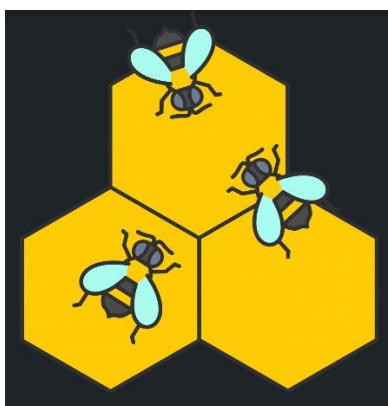


# INTELLECTUAL OUTPUT 4 FINAL REPORT

## NATURAL ENTREPRENEURS ASSESSMENT GUIDELINES



Developed in the project  
Natural Entrepreneurs

co-funded by the Erasmus+ Programme of the European Union.

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# Natural Entrepreneurs Assessment Guidance

These assessment guidelines provide teachers additional guidance in assessing student learning. They offer assessment options addressing the key entrepreneurship and biomimicry competences developed within Natural Entrepreneurs (NatEnt). The biomimicry competences are closely linked to science competences in national curricula. Relevant science competences are integrated into the Biomimicry Rubric, which can be further adapted by teachers to meet local science standards.

## 1. Biomimicry Competences

For the biomimicry competences, we suggest looking at specific competences needed to do biomimicry, such as:

- How well students can translate identified functions and relevant context from societal challenges into biological functions.
- How well students can derive underlying design principles from discovered biological models.
- How well students use these abstracted principles for creating innovative, sustainable solutions and present these effectively.

Additionally, we suggest including some evaluation/assessment questions concerning the human-nature relationship as that is such an integral part to doing biomimicry.

## 2. Entrepreneurship Competences

We also promote digital skills and entrepreneurship competences. As a basis we used adopted competences from the EU Entrepreneurship Competences Framework. These are significantly addressed with NatEnt and are integrated into the NatEnt Biomimicry Rubric and the NatEnt Student Evaluation Questions.

With NatEnt students will learn how to:

- Define a meaningful challenge whilst considering contextual factors.
- Relate sustainability issues to a topic and how their design could help achieve the environmental, social, and cultural benefits (related to the SDG's).
- Pitch their story and proposed solution.
- Be resourceful, seek input from others and collaborate within and between teams (using the platform).
- Identify opportunities to further develop their design solution.
- Use entrepreneurial thinking to address sustainability challenges.
- Imagine a desirable future and link this with practical ideas.

Competence
<p><i>Spotting opportunities:</i></p> <ol style="list-style-type: none"><li>1. Identify and seize opportunities to create value by exploring the social, cultural and economic landscape</li><li>2. Identify needs and challenges that need to be met</li><li>3. Establish new connections and bring together scattered elements of the landscape to</li></ol>

create opportunities to create value
<p><i>Creativity:</i></p> <ol style="list-style-type: none"> <li>1. Develop several ideas and opportunities to create value, including better solutions to existing and new challenges</li> <li>2. Explore and experiment with innovative approaches</li> </ol>
<p><i>Ethical and sustainable thinking:</i></p> <ol style="list-style-type: none"> <li>1. Assess the consequences of ideas that bring value and the effect of entrepreneurial action on the target community, the market, society and the environment</li> <li>2. Reflect on how sustainable long-term social, cultural and economic goals are, and the course of action chosen</li> </ol>
<p><i>Motivation and perseverance:</i></p> <ol style="list-style-type: none"> <li>1. Be prepared to be patient and keep trying to achieve your long-term individual or group aims</li> </ol>
<p><i>Mobilizing resources:</i></p> <ol style="list-style-type: none"> <li>1. Get and manage the material, non-material and digital resources needed to turn ideas into action</li> </ol>
<p><i>Taking the initiative:</i></p> <ol style="list-style-type: none"> <li>1. Act and work independently to achieve goals, stick to intentions and carry out planned tasks</li> </ol>
<p><i>Working with others:</i></p> <ol style="list-style-type: none"> <li>1. Work together and co-operate with others to develop ideas and turn them into action</li> <li>2. Network</li> </ol>
<p><i>Learning through experience:</i></p> <ol style="list-style-type: none"> <li>1. Use any initiative for value creation as a learning opportunity</li> <li>2. Learn with others, including peers and mentors</li> <li>3. Reflect and learn from both success and failure (your own and other people's)</li> </ol>

### 3. Three Assessment Tools are Offered

Firstly, we offer the 'NatEnt Student Evaluation Questions' using a Likert scale. They assess each design phase (define, discover, create, communicate) used in the NatEnt platform, and can be used for formative (self)evaluation. We also included exit questions for summative (self)evaluation. This tool addresses both entrepreneurship and biomimicry competences.

Secondly, we provide specific biomimicry process related assessment questions, 'NatEnt Biomimicry Rubric', using graded statement of competence. These help teachers to assess student work with a specific focus on biomimicry.

Thirdly, we offer an open self-evaluation template, the 'NatEnt Student Project Reflection', in which students are asked to write a narrative in which they reflect on their own role, the team's performance, and their final result.

## Annex 1 – NatEnt Student Evaluation Questions

Below are self-assessment questions for each of the four phases (define, discover, create, communicate) as well as ‘Exit’ questions, to answer after finishing the whole process.

Competences by platform phases	Likert scale
<b>Define</b>	Very confident   Confident   Neutral   Not confident   Not confident at all
1. I can identify the key functions required to solve my challenge.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
2. I can make connections between nature and human design.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
The most important lesson I learned is....	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
<b>Discover</b>	
1. I can discover how nature delivers the functions I need for my challenge.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
2. I can describe how nature delivers different functions.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
3. I can abstract nature’s strategies into non-biological language.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
4. I can develop several ideas to create better solutions to existing challenges.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
5. I can combine knowledge and resources from a range of sources to improve results (other people, nature, online research, etc).	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
The most important lesson I learned is....	
<b>Create</b>	
1. I can integrate functions and strategies from nature into a design solution.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
2. I can use Nature’s Unifying Patterns to review my design and make improvements.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>

3. I feel more confident to work with others to design solutions to design challenges.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The most important lesson I learned is....					
<b>Communicate</b>					
1. I can turn my design solution into a pitch deck.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I can identify how to communicate my solution to others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I can identify opportunities to further develop my Design Solution in the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I can reflect on my work, learn from success & failure, and make improvements to my design solution.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The most important lesson I learned is....					
<b>Exit</b>					
1. I feel more confident to use entrepreneurial thinking to address sustainability challenges.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I can see the benefit of biomimicry to a range of careers and further study.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I can identify and assess my own and team's strengths and weaknesses.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I am more motivated to create positive changes through sustainable innovation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I feel connected with nature as a source of inspiration for solutions to human challenges.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I feel a greater sense of being part of nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. I feel confident to collaborate with teams from other countries to solve sustainability issues	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>
8. I can imagine a desirable future and link this with practical design ideas.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>

## Annex 2 – NatEnt Biomimicry Rubric

### BIOMIMICRY ASSESSMENT - JUDGING RUBRIC

*Adapted from The Biomimicry Institute*

Students' work will be scored on six criteria, detailed below. Each criterion is scored out of a possible 5 points, with increments of 0.5 allowed (e.g., 4.5 is a possible score).

#### Context and Relevance

This section looks at the team's ability to scope the project by defining the context appropriately as well as by defining a suitable research question. Successful scoping means defining or selecting<sup>1</sup> a meaningful challenge and considering factors such as design criteria, opportunities and constraints, materials, timing, resources, team expertise or limitations, stakeholders, policies, etc., which will lead to a relevant approach (suggestion of where to intervene in the system).

0	<ul style="list-style-type: none"><li>• No indication that any context or research questions were defined.</li></ul>
1	<ul style="list-style-type: none"><li>• Very poor/limited definition of context and research question.</li><li>• Poor problem identification.</li><li>• Approach has little or no impact on problems defined.</li></ul>
2	<ul style="list-style-type: none"><li>• Poor/somewhat limited definition of challenge and context and research question.</li><li>• Very basic problem identification; some issues.</li><li>• Approach has limited relevance to problems defined.</li></ul>
3	<ul style="list-style-type: none"><li>• Basic problem defined, at a manageable scale.</li><li>• Basic/good challenge and context and research question defined.</li><li>• Approach likely to have some impact on problems defined.</li></ul>
4	<ul style="list-style-type: none"><li>• Problem well defined, at a manageable scale.</li><li>• Challenge and context and research questions are well defined.</li><li>• Approach would have a significant impact on problems defined.</li></ul>
5	<ul style="list-style-type: none"><li>• Problem very well defined, at a manageable scale, key place to intervene.</li><li>• Challenge, context and research questions are extremely well defined.</li><li>• Approach would be a game changer for the problem defined.</li><li>• Team has considered everything.</li></ul>

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<sup>1</sup> Students may define their own challenge or select one of the suggested challenges on the natent.eu platform. In case they select a given challenge, questions regarding defining a challenge may be less relevant.



## Biomimicry Process

This section looks at the team's understanding of biomimicry, including a clear understanding of function and natural strategy; how well they discovered natural models using one or several methods; how well they applied a biomimicry methodology; and the uniqueness and depth of their emulation.

0	<ul style="list-style-type: none"> <li>● Design solution did not address function or strategy; no connection between organism/system emulated and why.</li> </ul>
1	<ul style="list-style-type: none"> <li>● Extremely limited discovery of natural models - no depth to the research or emulation.</li> <li>● Limited understanding of context, function, and natural strategy.</li> <li>● Connection between natural strategy and design solution is unclear/wrong.</li> <li>● Abstraction of design principles is very superficial or common.</li> </ul>
2	<ul style="list-style-type: none"> <li>● Limited discovery of natural models; more depth/relevance to the research and emulation needed.</li> <li>● Basic understanding of context, function, and natural strategy.</li> <li>● Connection between natural strategy and design solution is unclear or unsupported.</li> <li>● Abstraction of design principles(s) may be somewhat superficial.</li> </ul>
3	<ul style="list-style-type: none"> <li>● Relevant natural models were studied (quantity and quality) in terms of function.</li> <li>● Natural strategies were interpreted correctly; may have identified a pattern.</li> <li>● Some explanation of why a given natural strategy(---ies) was chosen to emulate; may be unclear whether best choice, or appropriate.</li> <li>● Abstraction of design principles(s) went beyond form and considered some context.</li> </ul>
4	<ul style="list-style-type: none"> <li>● Relevant natural models were studied (quantity and quality) in terms of function and interpreted correctly; pattern(s) was identified among natural strategies.</li> <li>● Reason why natural strategy(---ies) was chosen, and how design ideas are derived from these strategies, is clear and supported.</li> <li>● Abstraction of design principles(s) went beyond form and considered context.</li> <li>● Team explored ways to move beyond material and similar constraints.</li> </ul>
5	<ul style="list-style-type: none"> <li>● Relevant natural models were studied (quantity and quality) in terms of function and interpreted correctly; patterns were identified among natural strategies.</li> <li>● Reason why natural strategy(---ies) was chosen, and how design ideas are derived from these strategies, is exceptionally clear and supported.</li> <li>● Abstraction of design principles(s) went beyond form and considered context deeply.</li> <li>● Team explored ways to move beyond material and similar constraints, leading to creative new directions.</li> </ul>

## Social and Environmental Benefits

This section considers the team's understanding of sustainability issues related to their topic; the environmental, social, and cultural benefits (related to the SDG's) their design could help achieve; and whether and how nature's unifying patterns were applied to their design.

0	<ul style="list-style-type: none"> <li>● Design solution(s) will have no social or environmental benefits; Nature's Unifying Patterns were not considered nor applied.</li> </ul>
1	<ul style="list-style-type: none"> <li>● Shallow understanding of relevant sustainability issues.</li> <li>● Design solution(s) will have little positive environmental, social, or cultural impact.</li> <li>● Nature's Unifying Patterns were not considered or integrated very superficially.</li> </ul>
2	<ul style="list-style-type: none"> <li>● Limited understanding of sustainability issues related to their challenge.</li> <li>● Design solution(s) will have limited environmental, social, or cultural impact.</li> <li>● Nature's Unifying Patterns were integrated into the design solution but integration lacks depth.</li> </ul>
3	<ul style="list-style-type: none"> <li>● Solid understanding of underlying sustainability problems they aim to solve.</li> <li>● Design solution(s) likely will have some impact but the team may not have fully articulated/supported how their design solution will address given sustainability concerns (social, cultural, or environmental).</li> <li>● Nature's Unifying Patterns were considered.</li> <li>● Team went beyond simple regurgitations in explaining how Nature's Unifying Patterns were integrated but could have been more thorough/creative in their integration.</li> </ul>
4	<ul style="list-style-type: none"> <li>● Very good understanding of underlying sustainability problems.</li> <li>● Show clearly how design solution(s) will address environmental, social, and/or cultural concerns.</li> <li>● Nature's Unifying Patterns were considered throughout the design process.</li> <li>● Team showed good creativity and depth in applying Nature's Unifying Patterns to their design.</li> </ul>
5	<ul style="list-style-type: none"> <li>● Excellent and comprehensive understanding of underlying sustainability problems</li> <li>● Design solution(s) will succeed in addressing environmental, social, and/or cultural concerns.</li> <li>● Nature's Unifying Patterns were considered throughout the design process and integrated into the team's design solution (including the Pitch Deck components) in creative ways and at a level that reflects a deep understanding of these patterns and their potential to inform design and business.</li> </ul>

## Pitch Deck and Communication

This section considers how well the team presents their story.

0	<ul style="list-style-type: none"><li>● Pitch Deck materials are incomplete and haphazard.</li></ul>
1	<ul style="list-style-type: none"><li>● The design solution is unclear; team does little to support its arguments with properly cited material.</li><li>● Pitch Deck materials are barely adequate.</li><li>● Text is confusing, visuals are missing/not helpful, the pitch does little to highlight process or generate interest.</li></ul>
2	<ul style="list-style-type: none"><li>● The design solution is there but could be better articulated; some information may be missing.</li><li>● Pitch Deck materials have a basic logic and flow but fail to adequately communicate the proposed design concept or whether the team followed the biomimicry process.</li><li>● Basic visual materials are provided but are not engaging/supportive.</li></ul>
3	<ul style="list-style-type: none"><li>● Team tells a good story.</li><li>● The proposition is clear; data is properly attributed.</li><li>● Pitch Deck materials are organized and helpful.</li><li>● The Pitch Deck provides solid support for how the team approached the biomimicry process, arrived at their concept, and assessed sustainability benefits.</li></ul>
4	<ul style="list-style-type: none"><li>● Team tells a great story and draws readers/viewers in.</li><li>● Design solution is clear; data strongly supports design arguments and is properly attributed.</li><li>● Pitch Deck materials are organized and compelling; visual materials, especially sketches, provide strong support and documentation for the design solution and how it was derived.</li><li>● The Pitch Deck flows very well, showcases the team's process and strengths, and provides solid support for how the team approached the biomimicry process, arrived at their design solution, and assessed sustainability benefits.</li></ul>
5	<ul style="list-style-type: none"><li>● This team has the making of professional marketers, amazing storytellers, with compelling and highly creative materials.</li><li>● The proposed design solution is clear; data strongly supports the team's design arguments and is properly attributed.</li><li>● Visual materials, especially sketches, provide excellent support for the design solution and how it was derived.</li><li>● The Pitch Deck makes a strong case for why the team chose to work on a particular challenge, showcases their process, and eases the reader through how the team approached the biomimicry process, arrived at their design solution, and assessed sustainability benefits.</li></ul>

## Teamwork and Collaboration

This section assesses teamwork and the collaboration between teams using the platform.

0	<ul style="list-style-type: none"><li>• There is no indication of any teamwork, within the team or with other teams.</li></ul>
1	<ul style="list-style-type: none"><li>• Team shows little evidence of collaboration.</li><li>• It is unclear how each team member contributed and who had what role.</li><li>• Has not reached out or contributed to other teams.</li></ul>
2	<ul style="list-style-type: none"><li>• Team shows some evidence of collaboration with roles assigned.</li><li>• Has not attempted to recruit additional expertise; sought only superficial outside assistance or mentorship.</li><li>• Has looked at contributions from other teams but it is unclear if or how these were integrated.</li></ul>
3	<ul style="list-style-type: none"><li>• Team was motivated and worked together; submission materials reflect that.</li><li>• The team has looked at other contributions and offered some high-level ideas to others.</li></ul>
4	<ul style="list-style-type: none"><li>• Team worked together very well; inputs from all team members were clearly used and combined.</li><li>• Team has consulted other teams and key experts and mentors along the way.</li><li>• Team helped other teams on the platform.</li></ul>
5	<ul style="list-style-type: none"><li>• Extremely impressive team; they have "startup" written all over them.</li><li>• Shown they are resourceful and can work around limitations; not afraid to seek input from other teams and key individuals.</li><li>• Team proactively contributed to several other teams.</li></ul>

### **Annex 3 – NatEnt Student Project Reflection**

*Reflect on yourself.*

Describe in your own words how you contributed and what you learned from doing the project. What was your role in the team? What went well? What could have been better?

*Reflect on the team.*

Describe in your own words how you worked as a team. What went well? What could have been better? What challenges did you encounter and how did you respond?

*Reflect on the result.*

How do you feel about the result? What would you do differently the next time? Why? What are you most proud of?

A large, empty rectangular box with a thin black border, intended for the user to write their reflection on the result.