DARK GRAINS OF SAND: A GEOLOGICAL STORYTELLING

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Introduction

In the secondary Italian school the Earth science learning begins at first year (students 14 years old), in synergy with other natural sciences such as Astronomy, Chemistry and Biology. Italian teachers have to focus on the landscape geomorphological aspects even Earth processes are difficult to display since they are related to certain phenomena happened during the past and often far from the involved countries.

The aim of this work is to show how a learning process can be developed on the geological and geomorphological occurrence, totally free from school books, starting from a trip and based on an inverted sequence experience-theory, so far from the canonical paths. Exploring before teaching allows a lifelong learning, focusing on phenomena observation and data analysis, useful for developing scientific skills on young guys more similar to the Galilei approach to the natural sciences.

Objective

According to the IBSE - Inquiry Based Science Education approach, a learning unit has been implemented, starting from a walk along the light carbonate beaches of the Adriatic sea: a smart look to the sands. Students fantasy pushing them to explore some strange black grains on the sands. At this point, the teacher asks: "Dirty sands on our beaches?"

Methods

The teaching challenges

Due to the youngest age, a first level guided inquiry has to be adopted, so the teacher is the "guide of inquiry" encouraging the students using the research question "Why is the sand dark?". "Do all sands look the same?" and driving them around their investigation plans ("How can I measure grain size?"). A brainstorming about questions opens each lesson followed by a discussion on some hypotheses to investigate. The explanation follows the exploring step. This approach matches the "BSCS 5E Instructional Model" consisting in five phases: 1) the Engagement helps the students become engaged in a new concept through the use of short activities promoting curiosity; 2) the Exploration experience provides students with a common base of activities within which current concepts (i.e., misconceptions); processes; 3) the Explanation focuses students' attention on a particular aspect of their engagement and exploration experiences; 4) the Elaboration where teachers challenge and extend students' conceptual understanding and skills; 5) the Evaluation encourages students to assess their understanding and abilities.

Evaluation procedure isn't so easy because Italian assessment is mainly based on summative than a formative practice, otherwise collaborative practices such as collecting data in a group, planning and conducting investigations, interpreting evidences, drawing conclusions and discussing results with peers has been taken into account, as they are at the centre of the IBSE approach. Different rubrics are adopted for the different skills and different performance like participation and group work, research report, concept maps.

In particular the assessment process for the team work is composed of two parts: the first is the peer evaluation where every team member evaluates his peers; indeed the second is performed by the teacher.

In this phase the students use their knowledges to understand a wider context like the different coastal geomorphology of our country or the implications of different flow rate have for river morphology. Moreover they can understand the inferences between these phenomena and the important issues due to coastal erosion.

The main features of Vulture volcanos, Ofanto river, Adriatic marine currents and Apulian geological setting have been analized to explain the volcanic and carbonate grain composition of our sands.

"Determinition of a acid insoluble residue in sands"
1) Transfer the weighted sample "A"=3.0g to a 100 ml glass beaker and add enough deionized water to cover the sample;
2) Slowly and carefully pour 5 ml of hydrochloric acid (a small amount at a time) over the sample. Stir or agitate sample and acid until all bubbling or fཁormentation has ceased. Continue to add acid until no reaction is noticed. Then add an additional 1ml of acid to be sure that all carbonate is dissolved;
3) Place it in an oven to remove water;
4) Add deionized water to dissolve the white precipitations of calcium salt;
5) Filter through the filter paper to remove soluble calcium salt;
6) The remaining mass is the mass of volcanic grains.

"Let's observe and describe our sand"
"Why is the sand dark?"
"How many carbonate clasts are there?"
"Where does it come from?"
"Do all sands look the same?"
"Why do the beaches change during the time?"
"Are the grains old the same?"
"How do the grains build up our beaches?"

"Let's find out our sand has the 50% of carbonate grains"