

How were the Design Principles applied

The context

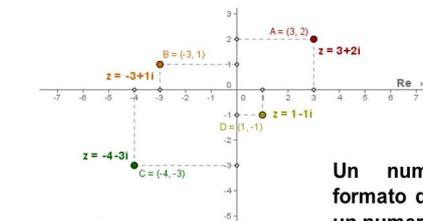
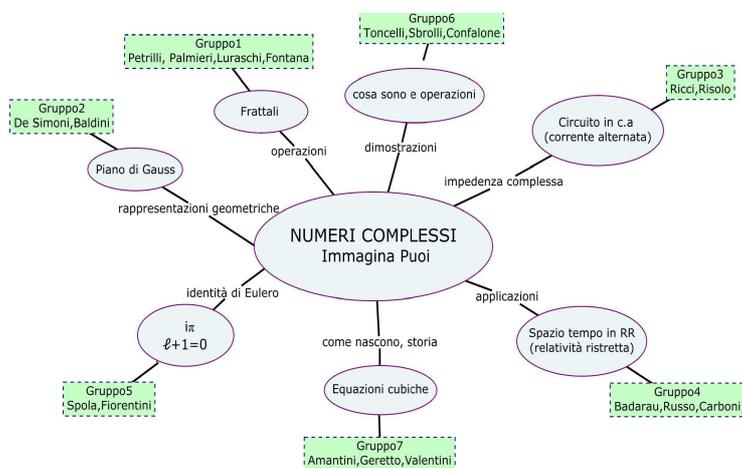
Authors: students of 5C class
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School: L.S.S. "A. Labriola"
City: Roma (RM) **Country:** Italy
Educational level and number of students: Scientific Liceum (ISCED 2011 Level 344) – n. 24 students
Topic: "Imagine, you can"
Main subject domain(s): Maths, complex and imaginary numbers
Duration: 10 months

The object: A tutorial (web – site) on complex numbers and their application in various field.

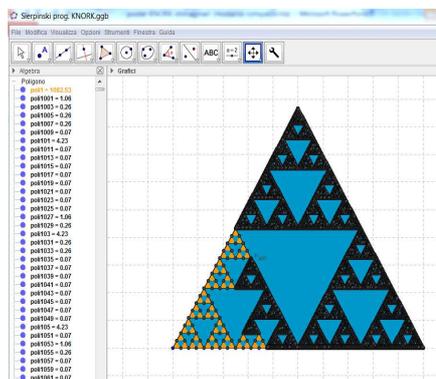
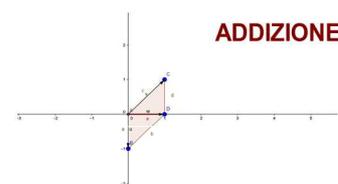
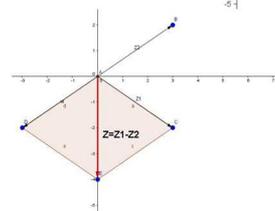
Why we choose to adopt TLA: Students turn proactive when directly involved in the construction of an artifact; furthermore they improve their personal baggage of soft skills.

DP	Implementation in the case
DP1: activities shared around objects	Several conceptual artifacts explaining the importance of imaginary and complex numbers, their historical origin and their applications in various fields: alternate circuits analysis, Minkowski space in Special Relativity, wave functions in Quantum Mechanics (Physics); Mandelbrot set and fractals (Maths, Graphic arts). Brainstorming on what kind of tutorial best fits the students ICT competencies.
DP2: integration between personal and collective agency and work	Jigsaw technique: expert groups work on different subtopics, each group develops knowledge and produce explaining materials; jigsaw group (the entire class) aimed at the diffusion of the knowledge among all the students. Several working roles established: expert group meeting coordinator, expert group coordinator for the production of the materials; expert group speaker; jigsaw group meeting coordinator.
DP3: knowledge transformations and reflection	Opportunities of reflection on the knowledge transformation occurring and achievements attained, are offered to students through questionnaires and thanks to feedback from the teacher during free discussion moments. Metacognitive strategies are put in evidence and strongly encouraged
DP4: long-term processes of knowledge advancement	In a learning by doing process, students acquire concepts and competencies by building the artifacts, in particular in the collaborative construction of the web – site.
DP5: cross-fertilization of knowledge practices and artifacts	Each expert group presents his results to the classroom. Free discussion with the teacher and and the students in the large group makes it possible to compare experiences, skills and knowledge developed within each group. The tutorial can be translated in other languages so that it can be appropriate for CLIL classes in Italy and maths/physics classes in other English – speaking classes.
DP6: flexible tools	Facebook and Whatsapp for discussion and sharing of ideas. Drive as a repository of documents and other working materials. C – map for the map of the project. A c++ platform for codeing and graphing of the Mandelbrot set. Geogebra dynamical geometry and CAS software for the representation of complex numbers and their properties, Web - site programming languages

Main results



Un numero complesso è formato da un numero reale e un numero immaginario. Sul piano di Gauss è rappresentato da un vettore.



A fractal representation of the Trialogical approach

insieme di mandelbrot

la formula ricorsiva:
 $z_n = z_{n-1} + C$ nel piano dei numeri complessi è stata usata per realizzare un programma in c++ che ci ha permesso di osservare ed esaminare l'insieme di mandelbrot.

Main challenges/constrains/problems

The trialogical approach requires much more time than a traditional lecture. Not all the expert groups develop an autonomous ability to achieve significant results. The most respondig groups went into the subject much deeper than in traditional non – trialogical classes

Further developments (if any)

Further subtopics to be added and the final web site to be realized