

Leonardo da Vinci: three easy pieces



Summary:

The activities investigate subjects studied and experimented by Leonardo da Vinci.

Aims:

to experiment Leonardo da Vinci studies. To help teachers develop their role as facilitators of students' learning, to support the diffusion of IBSE in school.

Main activities:

lab experiments about engineering, architecture and painting.

Narrative:

The course investigates the different aspects of Leonardo da Vinci works and studies: engineering, architecture, painting.

The course takes place in two areas of the Museum: the Leonardo interactive lab and the Leonardo gallery with the historical models realized on the basis of the Leonardo drawings. The two areas permit to investigate in deep the Leonardo thoughts, his notes, his historical period, the influences of the contemporary artists and scientists, the heterogeneity of his studies. The investigation is made not on the basis of his manuscripts but through interactive activities. Leonardo becomes a valid example of the interconnection between historical and cultural aspects with physics. The influence of

humanistic culture on the scientific one becomes an example of how to present science and technology in a multidisciplinary perspective in school. Every day of three of the course is devoted to a specific theme. In the first day teachers investigate the Leonardo machines: the aerial screw, the pulley, the cochlea. They discover how they work, how Leonardo imagined them, the drawing interpretation, and they try to put in practice some of his projects. In the second day static is investigated, in particular the equilibrium of some architectures. Some

examples of the questions posed to teachers are: why the marble of Milan Dome doesn't fall? Or why are there arches in many buildings? And which function they have? How do they work?

The third day is devoted to Leonardo polyvalence in science like in art. The teachers act as workers in a renaissance studio and experience the apprentice. They learn painting techniques like fresco and discover the different techniques used in the Renaissance and they compare it with the Last supper experimental technique.

Methods of learning/training:

inquiry, experimentation, collaborative learning, scientific method, discussion

End user:

in-service teachers of primary and secondary school

Involved actors:

teachers

Location:

National Museum of Science and Technology Leonardo da Vinci

Languages available:

Italian

Teachers' Competencies

1	subject matter/content knowledge	x
2	nature of science	x
3	Multidisciplinary	x
4	knowledge of contemporary science	x
5	variety of (especially student-centred) instructional strategies	x
6	lifelong learning	x
7	self-reflection	x
8	teaching/ learning processes within the domain	x
9	using laboratories, experiments, projects	x
10	common sense knowledge and learning difficulties	
11	use of ICTs	x
12	knowledge, planning and use of curricular materials	x
13	Information and Communication Technologies with Technological Pedagogical Content Knowledge	



Mapping best practices with main principles

1. Building interest in natural science phenomena and explanations:

The training course is built on a scientific topic and its applications. Through exploration, experimentation, observation, collection of data, development of hypotheses, through first hand involvement of the teachers, the course aims to raise interest in science and technology. Discussion in group aims at developing explanation of the phenomena observed. Leonardo is taken as a valid example of the wide curiosity to scientific and technological phenomena. The teachers discuss how to stimulate the same curiosity in students using the Leonardo method.

2. Building up informed citizens: Students understanding the nature of Science & Science in society:

Participants are called to understand their own contribution as citizens, the importance of their own participation and critical opinion and how their own choices create an impact on how science and technology are perceived and integrated within society. The social importance and impact of contemporary engineering on daily life is compared with Leonardo's age.

3. Develop multiple goals:

- understanding big ideas in science including ideas of science, and ideas about science
- scientific capabilities concerned with gathering and using evidence
- scientific attitudes

Teachers investigate scientific phenomena with interactive activities. They are able to explore notions, phenomena, principles and transformations; they also use the different phases of the scientific method. This allows them to deepen into the science process which means build a scientific knowledge about a range of topics, but understand also how science works and what scientific research means. Leonardo method of work is taken as example of the use of evidences and data to build a theory and of the influence of practical experiments on general scientific ideas.

4. Understanding students' concepts and learning style about of science phenomena:

The course aims at the development of knowledge and skills in teachers but concentrate also on a metacognitive reflection, focusing on teachers as learners. On this basis, teachers are also invited to examine their own students' learning and involvement in science as well as problems they might face with the students.

5. Relevance of the content to daily life of students:

The choice of the topic is based not only on its scientific importance but also on its relevance with daily life. Also, the educational methodology adopted by the Museum in the training course (as well as in its education programmes) puts at the centre the personal experience and knowledge of each individual. This means that everyday life experience of students is one of the main tools on which training builds. Moreover, the problem solving activities require teachers to use their background knowledge and consequently think of the students' own background. Leonardo engineering works are compared with contemporary engineer faced by teachers in daily life.

6. Understanding science as a process not as stable facts. Using up to date information of science and education:

Understanding science as an on-going, not consolidated process emerges from the very activity of experimenting and testing carried out by teachers during the course. On this basis teachers are also encouraged to consider the process they chose to use in order to solve the problem and to collect data in order to confirm or not their hypotheses. Leonardo da Vinci method of work is experienced and analyzed.

7. Activities for gaining knowledge, not for entertainment, nor for simple imitating of results:

The training course is based on a mix of activities which aim to develop subject-knowledge and skills in science and technology also through the use of interaction, confrontation. The course explores a specific topic not only in terms of its scientific and technological dimensions but also in relation to society, to everyday life and to individuals and emotions. We know that the personal and emotional involvement of participants in the learning experience maximizes the probability for effective learning.

8. Doing science: experimenting, analyzing, interpreting, redefining explanations:

The activities starts with an open scientific question posed by the museum trainer. The teachers conduct experiments to explore different answers following observation, data collection and interpretation, development of prediction and discussion of scientific ideas. The scientific method is the basis of all the work done. Leonardo da Vinci method of work is experienced and analyzed.

9. Assessment: formative ~ of students' learning and the summative ~ of their progress:

The museum is a informal environment of learning and has a role which is complementary to that of the school. Consequently, visitors' learning is not assessed like in schools. We do not use structured tools or processes for assessing the learning experience of our visitors (schools in this case) as this is not part of our education priorities. Informal, personalised, meaningful experiences for each person in a different way is the priority of our education programmes. At the same time, we run self-reflection sessions among education staff in order to analyse how our programmes are developed (education methodologies) and how interaction with the public takes place. The formative and summative assessment are left to the teachers.

10. Cooperation among teachers and with experts:

The training course builds close collaboration between museum experts and teachers as well as collaboration between teachers themselves. This collaboration continues also after the end of the course through update of training or distance support. Moreover, professionals from companies or universities with expertise in different fields are involved in the training. The teachers appreciate very much the discussion with the different experts.