# A Renaissance Enigma: Raphael and the Lustre Technique



# Daniela Ambrosi

## Liceo Scientifico "G. Galilei", Perugia, Italy

dagato@hotmail.it



#### Introduction

Recently it has been shown that lustre is a decorative technique, used by medieval and renaissance potters, that consists in silver and copper nano-crystals dispersed within the glassy matrix of the ceramic glaze. Here we report the findings of study on lustre of several shards belonging to Deruta pottery of XVI century. This has allowed the construction of a problem-based learning experienced in 4 classes during the school years 2010-2014. Students aged between 16 and 18 years. We have prepared the lesson plan for the teacher with steps and the learning activities.



Developing problem-solving skills: students have a goal or a challenge to resolve. The challenge/question is



set by the students themselves. This builds on their strengths, potentials and preferences. Learners become active researchers: research across varied media (text-based, video, audio, images, results of experiments, numbers, etc.) is the basis of the classroom activity. Learning by exploring: students can construct models, test ideas and evaluate the results themselves. The first activity is "Investigate", teachers can promote inquiry- and project-based learning to enhance students' critical thinking skills.

#### Activities that raise questions

Creation

Students must plan, design, and produce their own work. For example, a multimedia production or a presentation. It cannot be a simple repetition of information. All students work with real knowledgebuilding activities. Interpretation, analysis, teamwork, and evaluation are important parts of the creative process.



Students have performed in the school's chemistry lab experiments on colloidal systems using the cards on the website Nano You. To highlight the oxidation of the copper change from oxidation number +2 oxidation number +1 we performed the test with Fehling reducing carbohydrates. The students are engaged in well-structured independent learning at home, allowing the teacher to devote the time in the classroom to the project work and collaboration. A flipped methodology.



# Active investi-

The technology provides different ways for learners to get involved through hands-on learning activities. Connecting with the outside world: rather than working within the artificial boundaries of a school subject, the teachers and students select real-life challenges and data to investigate.





### Discussion

Who is Perugino and Raphael? Why has Raphael created a design for the ceramics of Deruta? Where is Deruta? What was in Deruta in XV century? Why Raphael is very important in Perugia at the end of 1400? What are Baglioni and Colonna Family? What is lustre?



Refle-<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>What<br/>Wha

Who is Piccolpasso and what he wrote? What is the Bolo? How it is made? What are the secrets of bolo? Where did you find the clay? It is assumed a geological research about clay rich in copper and silver in Tuscany.

## Core concepts

Redox. Environment oxidant/reductant Colloidal Dispersion System Weak acids/buffer system Phyllosilicates/Clays Crystal lattice/Hybridization Nanoparticles Clusters: Silver and Copper

Working with this approach has both strengths, and some weaknesses. You can get a greater motivation to study and improvement of student learning, which they also learn to work in groups and to apply the scientific method (IBSE). At disciplinary level, the chemistry's concepts are applied in concrete reality and in everyday life. The knowledge has been integrated with laboratory experiments related to redox reactions and colloidal systems. The students presented their work carried out in a show in the presence of an audience and their parents. Weaknesses are due to logistical and organizational issues, often the lack of adequate equipment and facilities.

#### References

Bolte, C. (2008). Science Education International, 19(3), 331-350.

Bolte, C., Streller, S., Holbrook, J., Rannikmae, M., Hofstein, A., Mamlok, R. & Rauch, F. (2012). Introduction into the PROFILES Project and its Philosophy. In Bolte, C., Holbrook, J., & Rauch, F. (Eds.). *Inquiry-based Science Education in Europe. Reflections from the PROFILES Project.* Berlin, Freie Universität Berlin. Print: University of Klagenfurt (Austria). pp 31-42.

Romani, A., Miliani, C., Morresi, A., Forini, N. & Favaro, G. (2000). Applied Surface Science, 157(3), 112-122.







