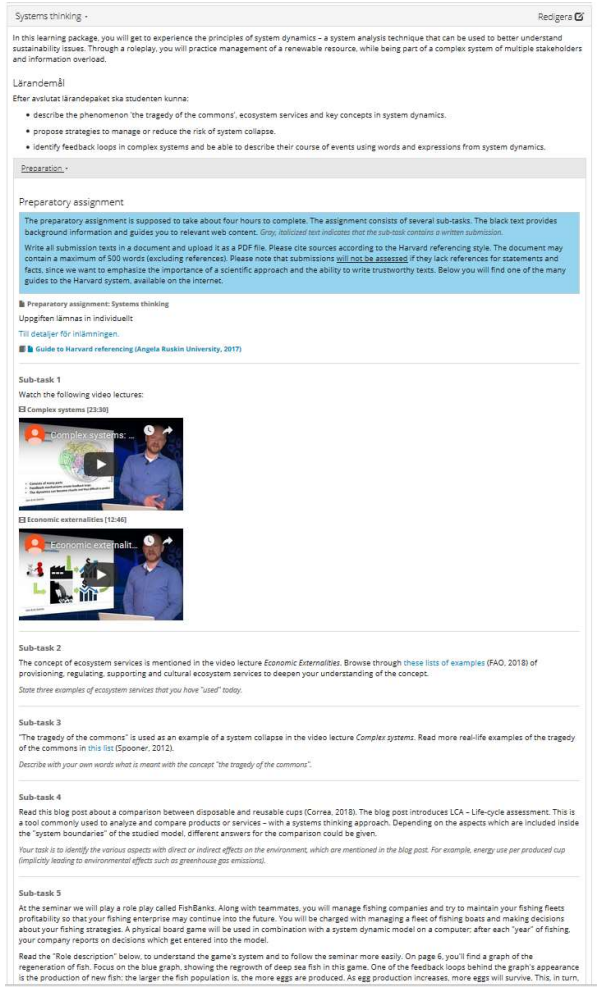
Systems thinking



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 avslutat 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

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.*

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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:

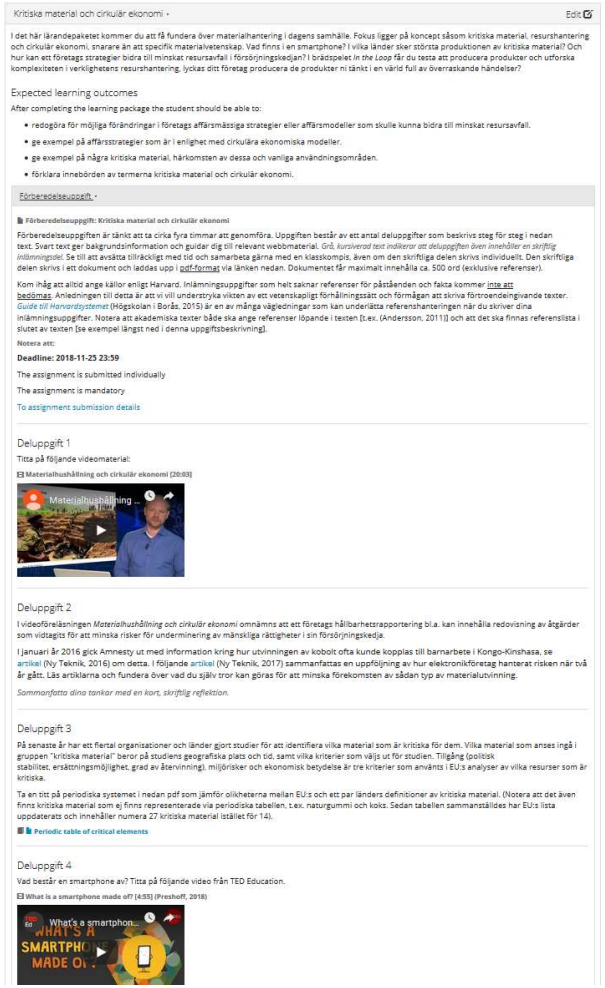
- ✓ Learning package around systems thinking
- ✓ Introduction to concepts such as feedback-loops, resilience, tipping points etc.

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


Kritiska material och cirkulär ekonomi

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 specifik materialvetenskap. Vad finns i en smartphone? I vilka länder sker största produktionen av kritiska material? Och hur kan ett företags strategier bidra till minskat resursavfall i försörjningskedjan? I brädspelet *In the Loop* får du testa att producera produkter och utforska komplexiteten i verklighetens 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 minskat resursavfall.
- 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 webbmaterial. *Grå, kursiverad text indikerar att deluppgiften även innehåller en skriftlig inlämningsdel.* 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 pdf-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 bedömas. Anledningen till detta är att vi vill understryka vikten av ett vetenskapligt förhållningssätt och förmågan att skriva förtroendeingivande texter. *Guide till Harvardsystemet* (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 löpande i texten [t.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 undermining 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. Tillgång (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 sammanställdes har EU:s lista uppdaterats och innehåller numera 27 kritiska material istället för 14).

Periodic table of critical elements

Deluppgift 4

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

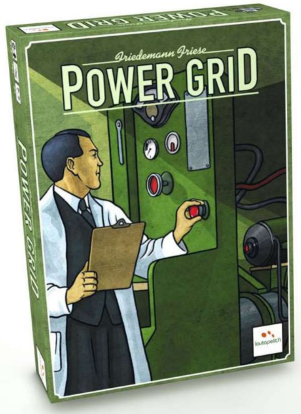
What is a smartphone made of? (4:55) (Preshoff, 2018)

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



Energy systems

Power Grid (2-6 players/teams):

- ✓ Introduction to energy systems, utility company strategies, systems thinking, energy resources, and resource economy
- ✓ Strategy game
- ✓ Each team takes on the role of a electricity utility company, building powerplants and trying to optimize their economy for fuels

Learning package:

- ✓ Based on learning energy systems and sustainable energy by rewriting the original game rules


SUSTAINABLE
DEVELOPMENT
GOALS
13 CLIMATE ACTION
5 GENDER EQUALITY
4 QUALITY EDUCATION
7 CLEAN ENERGY
8
9
10

My experience from the training


Pic: Jon-Erik Dahlin

- Peer support
- Small “class” facilitated sharing and discussions
- First time ever studying my “own” research topic in a course
- Encouraged to take action and network around sustainability integration
- Motivated to take part in SDG-integration work in Aalto
- Inspired to start planning new actions: courses, collaboration, research …

Climate and sustainability board games for university teaching

Meeri Karvinen, John Millar (Aalto University) and Jon-Erik Dahlin, (Snowflake Education)