



ÉCOLE NATIONALE SUPÉRIEURE DES MINES

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How to teach industrial ecology with a serious game ? An application to a waste management case in an island context

February 2022 Working group chaired by Jean Jouzel → Report to Frédérique Vidal
Minister for Higher Education, Research and Innovation :

- *Prepare all citizens to play an active role in the transition to a new society, in the face of ecological and societal challenges and the urgent need to tackle climate change.*
- *Raise awareness and provide training on the challenges of the ecological transition and sustainable development in higher education.*

Over 27 years' teaching experience, with a major in environmental studies (env regulation, environmental management, water and waste management, soil remediation, cleaner production, best available techniques)

Few traditional courses ... innovative teaching

- Simulation
- E-learning
- Problem-based learning
- Situational scenarios
- Serious game

2016: Complete restructuration of engineering courses

Basic information

- undergraduates and master's students
- 33h industrial ecology course :
 - Classical lectures,
 - Tutorials,
 - Conference and Visit
 - **A serious game TAMO LAVIVA**



Pedagogical objectives

- To understand the concepts and issues of industrial ecology (IE) in a given geopolitical context
- To know how to apply IE tools: territorial metabolism, flow analysis, environmental and economic analysis
- To acquire a general vision of flow management in an area and its links to regional dynamics (from the economic, social, environmental and governance perspectives)
- To conduct a negotiation around an IE project

the paradise



the hidden face of paradise



Serious game : a role play



The objective : collectively find a solution to the island's urban waste management

Mayor

the technical manager
of the island's waste
management system

a representative of
the hotel and
restaurant businesses

a representative of
the agricultural
sector

a representative
of an NGO



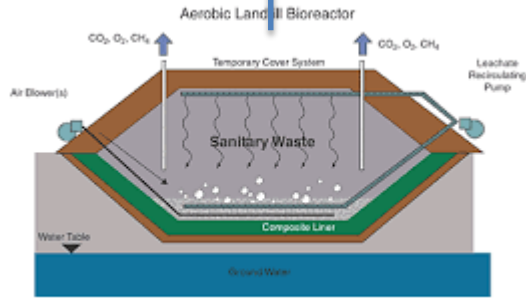
Scenarios

45% of input waste are biowaste

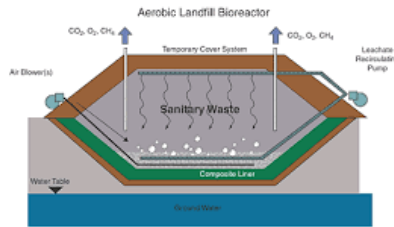
Opportunity to launch awareness program for waste reduction and sorting

Choice to legalise informal work

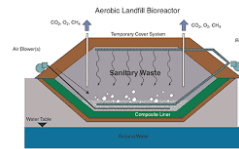
biogas



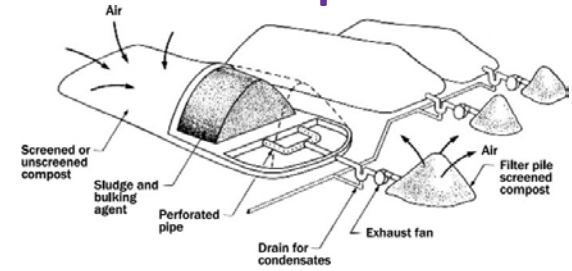
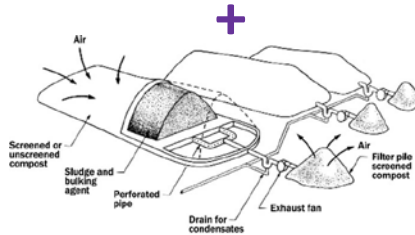
Scenario 1



Scenario 2



Scenario 3



Steps

MOOC : negotiation (6h)

Autonomous

preparing students for the
negotiating table

Students deliverables :

- a negotiation table
preparation sheet (MOOC)
- a checklist for a successful
agreement (MOOC)

Steps

MOOC : negotiation (6h)

Rôle and negotiating table preparation (3h)

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- a checklist for a successful agreement (MOOC)

One room one role

distribution of roles and role cards

Students deliverables :

- the preparation sheet completed (MOOC) for the negotiating table on the scenario to be dealt with

Steps

MOOC : negotiation (6h)	Rôle and negotiating table preparation (3h)	negotiation table and deliverables (4h)
<p>Autonomous</p> <p>preparing students for the negotiating table</p> <p>Students deliverables :</p> <ul style="list-style-type: none"> - a negotiation table preparation sheet (MOOC) - a checklist for a successful agreement (MOOC) 	<p>One room one role</p> <p>distribution of roles and role cards</p> <p>Students deliverables :</p> <p>the preparation sheet completed (MOOC) for the negotiation table on the scenario to be dealt with</p>	<p>One room one role one teacher</p> <p>2h : negotiation table</p> <p>30 min : finalization of scenarios and preparation of interventions for the plenary session</p> <p>1h30 : plenary session → Each group presents + feedback by role and on the game</p>

Composition of the game box

Design and Illustrations of the gamebox : Estelle OTTAVIANO, student in design 2023, Design School Saint-Etienne France








Objectives	Student's deliverables for evaluation
General vision of the flows management and actors	Mapping of exchanges between actors (typology of physical flows of information - relational - power games)


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Results of the environmental assessment and economic analysis with the Excel® Tool proposed



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Self-assessment (not included in the rating)	Individual feedback on how they have been active in the trading table

Feedback

- 86 trained students : three years of experimentation (2020 to 23)
 - Five teachers for the design, the tests and the animation
 - 10 meetings of 3 hours to ensure a good pedagogical alignment between the objectives, the lecture types and the evaluation of the knowledge acquired
 - Various activities : lectures, tutorials, visits, conferences, online course and the serious game
- ➔ make it possible to juggle theoretical knowledge and its implementation through more playful teaching

Student's feedback

“The course provides a broad knowledge of the principles, precautions and criteria for successful negotiation. It taught us to understand the intricacies, the mechanics, the give and take and the processes involved in achieving success in creating value together”.

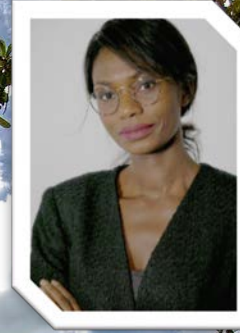
« At first it doesn't seem like you have to do much, but in fact you're a key player, and the role is pretty straightforward because you have nothing to lose. Very rewarding ! »
agricultural sector responsible role

« This negotiation turned out to be quite an immersive and instructive exercise, as it enabled us to clearly define the contours of a negotiation based on all the structural and social-economic constraints. »

The TEAM : Serious Game TAMO LAVIVA



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MINES
Saint-Étienne

Une école de l'IMT

Thanks !

