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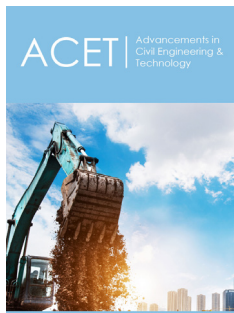
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On the Education of Engineer in the 19th Century: A Note from the Studies about Leonardo Da Vinci

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Abstract

In the second half of the nineteenth century, scholars and professors discussed a lot about the education of civil engineer; reflecting on the relationship between research and teaching and about the importance of theoretical lectures and the practical exercises. The mini-review discusses the same relationship, still actual, based on a note signed by Uzielli [1]; (1839-1911), teacher of Mineralogy and Geology in the Regia Scuola di applicazione per gli ingegneri in Torino now Politecnico of Torino, an important tool in order to valuate the link between research and teaching. Uzielli [1] wrote about a rock derived from quartz, giving to the students of the school of engineering the outcome of his research about Leonardo da Vinci- so-called Vinciano, a man considered the forerunner of the nineteenth-century progress, able to deal original themes in the fifteenth and sixteenth century that became key topics for the education of the engineer in the nineteenth century. At the same time, the note of the professor, famous for his researches about Cristoforo Colombo e Paolo Toscanelli, allows to evaluate the experimental and scientific method, for Uzielli founded by Leonardo and adopted, still today, in the education of engineers.

Keywords: Education; Leonardo da Vinci; Scientific method; Gustavo Uzielli

Introduction



Figure 1: Leonardo da Vinci e le Alpi [1].

In the extended field explored by the history of civil engineering, linked with the wide and articulated discipline of the history of architecture, the research about the education of the engineer is included in the discussion, in the nineteenth century even today, concerned the relationship between different matters and distinct teaching methods. The discussion is often focused on the value of lectures, evaluated like theoretical lessons, related with practise exercises, with the ultimate goal of educating graduate technicians with a lot of professional skills. Sometimes, in the teaching programme or in the rare handwritten notes

signed by the teachers, there's the reference to leading figures of the international culture of the past, especially lived in the early modern age, in the period so-called Renaissance by historians and critics. One of the main figures is Leonardo da Vinci (Figure 1), famous artist which occurs the fifth hundredth anniversary of the death in the 2019. In the nineteenth century, especially in Europe, many studies interested Leonardo and his works. Uzielli [1], who taught engineers geology, published some of them in Italy and he used his reports about Leonardo during his lessons. Now the scholars considered Leonardo like a forerunner of the nineteenth-century progress, able to deal broad and complex original themes in the fifteenth and sixteenth century that became key topics for the education of the engineer in the nineteenth century. Applying the traditional method of historical research, in which archives' documents are compared among others and with the bibliography, the mini review suggests associating research about Leonardo with the education of engineers, opening a new pathway for research.

A note from the studies about Leonardo da Vinci in one lecture for the engineers

In the second half of the nineteenth century, the studies about Leonardo da Vinci-so-called Vinciano-interested some scholars who read Leonardo's codes and manuscripts in order to know Leonardo's ideas, arts and sciences and, at the same time, in order to print all Vinciano's works. One of the main intellectuals who worked a lot about Leonardo was Uzielli [1], well-known scholar of Cristoforo Colombo e Paolo Toscanelli, who taught Mineralogy and Geology in the Regia Scuola di applicazione per gli ingegneri in Torino, now Politecnico di Torino, in the 1880s. In his teaching, he presented some concepts derived from Leonardo's studies. His main aim was to copy and publish Vinciano's codes and manuscripts, just when the only Leonardo's books published were the "Libro di pittura", about drawing and painting, and the "Del moto e misura dell' acqua", about the physical phenomenon of the movement of the water, edited in the seventeenth century, tool for the researches about hydraulics. Uzielli's idea derived from the French edition of the manuscripts belonged to the Institut of France in Paris, edited by Charles Lacher Ravaisson Mollien at the end of the nineteenth, from "The literary works of Leonardo da Vinci compiled and edited from the Original Manuscripts" written by Jean Paul Richer and published in London in 1883 and from the "Saggio sulle opere di Leonardo da Vinci" signed by Gilberto Govi in the 1872. In Italy, the initiative organized by Uzielli, who wrote about it with Govi and the others Italian Leonardo's scholars in the nineteenth - Giovanni Piumati, Edmondo Solmi, Luca Beltrami - could be read like a tool for making, after 1861, the identity of the new united nation-state.

Uzielli was born in Tuscany, in Livorno, not far from Vinci. He studied mathematics and then, interested in geography, a new subject in the nineteenth century culture, he worked in Rome, in Torino and in Parma and he wrote a lot, like we can read in his archive now in Florence, with the main intellectuals all over the world, especially in Europe. He taught since 1877, some years after his first works about Leonardo's botany and his studies about the Vinciano commissioned him by the Government, in the Regia Scuola di applicazione per gli ingegneri in Torino. The School, open

to students who had attended the two-year university course in Mathematical Sciences and aimed to educate "graduate engineers", was founded in 1859, in compliance with the law about education signed by Gabrio Casati. The main courses were architecture, chemistry, construction, geometry, steam and railways, mechanics, hydraulics, mineralogy and geology and legal subjects [2].

The chair of Mineralogy and Geology, immediately ascribed to Quintino Sella, a scientist and a political man who wanted to found Torino's school of engineering, was then attributed to Sella's assistant Bartolomeo Gastaldi and later to Uzielli. At once, he became the tutor of the geo-mineralogical collection (now Museo geo-mineralogico of Politecnico di Torino), a rich and extraordinary collection of minerals and rocks, made up from an old school and from seven thousand samples of Quintino Sella. In his lectures he interlaced knowledge learned from his research about Leonardo, Colombo and Toscanelli with the detailed analysis of rock and minerals, with the reports about the earth or with the studies about water. The teachers, often, published their studies about geology, and geography, in the «Bollettino del Club Alpino Italiano», the paper edited by an important and eminent association founded in order to promote mountain-climbing and mountain studies. In this Bulletin, in 1889, the Tuscan teacher published his essay titled "Leonardo e le Alpi" [1] in which, in the opening, he cited Leonardo's Manuscript G of the Institute of France. In the first sheet, the Vinciano wrote about the mountain Mombracco, near Saluzzo, not far from Torino, where there was «a fused stone mine, which is white as Carrara marble, without macules»; the painter is interested in it because he expected to receive the rock and to use it as a «tablet for colours». The rock, so-called in Italian language «bargiolina» because of its origins, derives from quartz and it is still currently used in prestigious building site. It's interesting to compare Uzielli's article with his handwritten notes for his lectures. In his notes in which he explained the different characteristics of rocks and minerals and their different uses, he wrote about the «bargiolina» as useful for «tables for color mills» (Biblioteca Nazionale Centrale di Firenze, Fondo Uzielli, strip 140, No. 18), like he could read in Leonardo's manuscript.

Conclusion

The research about Leonardo and Piemonte [1,3] and the comparison between Uzielli's notes and his lessons gave to engineers, published here for the first time like an outcome of my personal research, allows us to discuss the relationship between the research and the university lectures as well as to consider a different approach to Leonardo who, moreover, Uzielli [1] considered the founder of the experimental and scientific method (according to this method, hypotheses are discussed leaning on precise collection of data and the theories are rigorously analysed). Based on an historical studies started with the aim of recognize Leonardo's biography and his works, when none knew a lot about him, the Tuscan professor edited subsequent editions of his "Research about Leonardo da Vinci" (1872, 1884, 1896) in which he introduced the same scientific approach used by Leonardo and still used today. At the same time, this way of working is an example

to understand, and to use, the scientific method in the research and in the lectures proposed to the engineering students. The main aim of this mini review, in fact, is to discuss Leonardo's and Uzielli's scientific method, thinking about the relationship between research concerning Vinciano with the teaching to engineers. In Torino, for example, when Federico Sacco, a famous geographer and cartographer succeeded to Uzielli, taught Geology, he wrote about Leonardo and he justified in a few pages, edited in the years of the Second World War, the close relationship between knowledge, research, teaching and the scientific approach.

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