Teaching sustainability through Game Based Learning

Exploring potentials and critical points of games in Sustainability education.

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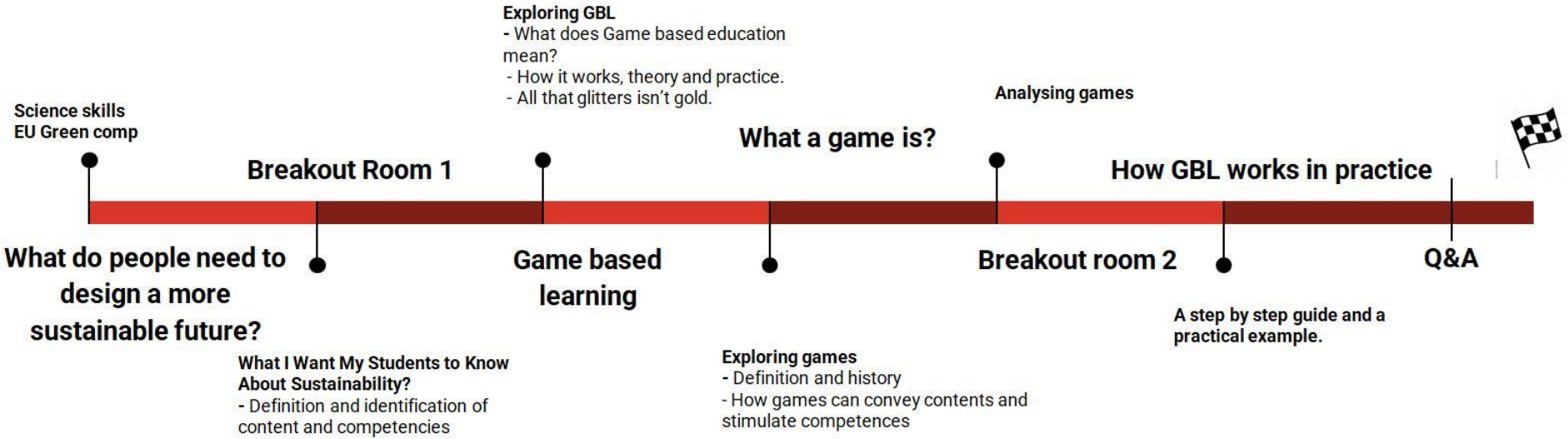
UNIVERSITÀ DI TRENTO Dipartimento di Lettere e Filosofia | GrACE Green Europe: Active Citizenship and the Environment

Jean Monnet EUROPEAN CENTRE UNIVERSITY OF TRENTO

The roadmap for today



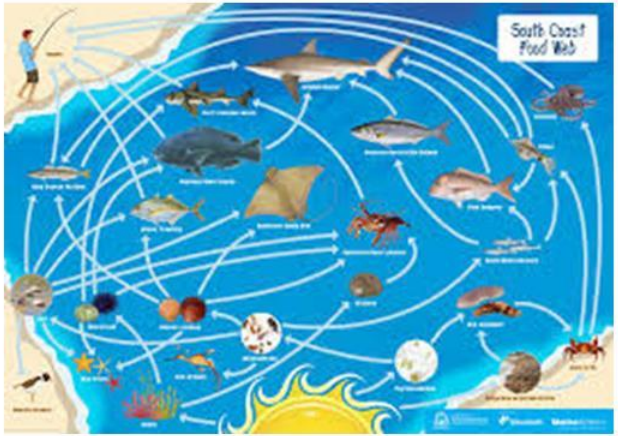
Who are we?

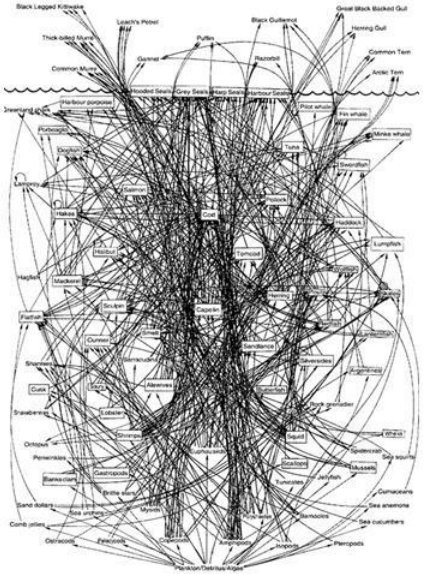
If it doesn't work go to mentimeter and use the code: 4768 6237

Visualize results

1 - What do people need to design a more sustainable future?

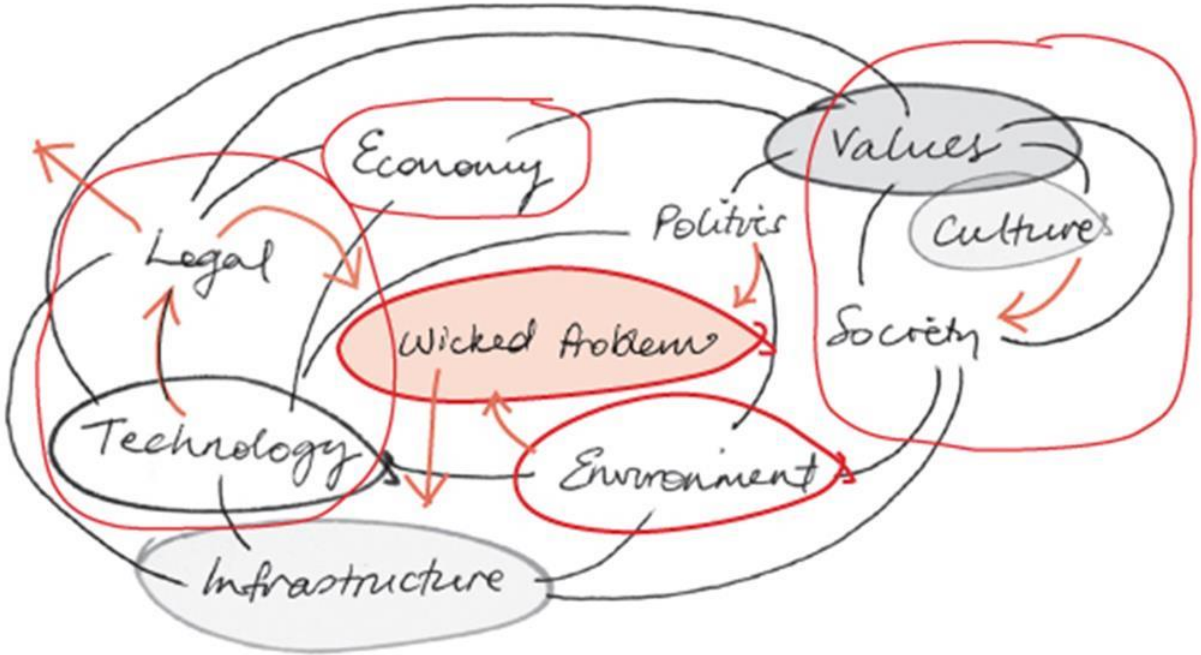
Sustainability is…



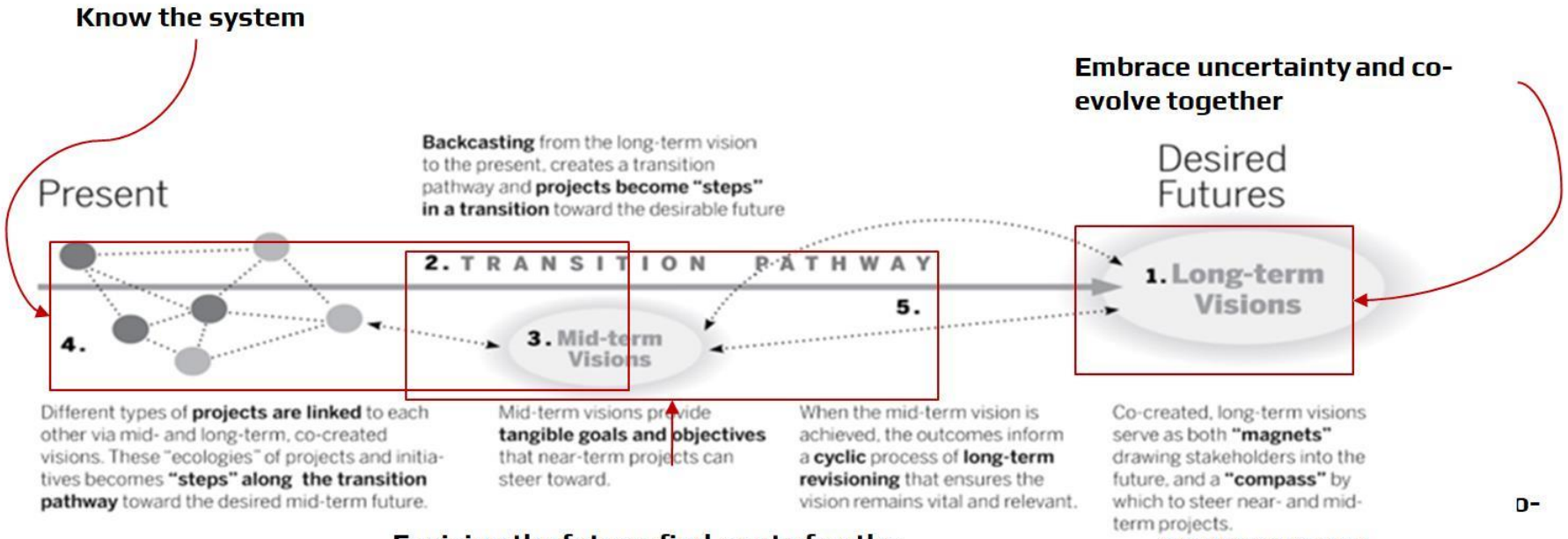


A **partial** food web for the Scotian Shelf in the Northwest Atlantic off eastern Canada. (Lavigne D., 1996)

Sustainability → wicked problem

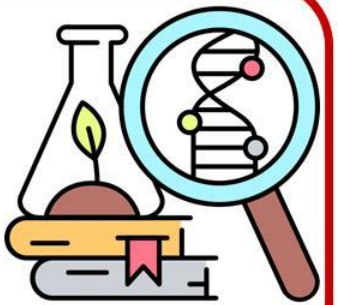


→ Sustainability education



Knowledge - contents

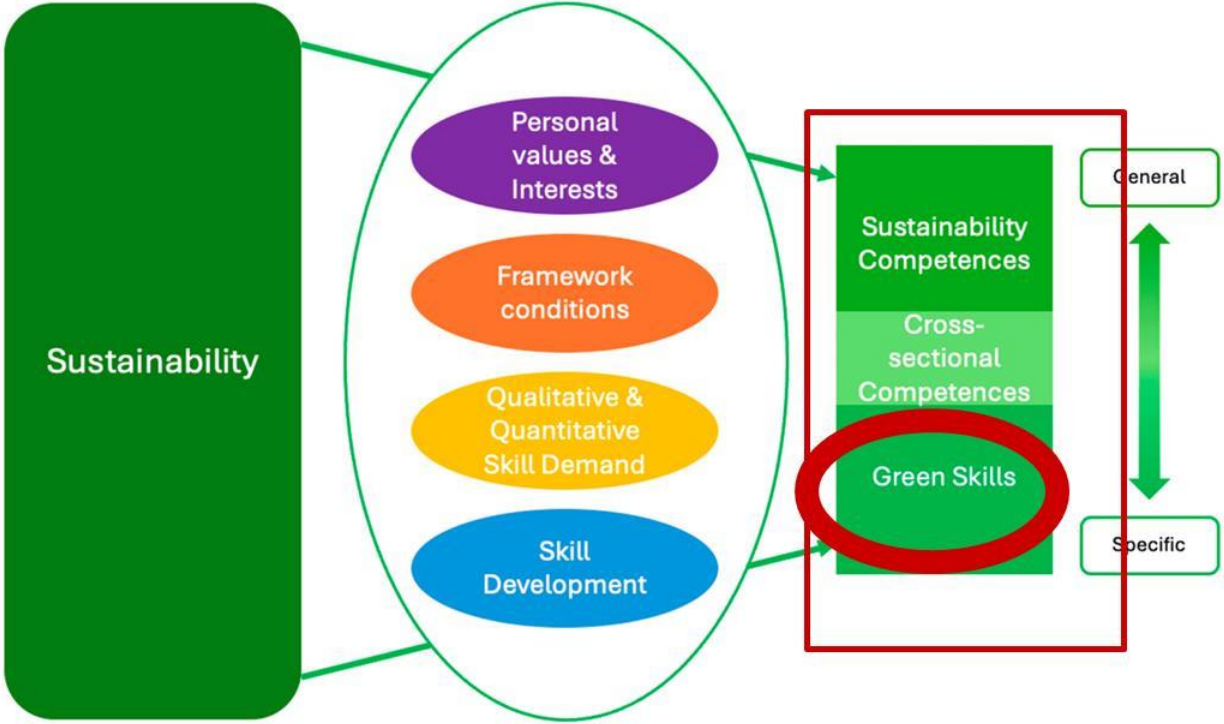
Economy and Social science

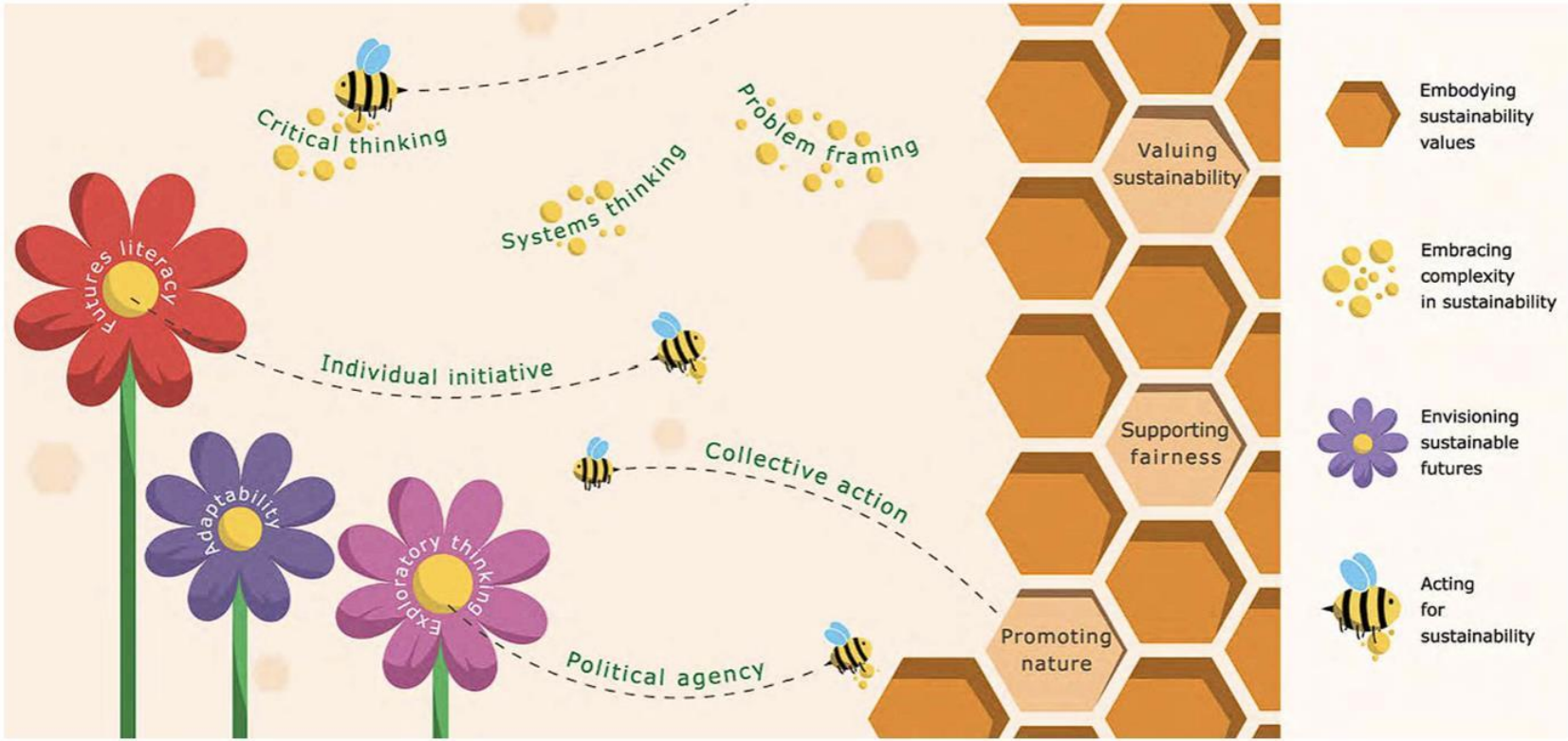


Humanities

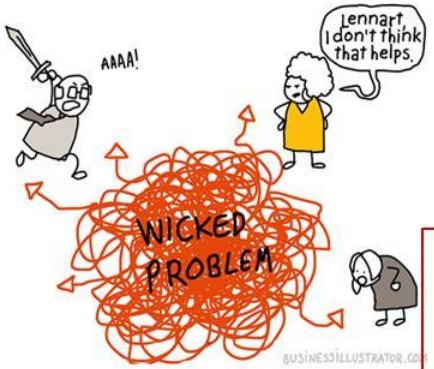
STEM…STEAM

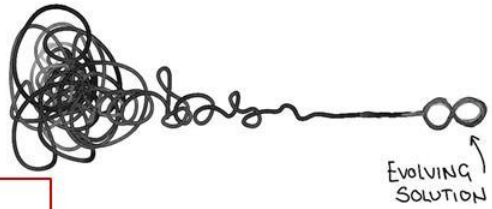
Competences and skills




Critical thinking
Problem framing
Systems thinking
Futures literacy
Individual initiative
Collective action
Adaptability
Exploratory thinking
Political agency
Valuing sustainability
Supporting fairness
Promoting nature
Embodying sustainability values
Embracing complexity in sustainability
Envisioning sustainable futures
Acting for sustainability

What do people need to design a more sustainable future?





- Scientific knowledge
- Awareness of systems and complexity
- EU green competencies - skills
- Reframe personal values
- Envisioning a common future

2 - Breakout room 1

Objective:

To collaboratively work on the different aspects of sustainability and identify key content and competencies that students should know about sustainability.

Duration → 20 minutes

What to do:

- Each group will brainstorm and list the key content and competencies related to sustainability that they believe students should learn to discuss/understand a topic - like climate change, renewable energy, waste management, etc.
- Competencies should include EU-green competence, scientific competences and/or life skills.
- Contents might include, Carbon cycle, prey-predator interactions, trophic networks,...
- Write these ideas on sticky notes using this code 4398 3172 o[illegible] code - if it doesn't work use the shared GFile

Duration → 12 minutes

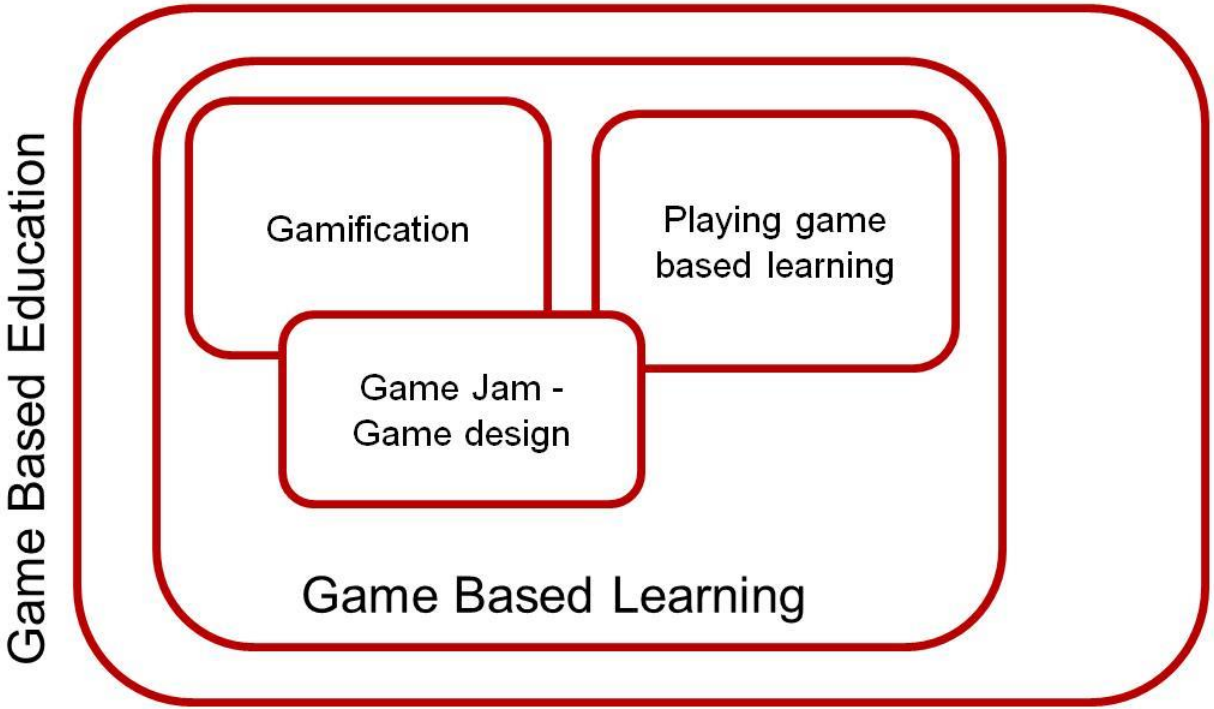
RESULTS HERE

3 - Game Based Learning

Or use this code: 1455 5370

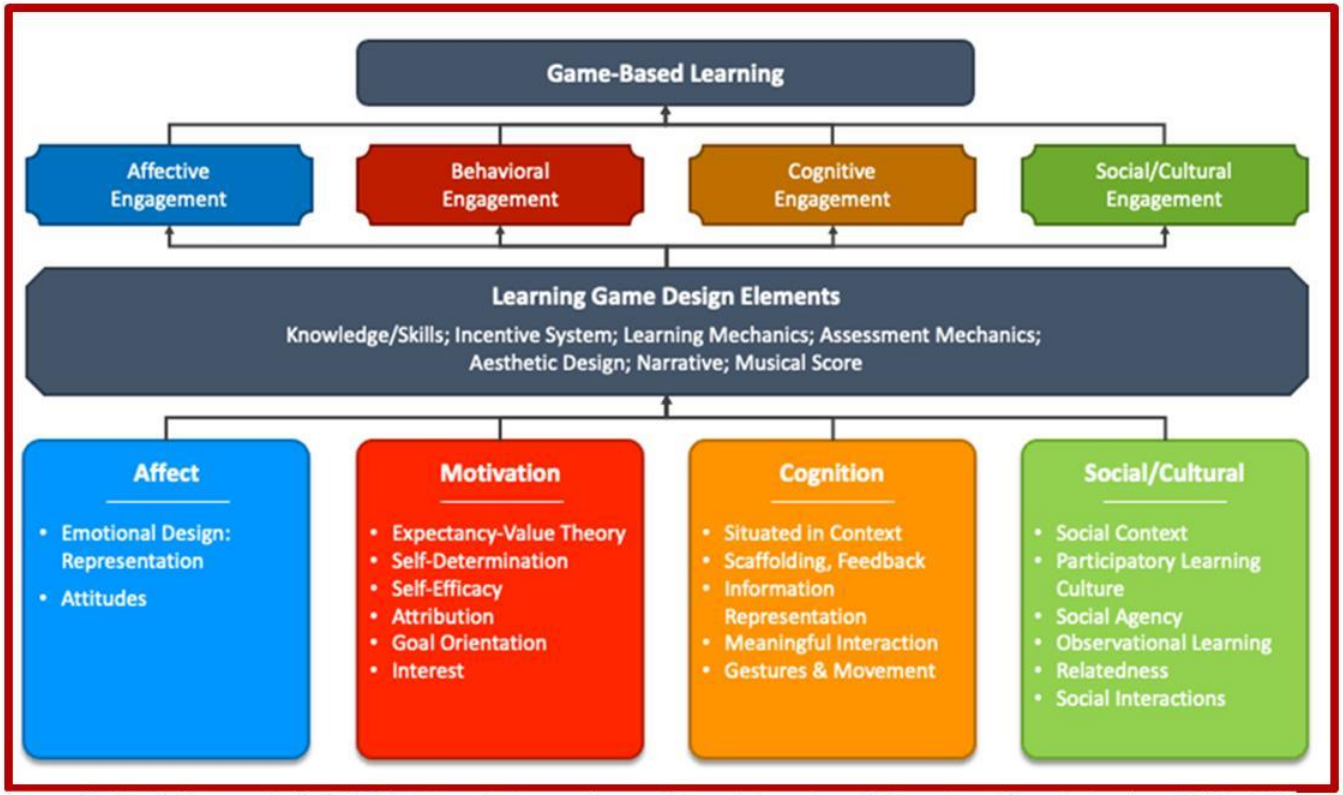
Results HERE

What does Game based education mean?



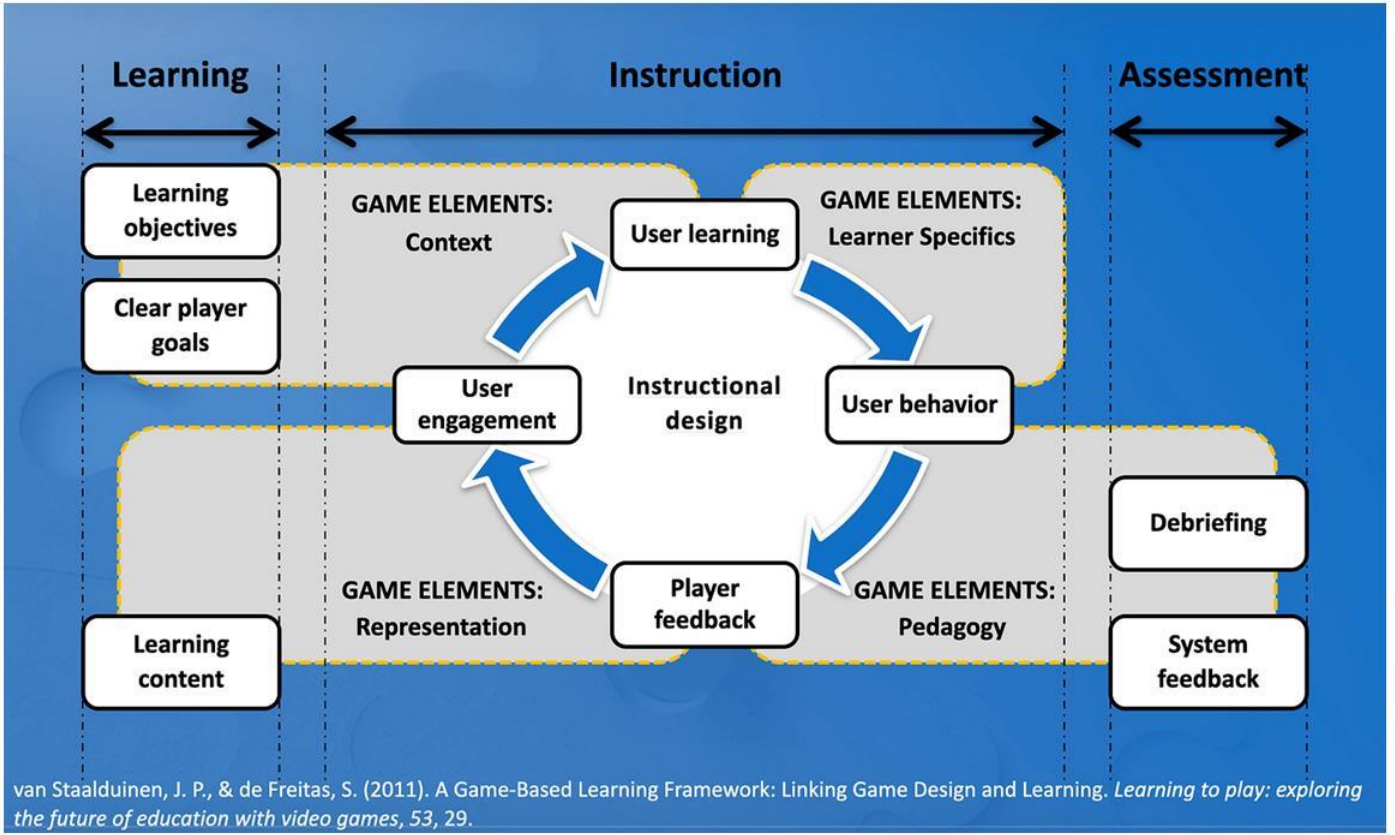
How it works, theory…

Game Based Education



Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of game-based learning. Educational Psychologist, 50(4), 263.

When we learn?

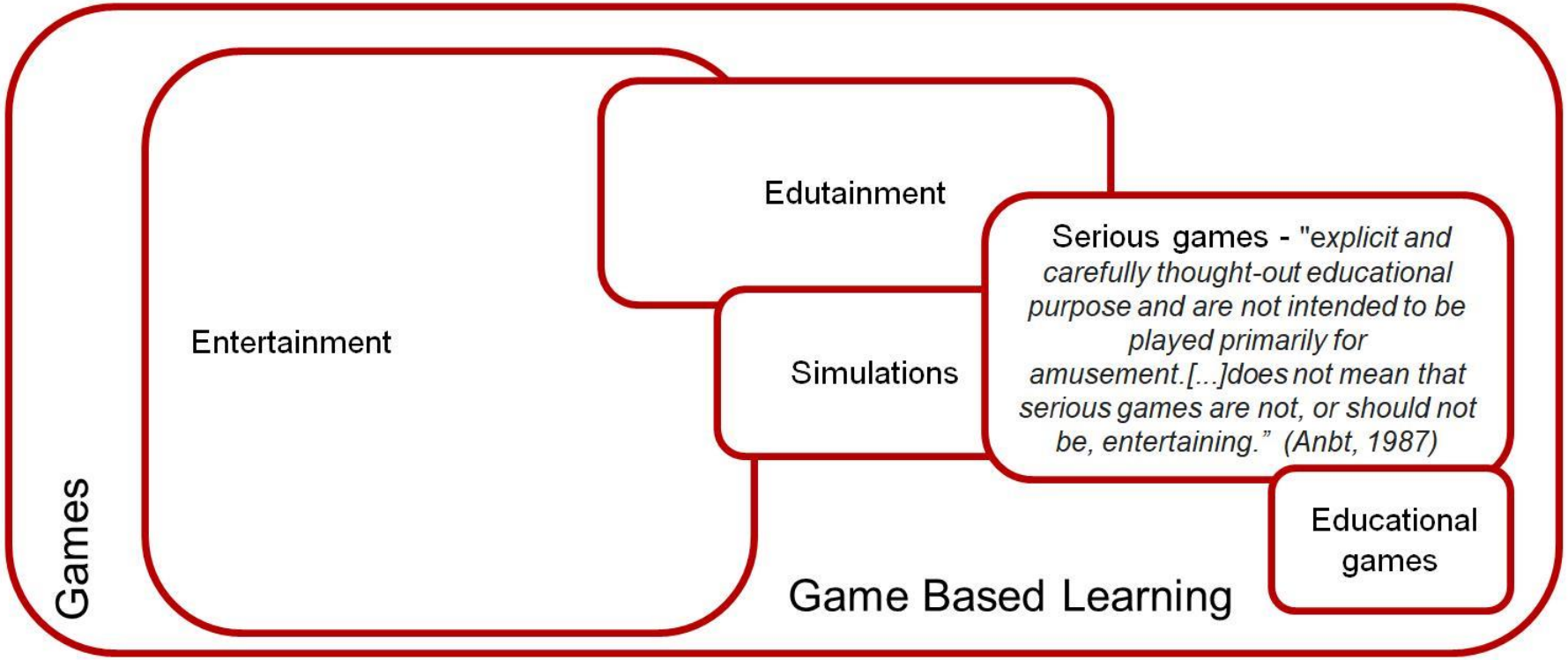


van Staalduinen, J. P., & de Freitas, S. (2011). A Game-Based Learning Framework: Linking Game Design and Learning. *Learning to play: exploring the future of education with video games*, *53*, 29.

All that glitters might not gold

01	Pre-knowledge	• Pedagogy and instructional design • How games are done and…if you are a gamer is a plus
02	Target audience	• Not all the students are willing to try a new approach • Flow and engagement are not easy to sustain • Playing can be frustrating/too challenging
03	Time consuming	• Time to prepare the module • Time to implement the GB in your class
04	Not easy to evaluate	• A change in the evaluation criteria and methods is mandatory but not always possible
05	Game characteristics	• Not all the games are good enough - contents/skills

What does Game based education mean?



Abt, C. C. (1987). Serious games. Lanham: University Press of America.

What does Game based education mean?

"Serious games, gamification and game-based learning are distinct from entertainment-oriented games in that, while they are often also enjoyable, they are designed for primary end purposes other than entertainment and leisure."

(Hamari J. et al., 2016)

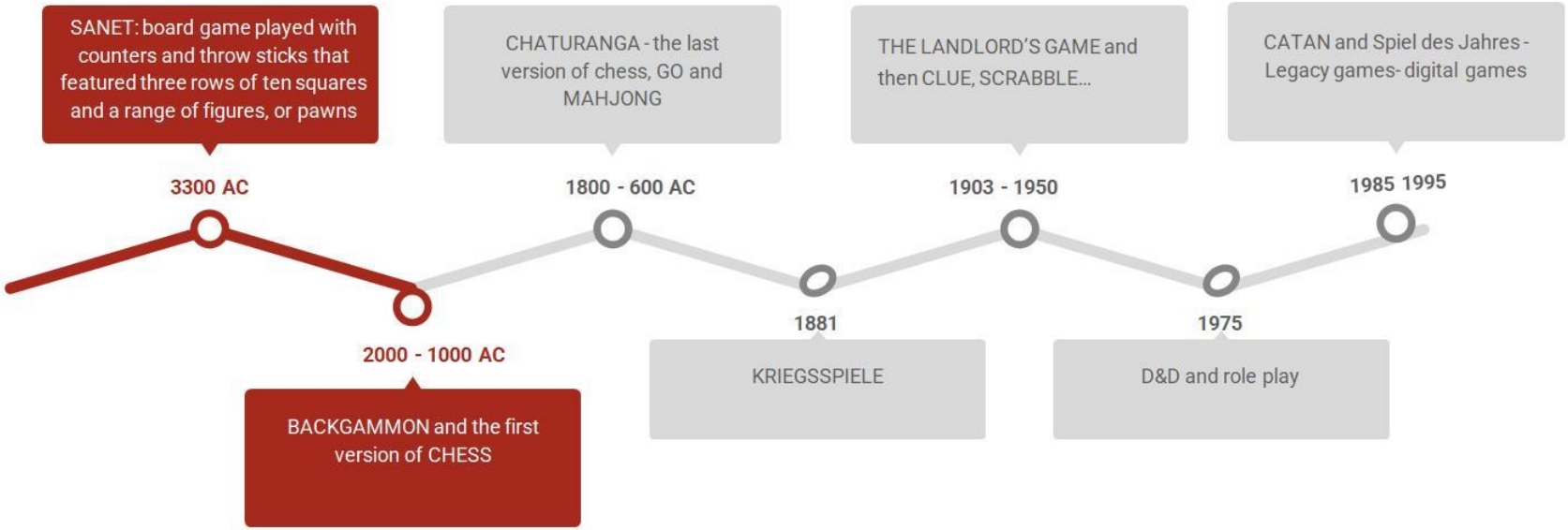
4 - What a game is?

"**A game** is defined as a **system** in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome.".

Artificial conflict

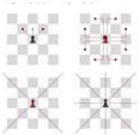
Salen, K., Zimmermann, E., Rules of play: game design fundamentals, Cambridge/London, MIT press. 2004

…and history


SANET: board game played with counters and throw sticks that featured three rows of ten squares and a range of figures, or pawns
3300 AC
2000 - 1000 AC
BACKGAMMON and the first version of CHESS
CHATURANGA - the last version of chess, GO and MAHJONG
1800 - 600 AC
1881
KRIEGSSPIELE
THE LANDLORD'S GAME and then CLUE, SCRABBLE…
1903 - 1950
1975
D&D and role play
CATAN and Spiel des Jahres - Legacy games- digital games
1985 1995

"**A game** is defined as a **system** in which players engage in an artificial conflict (game strategy and dynamics), defined by rules (mechanics + patterns), that results in a quantifiable outcome.".

Mechanics
- relations -



Patterns

Elements

Artificial conflict - Dynamics

Quantifiable result

Salen, K., Zimmermann, E., Rules of play: game design fundamentals, Cambridge/London, MIT press 2004

How a game can convey contents?

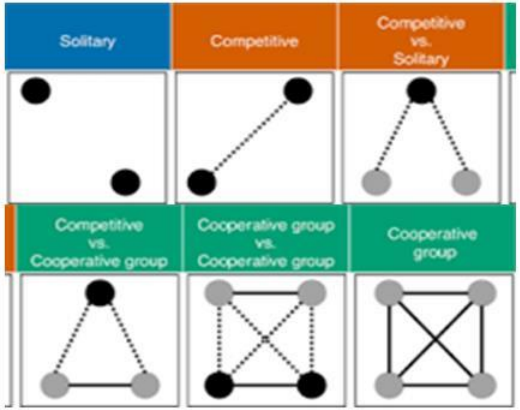
Cards and meeple

Concept - storyline

Tabletop

How a game can convey contents and skills?

Core dynamic



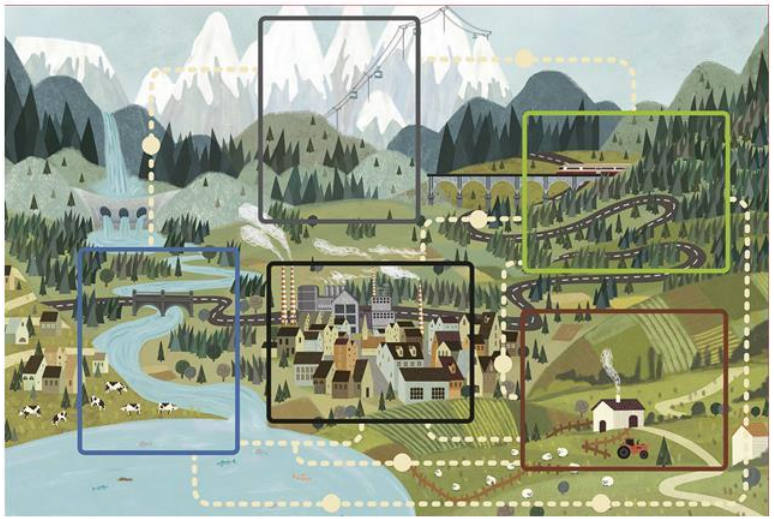
Feedback and rules

Scoring system

example - analysis of the game elements

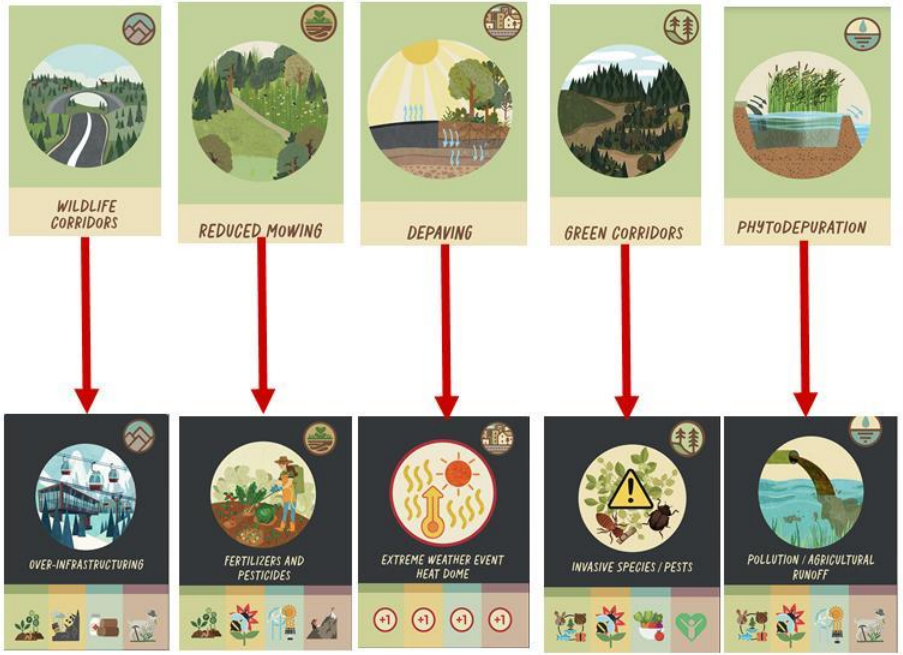
- **Cooperative** and **strategic** board game
- 4 players – age 12+
- Cooperate with each other to **mitigate the negative effects of overusing natural resources**, **rebuild ecosystems and restore their functions**, and save local communities. You will use **Green Infrastructure (GI) Cards and Ecosystem Services (ES) Cards in a race to save the five at-risk ecosystems**—mountain ecosystem, forest, rivers and lakes, the agroecosystem, and urban areas.

example - analysis of the game elements



- ✔ The concept of environment and landscape
- ✔ How ecosystems are linked each other and how are linked to the landscape
- ✔ How many ecosystems and characteristics of ecosystems
- ✔ Ecotonal areas
- ✔ Natural, semi-natural and anthropogenic ecosystems

example - analysis of the game elements



- ✔ The concept of **Nature Based Solutions** and **Green Infrastructures**
- ✔ How many GIs can be adopted, where and why
- ✔ How do they work and why they are crucial in **ecosystems restoration** and in **ecosystems services** recovering
- ✔ How they can contribute to the sustainability

4.2 - The FRACTAL board game example - analysis of the game elements

Game elements and mechanics

- Cooperative game mechanic
- Special powers of the characters
- Threat cards with immediate effects on Ecosystems service
- The temporary effect of GI cards
- The win/lose ratio and the critical point of ecosystems

EU-Green Comp

- Systems thinking → elements of a system, interconnections and delays in the system, feedback loops
- Future scenario building
- Problem solving and critical thinking

Skills

- Cooperation to face future challenges
- Negotiation and design of new common scenarios

5 - Breakout room 2

Objective:

To collaboratively work on how games element can be used to introduce concept and game mechanics can be used to foster some skills

Duration → 20 minutes

What to do:

- Each group will work on one game about sustainability → (you will have pictures of game elements and the game instructions)
- Read the materials you will provide with - a set of pictures of a game and a short version of the game instructions
- Brainstorm and list the key content - related to sustainability - can be easily introduced with game elements and through the game mechanics
- Write your findings using the shared file
- Sharing phase

  Duration → 20 minutes

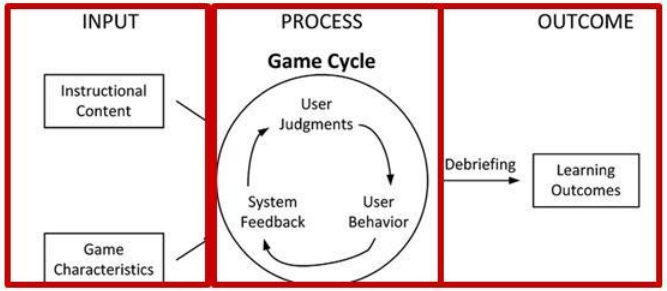
RESULTS HERE

6 - How GBL works in practice…

Before

- Set the expected educational outcomes (contents/skills).
- Analyse your target audience and…be ready to change e re-define your educational outcomes.
- Select the game …be ready to change e re-define your educational outcomes.
- Design the module - timing, instructions, assessment and feedback tools, rubric, how many debriefing phases, debriefing and metacognitive tools.

Game based module implementation

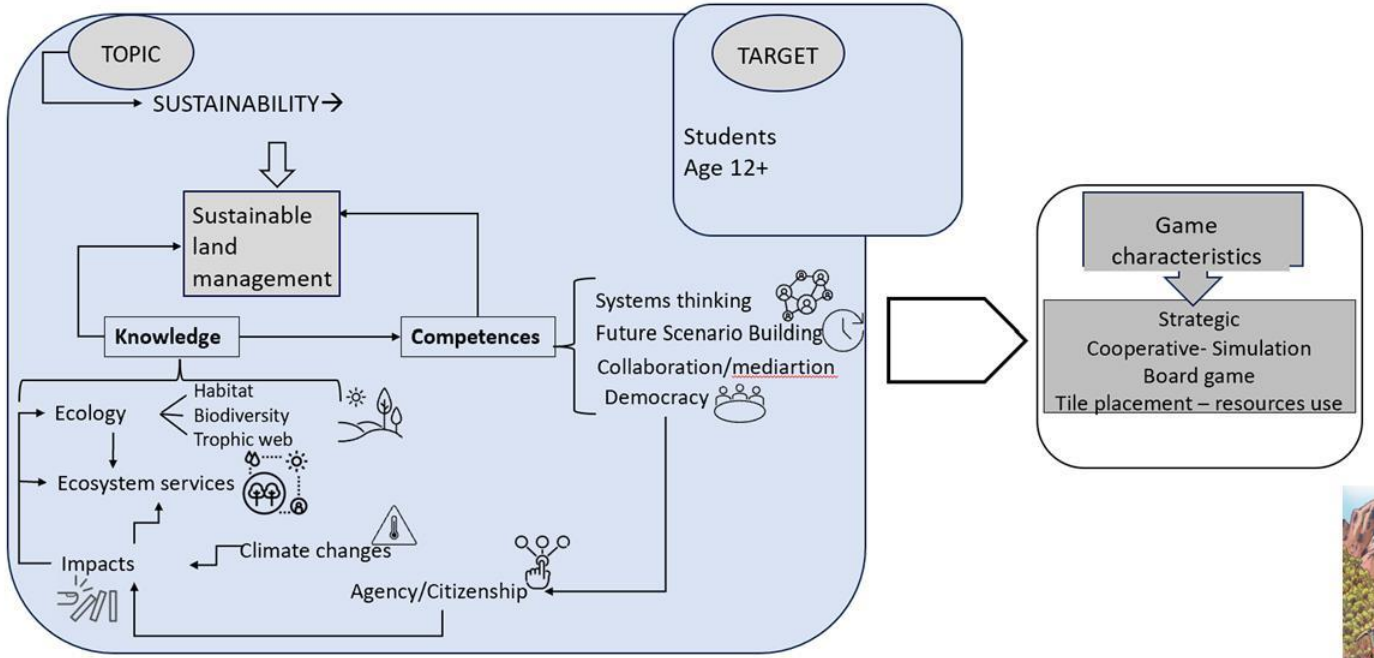


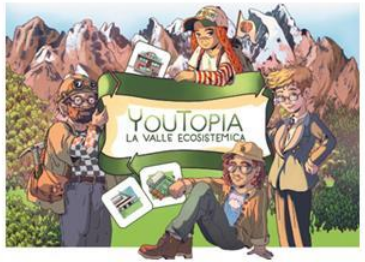
After the class

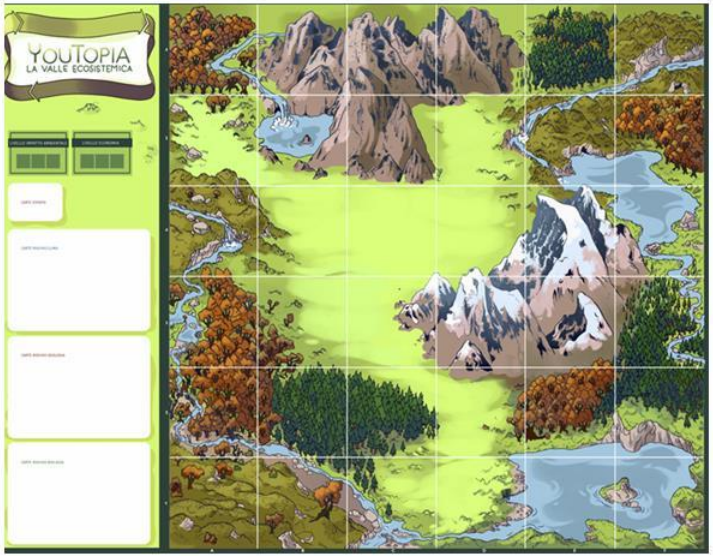
- Analysis of the feedback and assessment results → reflection and improvement
- Personalised or additional guidance for students
- Repeat the experience, try again!

Modified model by: Pan L, Tlili A, Li J, Jiang F, Shi G, Yu H and Yang J (2021) How to Implement Game-Based Learning in a Smart Classroom? A Model Based on a Systematic Literature Review and Delphi Method. Front. Psychol. 12:749837. doi: 10.3389/fpsyg.2021.749837

An example…


TOPIC
SUSTAINABILITY→
TARGET
Students
Age 12+
Sustainable land management
Knowledge
Competences
Systems thinking
Future Scenario Building
Collaboration/mediartion
Democracy
Habitat
Biodiversity
Trophic web
Ecology
Ecosystem services
Impacts
Climate changes
Agency/Citizenship
Game characteristics
Strategic
Cooperative- Simulation
Board game
Tile placement – resources use

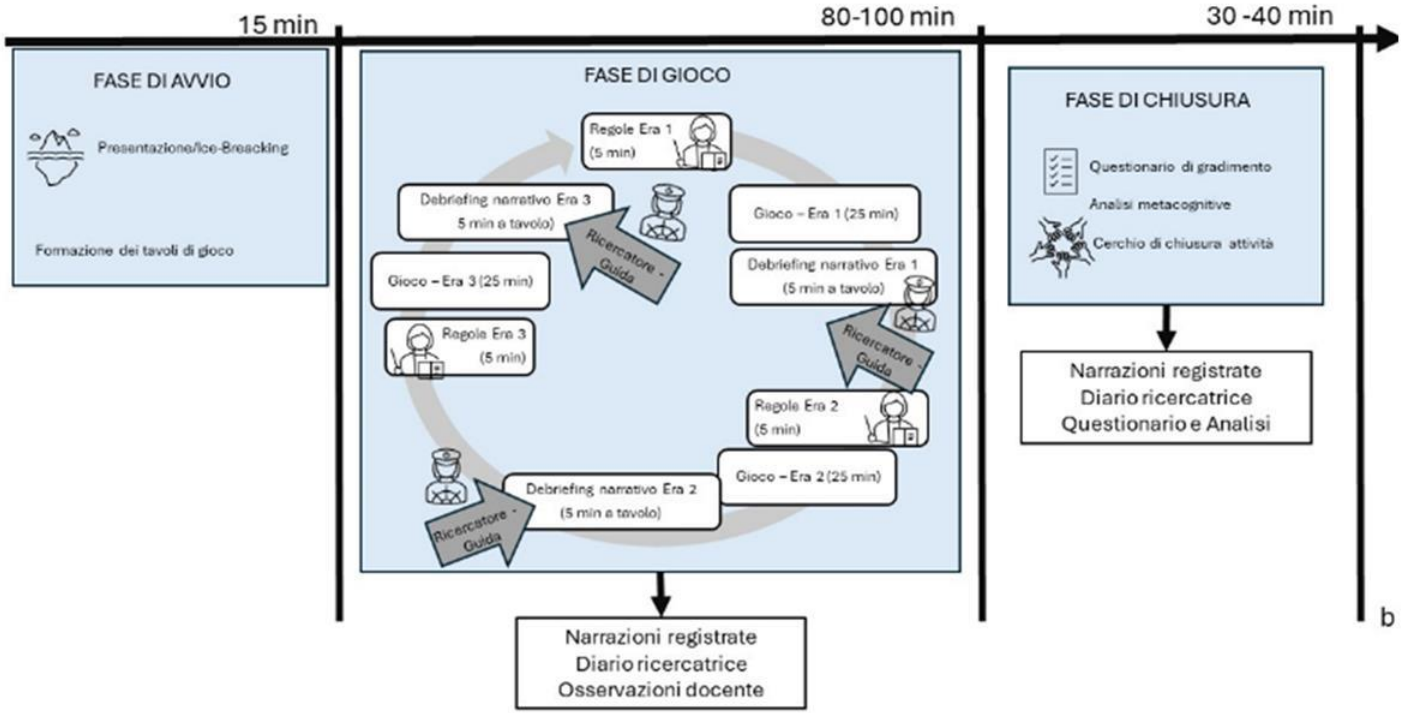

YOUTOPIA
LA VALLE ECOSISTEMICA



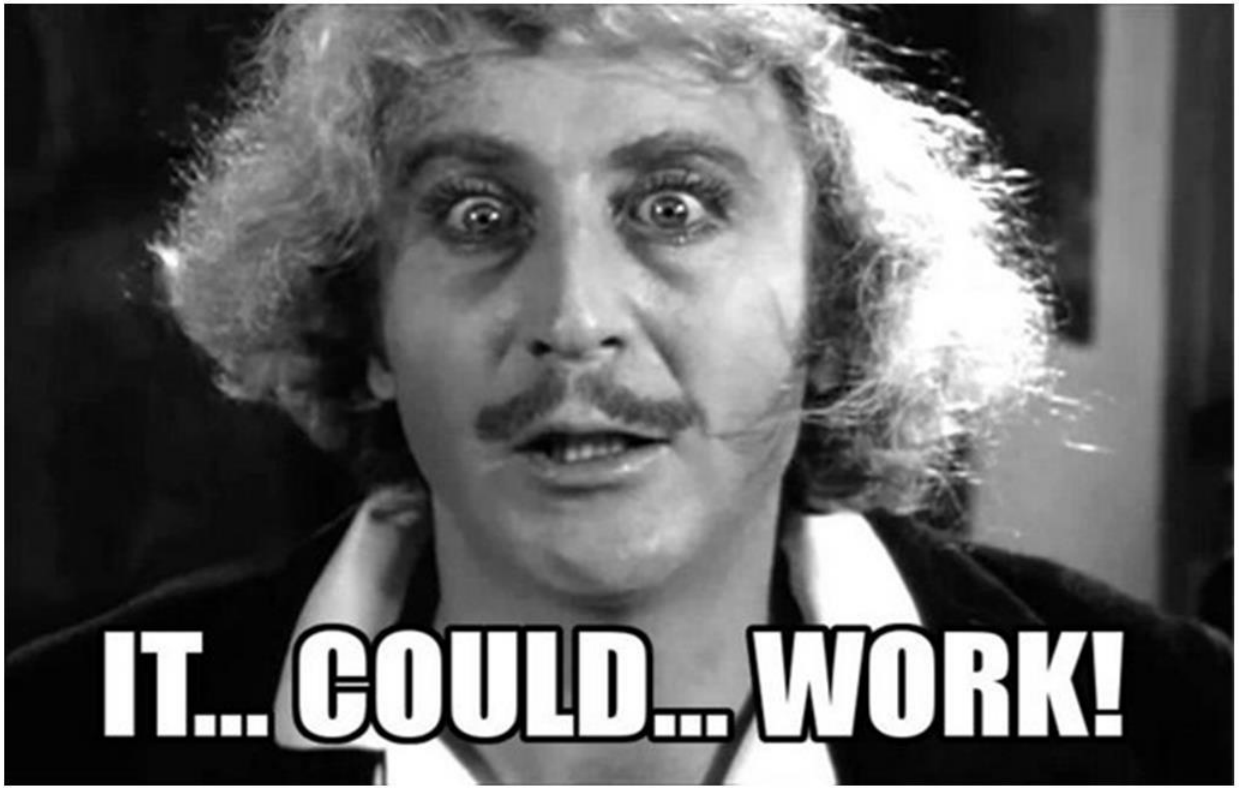
- **Cooperative** and **strategic** board game
- 6 players with special abilities linked to their expertise – age 12+

- Players are part of the same team and have a common goal: to drive the economic and social development of the valley while being careful to stay within the limits of environmental sustainability.

- Each action taken should be explained and approved by all the gamers and each player can use one of the “special power” to change or guide the final decision.


15 min
80-100 min
30 -40 min
FASE DI AVVIO
Presentazione/Ice-Breacking
Formazione dei tavoli di gioco
FASE DI GIOCO
Regole Era 1 (5 min)
Gioco – Era 1 (25 min)
Debriefing narrativo Era 1 (5 min a tavolo)
Ricercatore - Guida
Regole Era 2 (5 min)
Gioco – Era 2 (25 min)
Debriefing narrativo Era 2 (5 min a tavolo)
Ricercatore - Guida
Regole Era 3 (5 min)
Gioco – Era 3 (25 min)
Debriefing narrativo Era 3 5 min a tavolo)
Ricercatore - Guida
FASE DI CHIUSURA
Questionario di gradimento
Analisi metacognitive
Cerchio di chiusura attività
Narrazioni registrate
Diario ricercatrice
Questionario e Analisi
Narrazioni registrate
Diario ricercatrice
Osservazioni docente
b

It’s hard, but…



7 - Questions?

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Thank you!

Co-funded by the European Union

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