


Inspired by Nature

PRIMARY **Level 3** **Design Creativity Technology**

INSPIRED BY NATURE

Time Frame : 10 hours (6 Activities) + LdV Exhibition visit

Suitable VELS Outcomes

Communication

LEVEL 4 Listening, viewing and responding and Presenting

Listening, viewing and responding
Students ask clarifying questions about ideas and information they listen to and view. They develop interpretations of the content and provide reasons for them. They explain why peers may develop alternative interpretations. They describe the purpose of a range of communication strategies, including non-verbal strategies, and evaluate their effectiveness for different audiences.

Presenting
At Level 4, students summarise and organise ideas and information, logically and clearly in a range of presentations. They identify the features of an effective presentation and adapt elements of their own presentations to reflect them. Using provided criteria, they evaluate the effectiveness of their own and others' presentations.

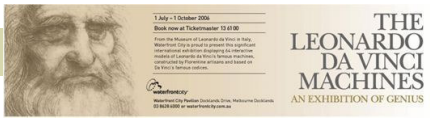
Design Creativity Technology

LEVEL 4 Investigating and designing, Producing and Evaluating

Investigating and designing
Students contribute to the development of design briefs that include some limitations and specifications. Individually and in teams, they use a range of methods to research and collect data in response to design briefs. They generate and communicate alternative design ideas in response to a design brief and use words, labelled sketches and models, to demonstrate that they are aware of environmental and social constraints. Students describe how their intended product will function or be used, and what it will look like in the context of the requirements of the design brief. They identify evaluation criteria from design briefs and use them to justify design choices.

Producing
Students use their production plan and select and work safely with a variety of materials/ingredients and systems components to produce functional products and/or systems. They use a range of measuring, marking, joining/combining techniques to alter materials and finishing/presentation methods, and operate tools and equipmentmaterials and finishing/presentation methods, and operate tools and equipment competently, showing consideration of safety and hygiene, and record their progress.

Analysing and evaluating
At Level 4, students reflect on their designs as they develop them and use evaluation criteria, identified from design briefs, to justify their design choices. They modify their designs/products/systems after considered evaluation of feedback from peers and teachers, and their own reflection. They describe the impact products and technological systems have on people and the environment.



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Mathematics

LEVEL 4 Space and Working mathematically

Space
They create two-dimensional representations of three dimensional shapes and objects found in the surrounding environment. They develop and follow instructions to draw shapes and nets of solids using simple scale. They describe the features of shapes and solids that remain the same (for example, angles) or change (for example, surface area) when a shape is enlarged or reduced. They apply a range of transformations to shapes and create tessellations using tools (for example, computer software).

Working mathematically

Students use the mathematical structure of problems to choose strategies for solutions. They explain their reasoning and procedures and interpret solutions. They create new problems based on familiar problem structures.

Science LEVEL 3

Science Knowledge and Understanding

Students identify and describe the structural features of living things, including plants and animals. They identify how these features operate together to form systems, which support living things to survive in their environments. They distinguish between biotic and non biotic factors in their environment and describe interactions that occur between them.

LEVEL 4

Science at Work

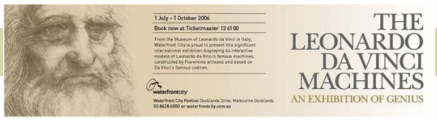
Students design their own simple experiments to collect data and draw conclusions. They describe the purpose of experiments they undertake, including a statement of ethical considerations, and relate this purpose to the nature of the data that is collected. They design and build simple models and write an account of the science that is central to explanation of the model. They use diagrams and symbols to explain procedures used when reporting on their investigations.

Students approach data collection systematically, and analyse data qualitatively in terms of errors of measurement. They use a range of simple measuring instruments and materials, and demonstrate understanding of their personal responsibility in using them. They identify and describe safety requirements and procedures associated with experiments and the use of standard equipment. Students use the terms *relationships* and *cause and effect* when discussing and drawing conclusions from the data they collect.

Thinking Processes

Reasoning, processing and inquiry

Students develop their own questions for investigation, collect relevant information from a range of sources and make judgments about its worth. They distinguish between fact and opinion. They use the information they collect to develop concepts, solve problems or inform decision making. They develop reasoned arguments using supporting evidence.



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Creativity

At Level 4, students use creative thinking strategies to generate imaginative solutions when solving problems. They demonstrate creativity in their thinking in a range of contexts and test the possibilities of concrete and abstract ideas generated by themselves and others.

Reflection, evaluation and metacognition

At Level 4, students use a broad range of thinking processes and tools, and reflect on and evaluate their effectiveness. They articulate their thinking processes. They document changes in their ideas and beliefs over time.

For Leonardo teaching resources: refer to School Programs Resource list

Download Student Activity sheet on Natural Design to accompany Exhibition visit.

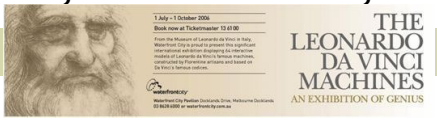
Context

As Leonardo's manuscripts reveal, he learnt much about the principles of movement by observing, examining and recording species in the natural world. The study of nature was the point of departure for any of his research. He documented his work using carefully annotated and scrupulously detailed drawings. Some of these will be on display at the exhibition.
Leonardo's curiosity about examining the world around him was broadly reaching.

(excerpts taken from : Leonardo's Machines, Da Vinci's Inventions Revealed, Edited by Mario Taddei and Edoardo Zanon, Text by Domenico Laurenza. Publisher: D&C)

Leonardo's Zoological studies

During the time of 1485- 1490 when Leonardo was in Milan, his notes (found in a manuscript that was stolen in the nineteenth century but later recovered) demonstrated that LdV was pursuing two main paths in his research on human fligth: studies on the fundamental laws of natural fligth and its imitation, and studies on the dynamic potential of the human body and the elaboration of the mechanisms able to use this potential to the fullest. The fundamental idea behind the flying machine was the imitation of the flight of winged creatures. Some of the studies on this folio deals with flight as found



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in nature. Here, Leonardo depicted various airborne creatures: a flying fish, a bat, a dragonfly and another flying insect. Leonardo compared four-winged flying animals with animals with membrane-covered wings. He was interested in the differences, but above all in the similarities. The comparative zoological studies are thus connected to those on the flying machine. The type of mechanical wings Leonardo designed during this period (which were found in Manuscipt B) are either double wings or membrane covered wings, in imitation of the bat or flying fish.

Student Challenge:

Compare the wingspans of 4 flying creatures (insects/birds/ mammals). (eg. Pelican, wedge-tailed eagle, cockatoo, bat, dragonfly) In a group of 2 make a model of the wing span and identify the parts. Eg. stretched skin, cartiledge, contour feathers.
Make a sketch of your model with identified notes.
At the Docklands exhibition make a sketch of LDV's models for flight. Label the parts. Present to your class using sketches and models a contemporary example of human design that has been inspired by nature.

Teacher Overview:

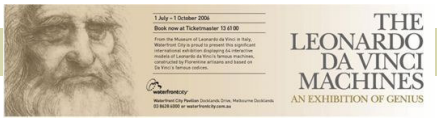
This Unit of Work explores the way human-made (synthetic) design are results of observation of the natural world. This is the method (Aristotlian biology) of study that Leonardo practiced when designing and inventing. Students closely observe, compare and model wingspans and find their own efforts consolidated by LdV's experiments in understanding flight. Students then consider other effects of natural design on synthetic design and specifically gain an understanding of the dependence of human kind on nature for learning about how things work.

Pre Exhibition

Activity 1 : Comparing wingspans.

Equipment: 3 metre long rope, balls of coloured string, paper, stapler, pens, measuring tape.

Ask students to work in pairs. Introduce some information about a variety of native flying species. Eg. Insects: dragonfly, butterfly Birds: wedge-tail eagle, pelican, cockatoo. Mammals: flying fox (bat)



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Their task is to find out the length of their creatures' wingspan.

Ask students to mark out on the length of rope the full length of the wingspan using different string colours. Compare to own arm lengths.

Activity 2: Wing span model making.

Equipment: 2 mm thick wire, nylon webbing, blutack, measuring tape.

Demonstrate how to assemble materials to produce a 3-dimensional shape.
In pairs, ask students to construct a model of their creatures' wingspan.
(Wedge-tail eagle model-makers may need to create a 1: 2 scale model!)

Activity 3:

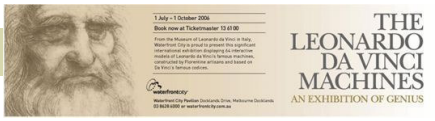
Students make a sketch based on the wing span they have modeled, annotating the parts which are skin (membrane) and cartiledge (rigid support).
Students present their models and sketched to the class. How can studying these wings have been useful to people?

Pre Exhibition discussion:

LDV's famous series of flying machines are based on a long study of the workings of birds' wings. They sometimes proved dangerous. One demonstration ended in a crash which nearly killed one of Leonardo's servants but others managed to fly in modern times, such as the giant pyramid parachute that has been successfully tested in Canada.

Activity 4: **visit to Exhibition**

Students work individually with activity packs.
This should include a sketchbook and a specially written activity sheet **'Inspired by nature'.**



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Students are asked to choose an LDV exhibit which is based on flight. This might be:

- Hang-glider
- Flying Machine
- Glider
- Flapping Wing Experiment
- Study of a wing in One Piece
- Parachute

Make a sketch of this exhibit, labeling all the parts according to the material used. Eg. membrane, rigid support and any working parts. Show how the moving parts, if any, relate to and affect each other. Comment on finding the source of LDV's ideas (looking at LDV's sketchbooks).

Activity 5: ***post Exhibition visit***

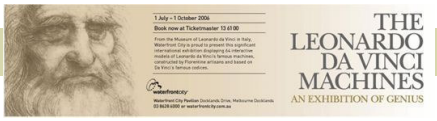
Exhibit findings from the museum and present to class (presentations could be filmed). Discuss LDV's sketchbooks.

Investigating Task:

Find out and present to class an example of human design that has been inspired by nature. (You might prompt students by giving them links)

Eg. Zebra = zebra crossing
Afghan dog & birs = Velcro
Shark skin = swim streamline suit
Cats = cats eyes
Human membranes = filtration systems
Octopus = bunji ropes
Beetles = Volkswagon design

This work and all previous work from earlier activities can provide the core of a student owned exhibition.



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My own Teacher notes: