

MODULE 3 – RESPONSIBILITY, PROMOTED THROUGH STEM EDUCATION

ONLINE HIGH-FLIERS OPERATIONAL MANUAL FOR UNIVERSITY SCIENCE STAFF

A handbook to implement High-Fliers module 3

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THE STRUCTURE OF THE MODULES OF THE **HIGH-FLIERS** PROGRAMME:



ERASMUS+ High-Fliers – Highly Interactive Guidance Helpful for Leadership in Educationally Relevant Skills

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OBJECTIVES OF MODULE 3

After this module, participants should be able to:

- acquire and understand the importance of social skills (e.g. self-responsibility, responsible action, cooperation/collaboration, reflecting through adopting multiple roles) and skills to apply to STEM-related positions (presentation skills, interaction, leadership skills, understanding surroundings, democratic values).

STRUCTURE OF MODULE 3

Types of activities	Before Session 1. (1h)	Session 1. Reflecting on Responsible Behaviour (1,5h)	Session 2. MoGreen Project: the beginning of a journey (1,5h)	Session 3. MoGreen Project: from concept to action (1,5H)	Session 4. Ending session (1,5h)
Essay	+				
Introduction of the scenario		+			
Theoretical section		+		+	
Panel discussion (role play)		+	+	+	+
White report					+
Sum-up, evaluation, conclusion					+

Scenario setting	Contextualization/ De-contextualization	Re-contextualization
As members of the MoGreen project team, participants explore strategies for transforming a city into a Green City.	Through role-playing, participants assume the roles of multidisciplinary experts and engage in reflective discussions on the transformation of a city into a Green City. Also, they present their arguments using Toulmin's argumentation model, both verbally and in writing.	This session aims to equip teaching professionals with the necessary skills, attitudes, and collaborative abilities to engage in responsible scientific discussions with their peers.

BEFORE SESSION 1.

STRUCTURE OF ACTIVITIES

Activities	Time
Writing an essay	60 min
Homework assignment	<p>Participants are required to write an essay, one week prior to Session 1, based on the paper "The Realisation of Global Warming". It is expected that participants are able to reflect on the importance of grounding decisions on scientific knowledge. These essays are used later in Session 1. to introduce the concepts of responsible behaviour, self-responsibility and justified decision-making.</p> <p>Writing length: 1A page</p>

MATERIALS

Williams, B., Clough, M. P., Stanley, M., Takle, E. S, & Colbert, J. T (n.d.). *The Realization of Global Warming*. <https://www.storybehindthescience.org/>

ACTIVITIES

Proposed scenario for the essay:

Based on the paper "The Realization of Global Warming", write an essay about the importance of grounding decisions made on scientific knowledge and adopting responsible environmental behaviour. The goal is to write an essay that is approximately one page in length.

In your essay, you should first summarize the main points made in the paper "The Realization of Global Warming" about the importance of basing our decisions on scientific knowledge and responsible environmental behaviour. Next, you should discuss why these points are important and provide examples of how this can be applied in real life. Finally, you should conclude by reiterating the importance of grounding decisions on scientific knowledge and responsible environmental behaviour in order to mitigate the effects of global warming.

It is important to use clear, concise, and well-structured writing, and make sure to provide enough evidence and examples to support your arguments.



SESSION 1. REFLECTING ON RESPONSIBLE BEHAVIOUR

1.1. OBJECTIVES

After this lesson, participants should be able to:

- recognize the importance of self-responsibility in STEM teaching;
- understand and define the concept of “Responsible behaviour”; “Self-responsibility” and “Justified decision-making”;
- describe, define and understand the concept of “green city”;

1.2. STRUCTURE OF ACTIVITIES

Activities		Time
Introduction	Description of module structure, content, and objectives	10 min
	Introduction to responsible behaviour, self-responsibility, justified decision-making, based on the analysis of the participants written essay	30 min
	Scenario setting - Introduction to the MoGreen Project	5 min
The concept of a “green city”	Reading paper Brillhante & Klaas (2018)	15 min
	Discussion about the concept of a “green city” – task 1	30 min

1.3. MATERIALS

Brilhante, O. & Klaas, J. (2018). Green City Concept and a Method to Measure Green City Performance over Time Applied to Fifty Cities Globally: Influence of GDP, Population Size and Energy Efficiency. *Sustainability*, 10, 2031. <https://doi.org/10.3390/su10062031>

1.4. ACTIVITIES

Introduction and definitions of concepts

This activity is designed to encourage participants to think critically and reflect on the concepts of “responsible behaviour”, “self-responsibility”, and “justified decision-making”. The teacher first analyses the participant’s previously written essays on these topics to gain insight into their current understanding and perspectives. Through class discussion, the different perspectives and definitions of these concepts are analysed, providing the participants with a comprehensive view of these topics.

The core of the activity is a whole-group discussion, where the participants have the opportunity to engage with each other and analyse the concepts in-depth. Through this discussion, participants gain a



deeper understanding of these important topics, as well as develop critical thinking and communication skills. Ultimately, the goal of this activity is to help participants make informed, responsible, and sustainable decisions in their daily lives.

Current definitions of each concept, that could be used at the end of the class discussion, to organize ideas:

Responsible behaviour - “[...] entails self-motivation and self-guidance, and not obedience and compliance to rules merely in response to external supervision, rewards and punishment. It refers “to moral and social responsibility, which is the ability to make decisions that concerns issues of justice, rights, and the welfare of others, and to act in accordance with such decisions” (Bear, Manning & Izard, 2003, p. 140).

Self-responsibility - “[...] means the accountability of an individual or collective actor for actions that have already been performed or are going to be performed in the future” (Maier, 2019, p.27). “Related to this concept is that of autonomy, which points ideally to the capacity of human beings to reason self-consciously, to be self-reflective and self-determining [...] autonomy designates the ability to deliberate, judge, choose, and act with regard to various courses of action, in private as well as public life” (p. 28).

Justified decision-making - “Involves explicit representation of the assumptions of, and steps in, the argument. Arguments for a decision are justified in some way and the credibility of the justification influences the force of the argument” (Fox & Mogdil, 2006, p. 276).

Scenario setting

After gaining an understanding of the concepts of "Responsible behaviour," "Self-responsibility," and "Justified decision-making," the participants are presented with the initial scenario for Module 3. This scenario is incorporated into activities during Sessions 2, 3, and 4.

Initial scenario:

The City Council is implementing various measures to transform the city into a Green City. These measures include:

- Implementing traffic conditioning in the city to promote bicycle usage.
- Promoting healthy habits, such as outdoor exercise, for the entire population.
- Creating a green ring that surrounds the city.

However, the Active Neighbourhood, which focuses on promoting the well-being and cooperation between generations, raises the following concerns:

- Conditioning traffic in the city: this may limit people's mobility.
- Promoting the use of bicycles: it is not possible for everyone.
- Promoting healthy habits such as outdoor exercise for all population: requires appropriate outdoor spaces.
- Creating a green ring that surrounds the city: it is not within walking distance of all housing blocks and may demand the individual use of cars.

Participants reflect on how to transform the city into a Green City and propose solutions to address these challenges.

Discussion about the concept of “green city” – task 1

In this activity, participants are tasked with exploring the steps necessary to turn a city into a Green City, while taking into consideration the perspectives of the City Council and the Active Neighbourhood. The first step in this process is to understand the concept of a Green City.

To accomplish this, participants are asked to read selected sections of the paper Brilhante & Klaas (2018) that provide insight into the Green City Conceptual Framework. The sections they read include the Abstract and Introduction, the Green City Conceptual Framework and 3.4.5. Assessing the Claim that a Green City is also a Sustainable and Liveable City.

After reading these sections, participants participate in a group discussion to further analyse the concept of a Green City. The discussion is guided by the paper's definition of a Green City as "one of the latest responses to the diverse efforts and research conducted to address the problems caused by the dispersed model of city development and to help cities to become more sustainable (greener), less dispersed and more liveable."

During the discussion, participants explore the following topics:

- The main concepts that emerge from the theory of sustainability applied to city development.
- The definition of "Green" and "greening".
- Thematic areas involved in the Green City Conceptual Framework.
- Main influences on Green City Performance.

The goal of this activity is to encourage participants to think critically about the concept of a Green City, and to understand the steps necessary to make a city more sustainable, liveable, and less dispersed.



SESSION 2. MOGREEN PROJECT: THE BEGINNING OF A JOURNEY

2.1. OBJECTIVES

After this lesson, participants should be able to:

- identify and discuss measures to mitigate Climate Change.
- analyse and evaluate real-life problems, conceiving possible solutions, supported by scientific knowledge.
- develop autonomous research on the scientific field using critical thinking.
- develop a critical assessment of the advantages and disadvantages of different solutions.
- recognize the importance of teamwork to answer to complex scientific problems.

2.2. STRUCTURE OF ACTIVITIES

Activities		Time
MoGreen Project: the beginning of a journey	Task 2	90 min

2.3. ACTIVITIES

MoGreen Project: the beginning of a journey

As mentioned in the main scenario for Module 3, participants are guided to participate in the MoGreen project. In this activity, participants are assigned to a team and tasked with becoming a part of the MoGreen project. Their objective is to come up with solutions to make a city more environmentally friendly and sustainable, referred to as a Green city. The participants work in groups of 3 to 5, depending on the size of the class, to brainstorm and discuss different solutions for various aspects in the city, such as energy, transportation, urbanism, urban biodiversity, and public health.

Each group (expertise in one of the disciplinary areas considered) appoint a designated leader who acts as a speaker for the group. The participants conduct research and gather information and arguments to support their ideas. They then participate in a role-playing panel discussion with other expertise teams to share their solutions. Finally, the participants come together as a class to present a white report that outlines the target areas for intervention and citizens' commitment to making the city more environmentally conscious.

This activity requires collaboration and effective communication skills, as participants work in a multidisciplinary environment and present their findings to the class as a whole.

Proposed briefing scenario for task 2:

Create an expertise team to discuss possible solutions (for instance, energy, transport, urbanism, urban biodiversity or, public health), discuss possible solutions for the problem and prepare to participate in a panel discussion with other expertise teams and, finally, present a white report that establishes the target areas of intervention and citizens' compromise.

- Create an expertise team to discuss possible solutions (energy, transport, urbanism, urban biodiversity, public health)



- Choose a team leader as speaker for the group
- Search for information and arguments (Group work)
- Promote a panel discussion with other expertise teams (Role playing)
- Prepare a report as a white paper that establishes the target areas of intervention and citizens' compromise (multidisciplinary team - the class)

Teacher guidelines:

- Form different groups with different areas of expertise (energy, transport, urbanism, urban biodiversity, or public health) and ask each group to choose a speaker.
- Explain the goal of preparing a panel discussion between the groups, which is moderated by the team leaders (role playing).
- Select two team leaders (depending on the size of the class) to oversee the work of each group and moderate the panel discussion.
- Assist the groups in their research for information and arguments to support their solutions (group work).
- It should be highlighted to participants that they have the freedom to think of any solutions to solve the problem.

Note: The panel discussion leading to the white paper report is performed in the next sessions.



SESSION 3. MOGREEN PROJECT: FROM CONCEPT TO ACTION

3.1. OBJECTIVES

After this lesson, participants should be able to:

- identify and discuss measures to mitigate Climate Change;
- argue using Toulmin's Model;
- apply different problem-solving techniques in order to solve problematic situations;
- communicate in a clear and appropriate way, in order to convey the respective messages, in science field;
- demonstrate an assertive and affable attitude using articulated argumentation;
- apply communication mechanisms/strategies in panel discussions;

3.2. STRUCTURE OF ACTIVITIES

Activities		Time
Finishing Task 2		30 min
MoGreen Project: From Concept to Action	Panel discussion – Role playing	40 min
	Introduction to an argumentation model (Toulmin)	20 min

3.3. ACTIVITIES

Panel discussion

Panel discussion learning objectives:

- communication skills
- justified decision-making
- leadership skills
- reflection by confronting multiple perspectives
- respect to democratic values

Participants are required to complete the team-work, so they can progress to the panel discussion.

The participants are required to provide answers for the following problem: “how to turn a city into a Green city?”. It should be highlighted to participants that they have the freedom to think of any solutions to solve the problem.

Each participant assumes the role of an expert and verbally shares and defends their solution for the given problem with the rest of the group. It is important that each participant has an opportunity to share his/her ideas and that other participants listen. The team leaders pose questions to the experts in order to clarify positions and arguments and to find points in common in order to develop a collective proposal for the white paper.



Proposed briefing scenario for the panel discussion guidelines (to the participants):

Each person within the group assumes the role of an expert in a certain area and prepares their proposals for the issues that have been raised. The group's speaker presents the group's ideas within 5 minutes.

The team leaders ask for clarification of positions and for arguments for and against the different positions. Each "expert" responds to the team leader questions and may question other "experts".

The team leaders summarize the main questions that need to be further addressed in order to have a collective proposal for the white paper.

Panel discussion guidelines for the teacher:

- Present the discussion panel guidelines and learning objectives before participants work in the groups.
- Asks "experts" to record their positions and arguments and share them with the teacher at the end of this session.
- Check the nature of their arguments as they prepare for the discussion; question them if appropriate.
- Make sure that the team leaders understand their/his/her role as moderator of the discussion, with the goal of arriving at a collective proposal.
- As the participants present their arguments, take note how they fit into the Toulmin model of argumentation.

Moderator guidelines (not for participants):

In case the participants require further guidance to develop their ideas, the moderator may provide the following guidelines, taking into consideration the proposals of each group/experts:

Biodiversity: to question about the advantages and disadvantages of green ring around the city Vs green islands (taking into consideration the biodiversity preservation Vs the citizens' comfort and life quality)

Energy and transports: to question about the advantages and disadvantages of using individual transports (with or without shared use) Vs public transports; advantages and disadvantages of using alternative sources of energy to fossil fuels.

Urbanism: to question about the advantages and disadvantages of cycle-paths and the concentration of services in specific places in the city Vs local commerce and services.

Public Health: to question about issues related to the wellbeing, such as noise, air quality, facilities for physical activity; and issues related to individual mobility.

Introduction to Argumentation and Toulmin's Model

Once participants discuss the solutions they have for the problem, the teacher introduces the notion of argumentation and to Toulmin's model, which is to be used later to put forward their resolutions in the white paper.

Argumentation

Briefly present the notion of argumentation, making connections with the Panel discussion that took place beforehand.

Toulmin's Model

Present the main features of Toulmin's model of argumentation as a tool that can support participants in organising and supporting the arguments they are to put forward in the White Paper.

Describes the argument in three dimensions:

- 1) Data (events or observations used to support the claim).
- 2) Conclusion/claim (opinions or explanations for the solution of the problem).
- 3) Guarantee/Warrant (statement relating the conclusions to the data).

Features still:

- 1) Foundation/Rationale (the reasons why the data support the claim).
- 2) Modal qualifier (indicator of the degree of certainty or uncertainty of an argument).
- 3) Refutation condition (gives information about the conditions under which the argument cannot be considered valid).



SESSION 4. END SESSION

4.1. OBJECTIVES

After this lesson, participants should be able to:

- recognise and understand the characteristics of white paper reports.
- work as a team, in a collaborative way, identifying common points of view.
- think about scientific topics in a critical way, exhibiting critical and scientific answers.
- write a white paper report, based on expert knowledge and research.
- self-identify developed skills.

4.2. STRUCTURE OF ACTIVITIES

Activities	Time
Reflection about the arguments used in the panel discussion	20 min
Writing of the white report	40 min
Reflection about the skills developed in the module	30 min

4.3. ACTIVITIES

Reflection about the arguments used in the panel discussion.

Guidelines for reflection on the arguments used in the discussion:

- Encourage participants to reflect on their own experiences and thoughts about the panel discussion. Ask them to consider what they learned, what they enjoyed, and what they would have liked to change.
- Ask participants to reflect on the process of the panel discussion, including the roles they played, the discussions they had, and the arguments they presented.
- Encourage participants to consider the arguments presented by each group during the panel discussion. Ask them to evaluate the strengths and weaknesses of each argument and think about how they would have approached the situation differently.
- Ask participants to reflect on the outcomes of the panel discussion and think about how the discussions and arguments could be used to inform the white paper.
- Ask participants: "What did you find most challenging about the panel discussion?" or "What do you think was the most valuable outcome of the discussion?".

Writing of the white paper report

Participants are required to write a white paper report giving the proposed solution for the problem. For this, based on the panel discussion in the previous lesson, each group chooses one of the proposals that emanated from the discussion, and justifies its relevance using the Toulmin model.

For writing the white report, participants should use the following guidelines:

A white paper is an authoritative document intended to fully inform the reader on a particular topic. It combines expert knowledge and research into a document that argues for a specific solution, or recommendation. The white paper allows the reader to understand an issue, solve a problem, or be able to make a decision.

A white paper should have the following components:

- Title page
- Introduction (including “Problem Statement”)
- Background (research-heavy)
- Proposed solution
- Conclusion
- References or citations

Note that, unlike most academic papers, the solution (ultimately, the main argument) should appear at the end, after the information has been presented and analysed (max. 5 pages; font: Times roman 12; spacing 1.5).

Teacher guidelines

Support participants in writing a white paper report that establishes the target areas of intervention and citizens’ compromise (the multidisciplinary team - the class).

Reflection about the skills developed

At the end of the module, participants engage in a reflection about the skills developed during the panel discussion. This reflection needs to focus on the application of the techniques learned in the module in professional life, as well as the importance of responsible behaviour, self-responsibility, and justified decision-making in STEM.

Guidelines:

- Participants should discuss the techniques learned in the module and how they can be generally applied in their professional lives.
- Participants should reflect on the importance of responsible behaviour, self-responsibility, and justified decision-making in STEM.
- Participants should consider how the skills developed during the panel discussion can be used in their future careers and how they can continue to improve in these areas.
- Encourage participants to think critically about the skills they developed and how they can be applied in their future careers.

- Participants should evaluate their own performance during the panel discussion and reflect on areas where they can improve.
- Conclude the reflection by summarizing the key 'takeaways' and highlighting the importance of responsible behaviour, self-responsibility, and justified decision-making in STEM.



REFERENCES

Bear, G., Manning, M., & Izard, C. (2003). Responsible behavior: The importance of social cognition and emotion. *School Psychology Quarterly*, 18(2),140-157. <https://doi.org/10.1521/scpq.18.2.140.21857>

Brilhante, O. & Klaas, J. (2018). Green City Concept and a Method to Measure Green City Performance over Time Applied to Fifty Cities Globally: Influence of GDP, Population Size and Energy Efficiency. *Sustainability*, 10, 2031. <https://doi.org/10.3390/su10062031>

Fox, J., & Modgil, S. (2006). From arguments to decisions: Extending the Toulmin view. In D. Hitchcock & B. Verheij (Eds.). *Arguing on the Toulmin model* (pp. 273-287). Berlin: Springer. https://doi.org/10.1007/978-1-4020-4938-5_18

Maier, R. (2018). Self-Responsibility: Transformations. *American Behavioral Scientist*, 63(1), 27-63. <https://doi.org/10.1177/0002764218816802>

Williams, B., Clough, M. P., Stanley, M., Takle, E. S, & Colbert, J. T (n.d.). *The Realization of Global Warming*. <https://www.storybehindthescience.org/>

Websites:

<https://writingcenter.uagc.edu/writing-white-paper>

<https://www.instructionalsolutions.com/blog/how-to-write-white-paper>

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