Biomimicry Design

Teacher Notes

Secondary (7-10)

ACTIVITY DESCRIPTION

The Biomimicry Design activity introduces students to key design principles and strategies in nature. Students read four Biomimicry Case Studies to consider how different designs draw on nature's systems and designs, to critically reflect on their application as a sustainable design solution. This activity can be extended to include a student research and design project where students address an issue, investigating and devising a sustainable design solution modelled on ecological principles.

INSTRUCTIONS

1. Tuning in

Outside, have students reflect upon the design and function of flora and fauna in the natural world. Pass around a leaf and invite students to observe the network of veins. To find out more, here is a link to a short video and article featuring ecologist and educator Janine M Benyus who founded the Biomimicry Institute.

Tuning-in questions:

1. What do you notice about this pattern? What purpose do the veins serve?
2. Where else do we see this pattern in nature and why?
3. How do these networks for transporting water compare to our own man-made systems to transport water around this school?

Introduce Biomimicry

Biomimicry is the mimicry of nature's design features to solve complex human problems.

2. Biomimicry Case Studies

Divide the Biomimicry Case Studies between different groups and read about each biomimicry design. Identify the sustainability issue and the design solution, and discuss how design solutions and features in nature can inform the final design or product.

Nature's Design Principles and Strategies

Biomimicry is the mimicry of nature's design features to solve complex human problems. While many biomimicry examples draw directly from a design feature observed in nature, they will also draw on how nature works in relationship to its environment. Read through 'Nature's Design Principles and Strategies' in order to support this. Which strategies and principles does the design in your case study draw upon?

Questions:

1. What was the sustainability issue you read about and how was it addressed using biomimicry?
2. Which key principles and strategies in nature does the design draw on?
3. How is the design effective or limited as a sustainable solution? Discuss.
4. Do you think the design could be improved? How?

3. Observations in our environment

Invite students to explore the natural environment in the school for various design features or patterns. What purpose may these features serve?

SUGGESTIONS FOR ASSESSMENT

Formative

1. Participation in the Biomimicry Design activity
2. Participation in the Discussion questions above

Summative

Students investigate a sustainability issue and design a biomimicry solution informed by two or more key ecological principles and strategies. Students present their design to the class. Please visit asknature.org for a comprehensive list of design features in nature for some inspiration!

BACKGROUND NOTES

Biomimicry is a cutting-edge approach to innovation that seeks sustainable solutions to human challenges by emulating nature's time-tested strategies. Nature has been coming up with new designs through millions of years of gene mutation and evolution. The models, systems and elements of nature can in turn inform significant man-made innovations across a broad range of domains from household items, to fashion, technology, medicine, urban design, architecture and more. Observing and understanding nature's key design principles and strategies can inform creative problem solving across a range of areas that encompass sustainable outcomes.

While many biomimicry examples draw directly from a design feature observed in nature, in order for them to be truly sustainable (e.g. not drawing on more resources from the earth or generating a product that will become a waste item) the design will also incorporate how plants or animals function sustainably within a system. This is based on nature's design principles, for example, 'all waste in nature is a resource' where organic material biodegrades. You can read more about Nature's Design Principles, based on Janine M Benyus' work, here.

To explore more Biomimicry innovations please visit asknature.org

RESOURCES

Janine M Benyus (Biomimicry Institute) video on Biomimicry
https://www.fastcompany.com/3000092/janine-benyus-biomimicry-innovation-inspired-nature

Biomimicry Institute
https://biomimicry.org/biomimicry-examples/
https://asknature.org

Janine M Benyus TED Talk on Biomimicry
https://www.ted.com/talks/janine_benyus_biomimicry_in_action

ACCESS THIS ACTIVITY

Visit the **CERES School of Nature and Climate website** to download the activity -
https://sustainability.ceres.org.au/education-resources/curriculum-activities/

CERES SCHOOL OF NATURE AND CLIMATE

Curriculum and RSS Links

KEY CONCEPTS

Biodiversity, Species Adaptation, Evolution, Climate Change, Energy Efficiency, Waste

KEY LEARNING INTENTIONS

1. Students will be able to describe key design principles and strategies of ecological systems
2. Students will be able to evaluate if a design is sustainably sound using ecological principles and strategies as their criteria

VICTORIAN CURRICULUM

Science

7 – 8	9 – 10
Science and technology contribute to finding solutions to a range of contemporary issue; these solutions may impact on other areas of society and involve ethical considerations (VCSSU090)	The values and needs of contemporary society can influence the focus of scientific research (VCSSU116)

Design & Technologies

7 – 8	9 – 10
Independently develop criteria for success to evaluate design ideas, processes and solutions and their sustainability (VCDSCD052)	Critically analyse factors, including social, ethical and sustainability considerations, that impact on designed solutions for global preferred futures and the complex design and production processes involved (VCDSTS054)
Analyse ways to create designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment (VCDSTC048)	Evaluate design ideas, processes and solutions against comprehensive criteria for success recognising the need for sustainability (VCDSCD063)

CERES SCHOOL OF NATURE AND CLIMATE

SUGGESTED RESOURCESMART SCHOOLS MODULE LINKS

Undertaking the activity as described above links to the ***ResourceSmart Schools Biodiversity Module - actions B1.1, B1.2, B1.3, B1.4***

Below is a list of extension activities that link to additional actions of the Biodiversity module:

1. Conduct a flora and fauna survey within the school grounds, a local park, reserve or at CERES Environment Park and record the various design features and functions that you observe ***(ResourceSmart Schools Biodiversity Module - actions A1.1, A1.3, B1.1, B1.3)***
2. Students identify where biomimicry can provide a solution to a sustainable issue. Visit asknature.org for different ecological designs and strategies to draw upon in your research ***(ResourceSmart Schools Biodiversity Module - action B1.3)***
3. Students exhibit their sustainable design solutions and present to the whole school and local community ***(ResourceSmart Schools Biodiversity Module - actions B1.1, B1.3, C1.1, C1.3)***
4. Students invite local businesses or organisations to speak to the school about their design solutions for a healthy environment ***(ResourceSmart Schools Biodiversity Module - actions A3.3, C3.1, C3.3)***
5. Students write a report or article for the school newsletter, local paper or radio, about key examples of biomimicry and solutions for sustainable design ***(ResourceSmart Schools Biodiversity Module - actions B1.1, B1.3, A3.3, C3.1, C3.3)***

Speak to your CERES ResourceSmart Schools Facilitator about further links to the Biodiversity Module.