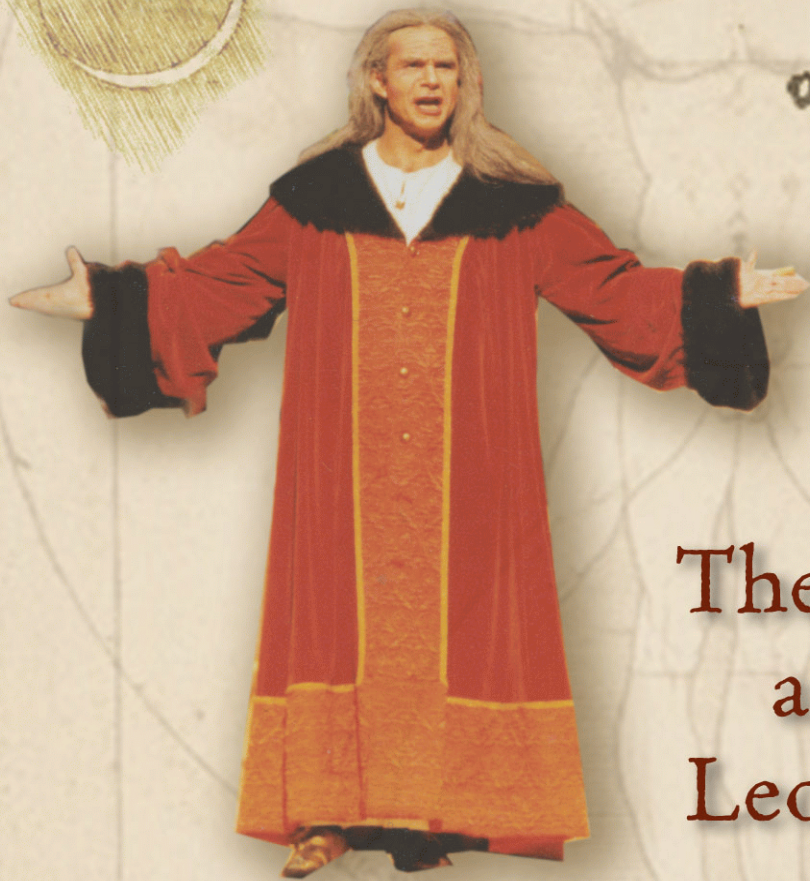# Leonardo's Workshop

The Invention, Art and Science of Leonardo da Vinci

Library of Congress Teacher's Guide

What's Inside:
- Introduction & Learning Objectives
- Meet Leonardo da Vinci
- Renaissance Italy
- The Gutenberg Bible
- Activities
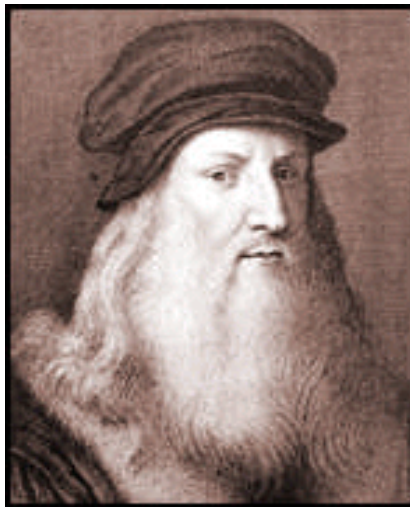- Resources for Further Reading

Introduction

The life and works of artist and scientist Leonardo da Vinci continue to fascinate us because, while he exemplified the Italian Renaissance, he transcended his time and place, inventing things like a helicopter 500 years before the technology existed to build one. This performance invites you to visit the workshop of Leonardo's mind where you can learn how a genius thinks.

Enough material has survived from his art works and notebooks to give us a picture of Leonardo as almost the singular embodiment of the Renaissance. His mastery of disciplines as diverse as painting, anatomy, engineering, and music were celebrated in his lifetime and have been the subject of fascination ever since. He called himself "unlettered" yet commanded the knowledge of the major scholarly works of the time, and anticipated a long list of later discoveries, especially in his mechanical inventions.

Here are some of the things you and your students will experience.

✓ Learn about the importance of books and libraries as repositories of knowledge, history and culture
✓ Learn how science and math can be used to make great art
✓ Learn about Renaissance Italy – its customs and costume, Lorenzo di Medici and other residents of Florence, songs, and dance
✓ Discover the world of Leonardo's Notebooks and learn how he observed, collected, and documented his observations
✓ Find out the value of learning you do on your own

(Appropriate for students ages 7-18)

Meet Leonardo da Vinci

Born in Vinci (his name means "Leonardo of the town Vinci") in 1452, Leonardo spent his early life in the small town living with his uncle, exploring the countryside and recording his observations as sketches. Because he was born out of wedlock, most opportunities for formal education and many professions were closed to him. He was taught basic skills – reading, writing, using an abacus – by a priest.
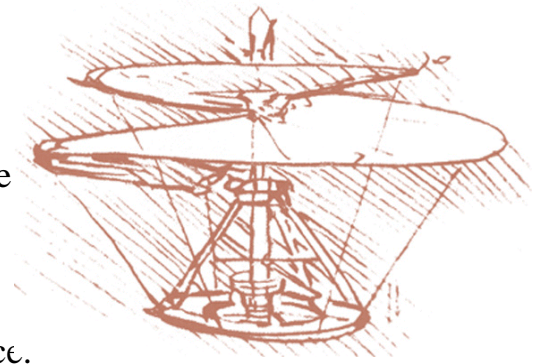
His father arranged for Leonardo to join him in Florence ("Firenze" in Italian) and apprentice in the prominent painting and sculpting studio of Andrea del Verrocchio in 1467. It was then common for boys of 12 or 13 to learn business or technical occupations as apprentices. His work as a servant in the studio was in exchange for instruction and training in all aspects of the work of Verrochio's studio. As g*arzone*, or studio boy, Leonardo learned to grind pigment to make paint, prepare painting surfaces, make paint brushes and polish bronze sculpture. At the end of his six-year apprenticeship, Leonardo was admitted to the Florentine painters' guild as *maestro* or master, but stayed on with Verrochio until 1482.

It was in Verrochio's studio that Leonardo began to use science and mathematics to improve his art. He helped develop techniques for mixing and using oil paint, which had only recently been introduced in Italy. He also discovered a way to create the illusion of three-dimensionality in his

paintings by using geometry. Several Renaissance scholars had developed theories of perspective, the presentation of three-dimensional objects on a two-dimensional surface, but Leonardo improved upon existing theories by Brunelleschi and Alberti, and his paintings became study pieces for the artists of his day. His scientific approach to art was in part an effort to persuade others that painting should be considered at the level of the liberal arts, i.e. rhetoric, philosophy, mathematics, poetry, etc. What is more scientific,

he reasoned, than being able to see and to project what one sees onto a flat surface?

As Leonardo moved from Milan, to Venice, and finally France, he used his ability as an artist and inventor to gain access to the highest levels of power and wealth. His ability to cultivate wealthy and influential patrons of his work was a key factor in his remarkable career.

Renaissance Italy

The Renaissance, or rebirth, of Europe beginning in the 15th century was a time of great opportunity and achievement in culture, exploration, and the accessibility of knowledge. In Italy, wealthy ruling families such as the Medicis commissioned great works of art and architecture. Masterpieces like the Sistine Chapel remind us today of the great achievements of this time. Explorers such as Columbus and Magellan set out on voyages to lands and cultures unknown to Europeans at that time. They established contact and trade with cultures across the globe and made an unprecedented variety of goods from India, central Asia, and the Far East available.

Prior to the advent of the printing press in the late Middle Ages, books were hand-written by monks, one at a time. Information and knowledge was available only to those who had the wealth to obtain monastic manuscripts. Printed books were a crucial catalyst for the Renaissance, resulting in the publication and dissemination of classical texts and works by contemporary authors. Each successive generation grew increasingly literate due to the speed and availability of knowledge. Use of the vernacular languages (as opposed to Latin) increased, resulting in more books that could be read by literate, and not only learned people.

Scientific knowledge became accessible to many more people through books; this ability to

share information also provided an opportunity for rebuttal and exchange of ideas. Leonardo carefully analyzed the approximately 116 books he owned and recorded his response and disagreements with them in his notebooks. For Leonardo, the most reliable source of knowledge was his own observation.

The Gutenberg Bible

Don't miss the opportunity to see the Library of Congress' edition of the Gutenberg Bible. Printed in 1456, it is one of only 48 copies of the original in existence, and one of only three perfect copies printed on vellum. This Bible is the first incunabula – a book printed before 1501 – printed with moveable type. Leonardo da Vinci collected books for his own library like another Renaissance man, Thomas Jefferson. Jefferson's books became the foundation for the Library of Congress' Rare Book collection, but since its founding, the Library has collected nearly 5,700 fifteenth-century books and incunabula – the largest collection in the western hemisphere.

Copies of many of the books Leonardo owned are also in the Library of Congress' collection.

Suggested pre activities

Gutenberg and the Printing Press

The creation and use of moveable type to print books, first developed by Johannes Gutenberg in 1456, is the single most important factor in the widespread availability and dissemination of knowledge during the Renaissance. Information became available to many more people, and theories and ideas could be developed through the interaction that books enabled. Even though Leonardo da Vinci could not attend the university, the works of the most important scholars of his time were available to him through books. You can help students understand the significance of Gutenberg's invention by having them research his life and career on the web and reporting their findings on a time line, or by writing a report.
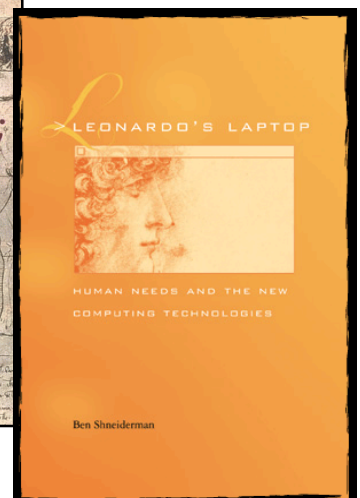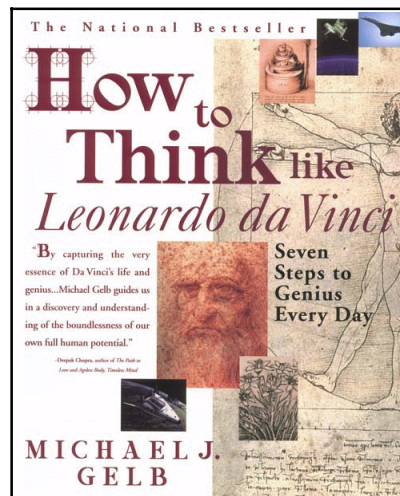
A lesson plan on this topic is available at:
http://www.educationworld.com/a_lesson/00-2/1p2178.shtml

Suggested post activities

Recent books:

Leonardo's Laptop (Ben Schneiderman, MIT Press, 2003) and *How to Think Like Leonardo da Vinci: Seven Steps to Genius Every Day* (Michael J. Gelb, Dell Books, 2000) are examples of the continued interest in Leonardo da Vinci's work.

Try these activities

Measure like Leonardo

Vitruvian Man: Leonardo da Vinci based his famous drawing on a description by the Roman engineer Vitruvius of the proportions of the human body. Determining ratio and proportion was an extremely important activity in the Renaissance-era because there was no standard monetary unit or standard system of weights and measures. People frequently encountered the need to estimate the size or value of something by comparing it to something else.

You can help students understand this principle by having them measure each section of their arms and legs with a string, stick, piece of paper, etc. and comparing the measurements. Ask students: Why do you think we call a unit of measurement 12 inches long a foot? How long is your foot compared to the length of your leg? How many hands long is your arm?

A lesson plan using the Vitruvian Man is available at:
http://mathforum.com/alejandre/frisbie/math/leonardo.html
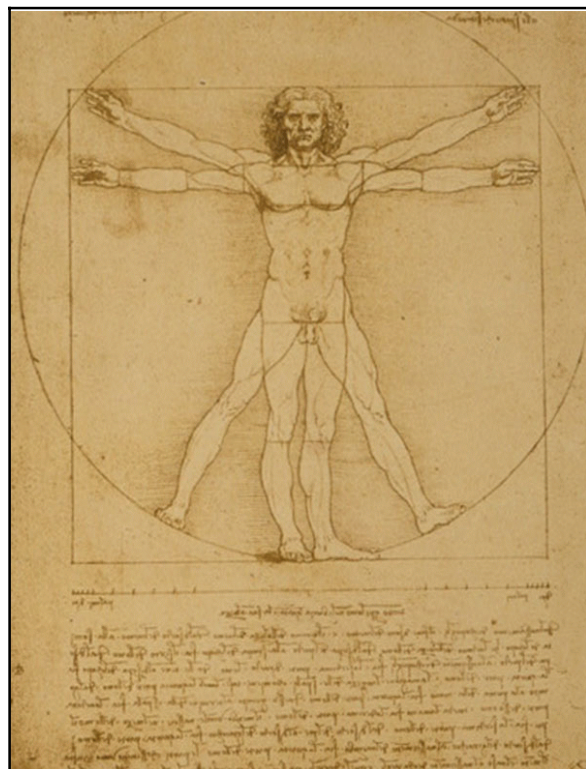
Draw like Leonardo

Geometric shapes: Leonardo da Vinci became fascinated with geometry and mathematics through his friendship and collaboration with Fra Luca Pacioli. You can help students learn more about basic geometric shapes by helping them learn to describe their qualities.

Ask them: What makes a square different from a circle? How many sides does a triangle have? How many points or corners? Have students work with shapes by creating tangrams; more advanced students can create three-dimensional shapes like da Vinci's illustrations for Pacioli's book, *Summa*.

A lesson plan on this topic is available at:
http://standards.nctm.org/document/eexamples/chap4/4.4/index.htm
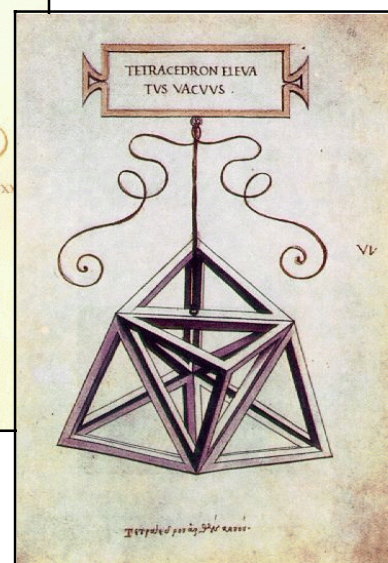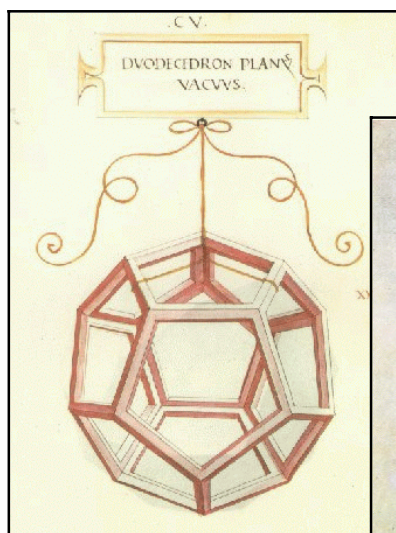
Play like Leonardo

Leonardo da Vinci invented set devices for the theater and even designed sets for several productions. Some of the ideas he recorded in his notebook concern how to make costumes or to light sets. Theatrical productions in Leonardo's day frequently made use of masks to identify characters the members of the audience would recognize. Much like today's sitcoms make use of stock characters such as the dumb jock, the geek, the snotty rich girl, etc. the Commedia's characters were equally well-known. They were identified in the productions by costume, mask, and mannerisms.

The following site has more information about the Commedia, as well as instructions for making a papier mache mask:
   **http://consorte_bella_donna.tripod.com/consortebelladonna/id3.html**

Observe like Leonardo

Leonardo valued his own observation above anything he read in a book. He wrote that his writings would be based on a "much greater and much more noble" authority than any written description. In fact, he frequently challenged the current knowledge of the time. For example, Leonardo did not accept the common belief that the moon had its own source of light. Through observation, he concluded correctly that the sun's reflection lights the moon. He also observed the moon for many days and noticed that the phases of the moon occurred regularly. He recorded his findings in his notebooks and drew the phenomena of earthshine, when the unlit portion of the moon is still visible in the night sky. Leonardo's emphasis on experience is a critical element in the development of the scientific theory. His notebooks contain examples of experiments he conducted again and again by just changing one variable.
Encourage students to observe the moon. They can keep a journal and sketch the moon at the same time each night, noting its location and phase; or they can create chart to track their observations.
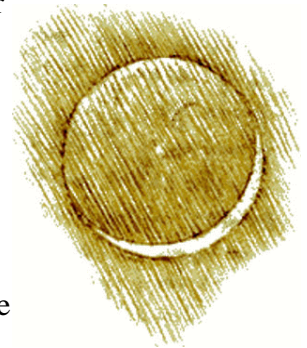
*A description and activity on the phases of the moon is available at:*
   http://www.astrosociety.org/education/publications/tnl/12/12.html
An introduction to the Scientific Method is available at:
   http://teacher.nsrl.rochester.edu/phy_labs/AppendixE/AppendixE.html

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Write like Leonardo

Leonardo was left-handed and wrote backwards in his notebooks from right to left. Try it yourself! Write your name or a word on one line, then try to write it backwards on the next line.

   http://www.mos.org/sln/Leonardo/ClassroomRighttoLeft.html
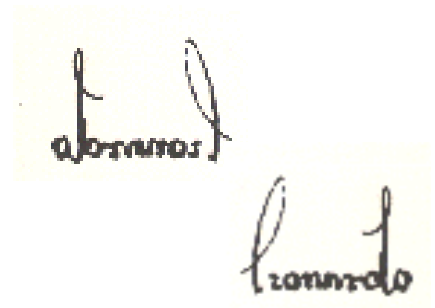
Books

Michael J. Gelb, *How to Think Like Leonardo: Seven Steps to Genius Every Day*. New York, NY: Delacorte Press, 1998.

Janis Herbert, *Leonardo da Vinci for Kids: His Life and Ideas: 21 Activities*. Chicago: Chicago Review Press, 1998. (A lively biography for grade 4 and up.)

Andrew Langley, *Leonardo da Vinci and the Renaissance*. Philadelphia, Pa.: Running Press, 2001. (Grade 4-6)

Fiona Macdonald, *The World in the Time of Leonardo da Vinci*. Parsippany, N.J. : Dillon Press, 1998. (Ages 9-12)

Richard McLanathan. *Leonardo Da Vinci (An Abrams First Impressions Book)*. Abrams Books for Young Readers, 1990. A fresh, detailed introduction to Leonardo's art and science, with great explanations and superb quality reproductions. (Gr. 5–12)

Irma A. Richter, ed., *The Notebooks of Leonardo da Vinci*. Oxford ; New York : Oxford University Press, 1998. (Comprehensive guide to Leonardo's drawings and writings.)

Stewart Ross, *Leonardo da Vinci.(Scientists Who Made History Series)*. Austin, TX : Raintree Steck-Vaughn, 2002. (Ages 9-12)

Peggy Saari & Aaron Saari, eds.; Julie Carnagie, project ed., *Renaissance & Reformation, Primary Sources*. Detroit : UXL, 2002.

Ben Schneiderman, *Leonardo's Laptop: Human Needs and the New Computing Technologies*. Cambridge, MA: MIT Press, 2002.

Diane Stanley, *Leonardo da Vinci*. HarperCollins, 1996. (Excellent introduction by one of the best children's biographers. Grade 2 and up.)

Media

The Cradle of the Renaissance: Italian Music for the Time of Leonardo da Vinci. London: Hyperion, 1995.

Web sites

Leonardo da Vinci: the Man & the Inventor
    http://www.lairweb.org.nz/leonardo/

Leonardo's Workshop: Renaissance Handbook
    http://www.sanford-artedventures.com/play/leonardo/index.html

Leonardo @ the Museum: Virtual Leonardo
    http://www.mos.org/leonardo/

Inventor's Workshop: Leonardo's Legacy
    http://school.discovery.com/lessonplans/programs/invention-leonardoslegacy/

Leonardo da Vinci, National Museum of Science and Technology, Milan
    http://www.museoscienza.org/english/leonardo/

Virtual Renaissance
    http://www.twingroves.district96.k12.il.us/Renaissance/VirtualRen.html

Leonardo Museum in Vinci
    http://www.leonet.it/comuni/vinci/