SECONDARY Level 5 Design Creativity Technology / Humanities: History

Leonardo's Bridge Structures

Time Frame: 7.5 hours (5 activities) + LdV exhibition visit

Suitable VELS Outcomes

Communication

LEVEL 5 Listening, viewing and responding and Presenting

Listening, viewing and responding
Students modify their verbal and non-verbal responses to suit particular audiences. They interpret complex information and evaluate the effectiveness of its presentation. When responding, they use specialised language and symbols as appropriate to the contexts in which they are working. They consider their own and others' points of view, apply prior knowledge to new situations, challenge assumptions and justify their own interpretations.

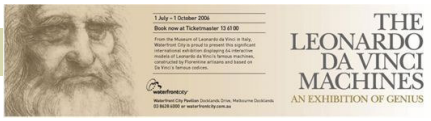
Presenting
Students use the communication conventions, forms and language appropriate to the subject to convey a clear message across a range of presentation forms to meet the needs of the context, purpose and audience. They provide and use constructive feedback and reflection to develop effective communication skills.

Design Creativity Technology

LEVEL 5 Investigating and designing, Producing, Analysing and evaluating

Investigating and designing
At Level 5, students use various strategies and sources of information to investigate and research a range of factors relevant to more sophisticated design briefs to which they have contributed. During the design process they clarify their understanding of design brief requirements and their design ideas by gathering, responding to and providing feedback to others. They develop evaluation criteria from the design brief to inform their judgments during the design process. They use a variety of drawing and modelling techniques to visualise design ideas and concepts. Students demonstrate understanding of design elements and principles and use appropriate technical language.

Students understand and logically sequence major stages of production, and calculate and list materials/ingredients and quantities needed for production. They record and communicate their ideas using a variety of media that includes information and communications technology equipment, techniques and procedures.



Leonardo's Bridge Structures

Producing
At Level 5, students work safely/hygienically with a range of tools and equipment, including some which are complex, and manage materials/ingredients, components and processes to produce products and systems, taking full account of the appropriateness of their properties, characteristics or expected outputs in meeting requirements of design briefs. They make modifications during production, providing a sound explanation for changes that demonstrates reflection, research, responsiveness to feedback, and use of evaluation criteria.

Analysing and evaluating
At Level 5, students select appropriate equipment and techniques to safely test and evaluate the performance of their products/systems. They suggest modifications to improve their products/systems in light of evaluation of their performance, function and appearance. They recommend improvements to the performance, function and appearance of others' product/systems. They describe and analyse the social and environmental impacts of their own and others' designs, products and technological systems.

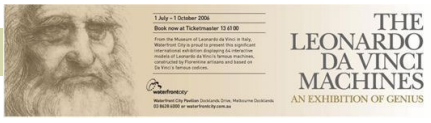
Humanities / History

LEVEL 5 Historical knowledge and understanding, Historical reasoning and interpretation

Historical knowledge and understanding
Students analyse and describe key events in ancient and medieval societies. They use a variety of sources to describe key aspects of these societies. They describe aspects of daily life in these societies such as work, the division of labour, family, clothing, housing and education. They explain key features of community life including myths and legends, religious beliefs and practices and cultural expressions such as art and drama. They analyse the ways that ancient and medieval societies were governed, identify political features and explain the nature of the political system, the dominant groups and how they established and maintained power. They describe the roles of key individuals and evaluate their contributions and legacies.

Students analyse change and continuity over time and compare key aspects of past and present societies; for example, aspects of daily life, social and political ideas and structures, and cultural values and beliefs. They demonstrate understanding of key concepts such as democracy, governance, the rule of law, justice, religion, liberty, authority, leadership, culture and feudalism. They explain the influences of ancient and medieval societies on contemporary societies.

Historical reasoning and interpretation
Students frame key research questions, plan their investigations, and report on their findings. They use a range of primary and secondary sources including visual sources that record features of the societies in their investigations. They identify the content, origin, purpose and context of historical sources. They evaluate historical sources for meaning, point of view, values and attitudes, and identify some of the strengths and limitations of historical documents. They use relevant historical evidence, concepts and historical conventions such as bibliographies to present a point of view. Students use a variety of forms to present their understanding.



Leonardo's Bridge Structures

Thinking Processes

LEVEL5 Reasoning, processing and inquiry. Creativity and Reflection,evaluation and metacognition.

Reasoning, processing and inquiry
At Level 5, students use a range of question types, and locate and select relevant information from varied sources when undertaking investigations. When identifying and synthesising relevant information, they use a range of appropriate strategies of reasoning and analysis to evaluate evidence and consider their own and others' points of view. They use a range of discipline-based methodologies. They complete activities focusing on problem solving and decision making which involve an increasing number of variables and solutions.

Creativity
At Level 5, students apply creative thinking strategies to explore possibilities and generate multiple options, problem definitions and solutions. They demonstrate creativity, in the ways they engage with and explore ideas in a range of contexts.

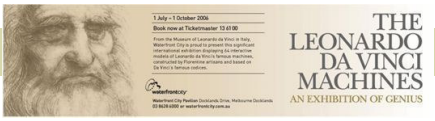
Reflection, evaluation and metacognition
At Level 5, students explain the purpose of a range of thinking tools and use them in appropriate contexts. They use specific language to describe their thinking and reflect on their thinking processes during their investigations. They modify and evaluate their thinking strategies. They describe and explain changes that may occur in their ideas and beliefs over time.

For Leonardo teaching resources: refer to School Programs Resource list

---

Context:

This unit of work is designed to introduce students to concepts of structure by studying bridge design. There is a discrete component within the unit which is focused on Leonardo's bridge designs. This unit can stand alone, be integrated with other structurally themed units of work or support complete LEONARDO's BRIDGE STRUCTURES unit.



Leonardo's Bridge Structures

Leonardo's Bridge Structures

Teachers notes

As can be seen of Leonardo da Vinci's Machines, many of his designs of bridges were to be used principally during wartime. In 1482, in his letter of introduction to Ludovico 'the moor' of Sforza he wrote:

' I can construct bridges very light and strong and suitable to be carried very easily, with which to pursue and at times flee from the enemy, and others, solid and indestructible by fire or assault, easy and convenient to transport and place in position'.

(excerpts taken from : Leonardo's Machines, Da Vinci's Inventions Revealed)

It is not known if Leonardo was commissioned to build his bridge designs. His notes however contain many drawings showing how to construct bridges with characteristics that were particularly useful during wartime.

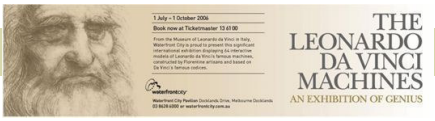
These types are:

- mobile bridges
- bridges constructed with very light materials
- bridges easily assembled and disassembled

The type of bridge that is easily assembled and disassembled is on display in the **Hydraulics** section of the exhibition; the MOVABLE BRIDGE.

Leonardo's ARCHED BRIDGE is on display in the **Mechanical** section of the exhibition. This type of bridge is also mobile and constructed with very light materials.

In the book ***' Leonardo's Machines, Da Vinci's Inventions Revealed,*** publisher ***D&C'*** his SWING BRIDGE is explored and graphically reconstructed.
It is assumed to be one of the designs Leonardo mentions in his introductory letter to Ludovico of Sforza in 1482. The main characteristic of this bridge is that it could be rapidly closed and opened, making it an effective tool in halting the advancing enemy.



Leonardo's Bridge Structures

Student Challenge:

Investigate examples of types of bridges and famous bridge disasters. Draw structural frame ideas from previous research. Design a free spanning scale bridge to support a load. Test.
At the Docklands exhibition make a sketch of Leonardo's model of bridges. Label the parts. Construct a model of his bridge design and present to class

Teacher Overview:

This Unit of Work introduces students to concepts of structure that they work with and put to test by building a bridge. This enquiry into structures is supported by a visit to Leonardo da Vinci's Machines exhibition where students are guided to closely examine Leonardo's bridges and other structures. This work could prompt a class model of a bridge or another of Leonardo's structures.

Pre- Exhibition

Activity 1

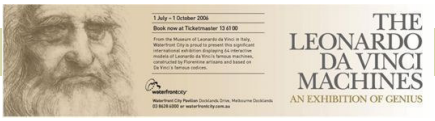
<u>Focused Practical Task</u>

Build a tower from newspaper competition. The tallest and most rigid wins a prize. Maximum team of 3 people.

Activity 2

Keep a sketchbook in which:
Learn about the difference between natural and human made structures.
Learn about structural elements of Bridges. What are compressive and tensile forces?
What are primary and secondary structures? Research types of bridges and materials used.
Eg. arch, beam, box-girder, cable stayed, cantilever, swing, rope, suspension, truss, etc. Give an example of 3 different types of bridges.

Research a famous example of a bridge disaster.



Leonardo's Bridge Structures

Activity 3

Present bridge disaster findings to class.

Design Brief:

You are to design a strong bridge in the same time period that Leonardo da Vinci was alive. A powerful warlord of the region wishes to commission your talents, to assist the advancement of your allied forces. In a team of 2, design a free spanning bridge to scale which will span a distance of 350mm and support a load. Your materials must be costed to fit within a budget that reflected Leonardo's time. (currency: ducats). You must test your bridge for load bearing fitness and strength. You should compile a structural report, detailing weight, materials, cost of bridge and team partnership.

What materials were available between 1452 and 1519?

Design side structure of bridge using black strips of paper on an A3 sheet. Wooden sticks (as girders) for a suitable bridge frame. Nylon 'fishing' thread. Card decking lengths.

Teams begin designing.

Activity 4

Visit Leonardo da Vinci's Machines exhibition.
Download Student Activity sheets on structures to accompany Exhibition visit.

Activity 5 & 6

Construct bridges. Class test of bridge weightbearing. Present to class with report including budget sheet. Which designs will the warlord commission?