Biomimicry Design for Sustainability Skills in VET

KA220-VET-00620D4B

KA220-VET - Cooperation Partnerships in Vocational Education and Training

WP3 Training modules on Biomimicry Process Design

D3.2 Biomimicry training modules

Let's Mimic 2023 – 1 – EL01 - KA220-VET-000158477B

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1. Introduction

Project Let's Mimic has developed innovative training modules designed to enhance the sustainability skills of Vocational Education and Training (VET) learners. These modules support the uptake of the biomimicry design process by guiding the six core steps of the biomimicry methodology: DEFINE, BIOLOGIZE, DISCOVER, ABSTRACT, EMULATE, and EVALUATE. Each module is crafted to provide a structured and practical learning experience.

The training modules on Biomimicry Process Design aim to introduce VET learners aged 14-16 to the innovative field of biomimicry. Biomimicry involves learning from and mimicking nature's strategies to solve human challenges sustainably. These modules aim to provide a comprehensive framework for students to explore and apply biomimicry principles. The development of these modules is guided by the framework defined within WP2, ensuring a cohesive and effective learning experience.

The primary purpose of these training modules is to promote sustainability skills among VET learners. By engaging with the biomimicry design process, students will develop a deeper understanding of how nature-inspired solutions can address environmental and societal challenges. The modules aim to foster critical thinking, creativity, and problem-solving skills, which are essential skills of the 21st century. Additionally, the modules support Project-Based Learning (PBL), encouraging students to work on real-world projects that apply biomimicry principles.

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2. Purpose and relevance

The training modules are meticulously designed to achieve specific objectives that enhance the sustainability skills of Vocational Education and Training (VET) learners. These modules are structured based on the six steps of the biomimicry design process: DEFINE, BIOLOGISE, DISCOVER, ABSTRACT, EMULATE, and EVALUATE. Each step is integrated into the learning experience to ensure a comprehensive understanding and practical application of biomimicry principles.

The training modules aim to achieve the following objectives:

- **Understanding biomimicry:** To provide learners with a foundational knowledge of biomimicry and its significance in promoting sustainability.
- **Exploring nature's strategies:** To enable students to investigate and analyse various natural strategies and their applications in design and technology.
- **Applying biomimicry principles:** To guide learners through the six steps of the biomimicry design process, facilitating hands-on experience and practical application.
- **Enhancing 21st-century skills:** To develop critical thinking, creativity, collaboration, and communication skills through PBL and biomimicry projects.
- **Promoting environmental awareness:** To raise awareness about environmental issues and the importance of sustainable solutions inspired by nature.

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3. Description of the training modules

3.1. TM01 Stylish and efficient ceiling fan inspired by the aerodynamics of the Sycamore tree seeds

This example presents the design of a ceiling fan that combines both aesthetic appeal and high efficiency, while drawing inspiration from nature, more specifically from the unique aerodynamic properties of Sycamore tree seeds.

This training module comprises a total of 30 tasks assigned to students, divided into the six steps of biomimicry as follows: 12 tasks for Step 1 - Define the Challenge, 6 tasks for Step 2 – BIOLOGISE, 2 functions for Step 3 – DISCOVER, 4 tasks for Step 4 – ABSTRACT, 4 tasks for Step 5 – EMULATE, and 2 tasks for Step 6 – EVALUATE.

The resources provided by the professors for this training module include 4 documents, 6 H5Ps, and 1 video.

3.2. TM02 Shark skin swimsuit to reduce drag

This example is of a nature-inspired swimsuit that reduces drag and allows swimmers to achieve faster speeds with minimal effort, more specifically, a swimsuit inspired by shark skin.

This training module contains a total of 28 tasks assigned to students, divided into the 6 steps of biomimicry as follows: 12 tasks for Step 1 - Define the Challenge, 4 tasks for Step 2 – BIOLOGISE, 2 tasks for Step 3 – DISCOVER, 4 tasks for Step 4 – ABSTRACT, 4 tasks for Step 5 – EMULATE, and 2 tasks for Step 6 – EVALUATE.

The resources given by the professors for this training module are: 1 document and 14 H5Ps.

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3.3. TM03 Efficient water harvesting in arid environments inspired by the beetles that drink water from air

This example presents the design of a scalable system that can harvest and store water in arid environments, drawing inspiration from nature, specifically the Namib Desert beetle.

This training module contains a total of 30 tasks assigned to students, divided into the 6 steps of biomimicry as follows: 12 tasks for Step 1 - Define the Challenge, 6 tasks for Step 2 – BIOLOGIZE, 2 tasks for Step 3 – DISCOVER, 4 tasks for Step 4 – ABSTRACT, 4 tasks for Step 5 – EMULATE, and 2 tasks for Step 6 – EVALUATE.

The resources provided by the professors for this training module include: 3 documents, 5 H5Ps, and 1 video.

3.4. TM04 Reflecting road studs inspired by the Cat eyes glow in the dark

This example presents reflecting road studs that combine both aesthetic appeal and high efficiency, while drawing inspiration from nature, more specifically from the unique properties of cat eyes that glow in the dark.

This training module contains a total of 27 tasks assigned to students, divided into the 6 steps of biomimicry as follows: 10 tasks for Step 1 - Define the Challenge, 5 for tasks Step 2 – BIOLOGISE, 2 for tasks Step 3 – DISCOVER, 4 tasks for Step 4 – ABSTRACT, 4 tasks for Step 5 – EMULATE, and 2 tasks for Step 6 – EVALUATE.

The resources provided by the professors for this training module include: 3 documents, 6 H5Ps, and 1 video.

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3.5. TM05 Multi-functional biodegradable shoes inspired by the biodegradability of algal organic matter

This example describes the design of shoes that combine both aesthetic appeal and sustainability, while drawing inspiration from nature, more specifically from the biodegradable properties of Algae.

This training module contains a total of 27 tasks assigned to students, divided into the 6 steps of biomimicry as follows: 10 tasks for Step 1 - DEFINE the challenge, 5 tasks for Step 2 – BIOLOGISE, 2 tasks for Step 3 – DISCOVER, 4 tasks for Step 4 – ABSTRACT, 4 tasks for Step 5 – EMULATE, and tasks 2 for Step 6 – EVALUATE.

The resources provided by the professors for this training module include: 3 documents, 6 H5Ps, and 1 video.

3.6. TM06 The termite mounds' tunnels and building design for efficient cooling and ventilation

This example outlines the design of a building ventilation system that combines efficiency and sustainability, drawing inspiration from nature, specifically from the unique cooling and ventilation properties of termite mounds.

This training module contains a total of 26 tasks assigned to students, divided into the 6 steps of biomimicry as follows: 8 tasks for Step 1 - DEFINE the Challenge, 6 tasks for Step 2 – BIOLOGISE, 2 tasks for Step 3 – DISCOVER, 4 tasks for Step 4 – ABSTRACT, 4 tasks for Step 5 – EMULATE, and 2 tasks for Step 6 – EVALUATE.

The resources provided by the professors for this training module include: 1 document, 6 H5Ps, and 1 video.

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3.7. TM07 Design a subway or railway network less prone to disruption inspired by the adaptive behaviour of slime mould

This example introduces the design of a railway or subway network that combines cost efficiency, decentralisation, resilience and scalability, while drawing inspiration from nature, more specifically from the unique way Slime Mould creates pathways when foraging for food.

This training module contains a total of 27 tasks assigned to students, divided into the 6 steps of biomimicry as follows: 10 tasks for Step 1 - DEFINE the Challenge, 5 tasks for Step 2 – BIOLOGISE, 2 tasks for Step 3 – DISCOVER, 4 tasks for Step 4 – ABSTRACT, 4 tasks for Step 5 – EMULATE, and tasks 2 for Step 6 – EVALUATE.

The resources provided by the professors for this training module include: 2 documents, 6 H5Ps, and 1 video.

3.8. TM08 High-speed and quieter passenger trains inspired by the kingfisher, the owl and the penguin

This example presents the design principles of a high-speed train that combines high speed and reduced noise pollution, specifically the “tunnel boom”, with energy efficiency, drawing inspiration from nature. More specifically, this is inspired by the silent flight of owls, the streamlined bodies of Adélie Penguins, and the head and beak of the Kingfisher.

This training module contains a total of 27 tasks assigned to students, divided into the 6 steps of biomimicry as follows: 10 tasks for Step 1 - DEFINE the Challenge, 5 tasks for Step 2 – BIOLOGISE, 2 tasks for Step 3 – DISCOVER, 4 tasks for Step 4 – ABSTRACT, 4 tasks for Step 5 – EMULATE, and 2 tasks for Step 6 – EVALUATE.

The resources provided by the professors for this training module include 5 documents, 12 H5Ps, and 3 videos.

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3.9. TM09 Safe, waterless and portable toilets

This example presents the design of a portable toilet that combines both aesthetic appeal and high efficiency, drawing inspiration from nature, specifically from the unique ability of plants to undergo evapotranspiration.

This training module contains a total of 27 tasks assigned to students, divided into the 6 steps of biomimicry as follows: 10 tasks for Step 1 - DEFINE the Challenge, 6 tasks for Step 2 – BIOLOGISE, 2 tasks for Step 3 – DISCOVER, 4 tasks for Step 4 – ABSTRACT, 3 tasks for Step 5 – EMULATE, and 2 tasks for Step 6 – EVALUATE.

The resources provided by the professors for this training module include: 2 documents, 5 H5Ps, and 1 video.

3.10. TM10 Eco-friendly urban noise reduction inspired by nature

This example is about creating passive, eco-friendly solutions to reduce noise pollution in cities, while being inspired by nature, more specifically by forests that dampen the sounds by layered vegetation and by beings like owls that possess soft feathers to minimise sound during flight.

This training module contains a total of 30 tasks assigned to students, divided into the 6 steps of biomimicry as follows: 12 tasks for Step 1 - DEFINE the Challenge, 6 tasks for Step 2 – BIOLOGISE, 2 tasks for Step 3 – DISCOVER, 4 tasks for Step 4 – ABSTRACT, 4 tasks for Step 5 – EMULATE, and 2 tasks for Step 6 – EVALUATE.

The resources provided by the professors for this training module include: 3 documents, 6 H5Ps, and 1 video.

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4. Conclusions

Project Let's Mimic represents a forward-thinking initiative aimed at equipping VET learners with essential sustainability skills through the innovative lens of biomimicry. By integrating the six-step biomimicry design process — DEFINE, BIOLOGIZE, DISCOVER, ABSTRACT, EMULATE, and EVALUATE — into structured training modules, the project fosters a hands-on, inquiry-based learning environment.

These modules not only introduce learners aged 14–16 to nature-inspired problem-solving but also cultivate critical 21st-century competencies such as creativity, collaboration, and environmental awareness. Each module exemplifies how biological strategies can inform sustainable technological solutions. Grounded in a cohesive pedagogical framework, the Let's Mimic modules empower students to engage with real-world challenges, promoting a deeper understanding of sustainability and the transformative potential of biomimicry in shaping a more resilient future.

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