Mathematics and Science study through the Arts

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Key to business (Italy)
Overview

1. Science and Art
2. Human being unity
3. Mathematics is everywhere
4. Art and student cognitive development
5. Art and student social development
6. Research description and results
A clear break between art and science, scientific and humanistic disciplines, took over only in the modern era, from Descartes onwards, with the so-called scientific revolution of the 17th century.
While less than a century before, the universal talent of the Italian Renaissance, Leonardo da Vinci celebrated the maximum coincidence between art and science.
Today's cultural horizon **bans** all **dichotomous stereotypes** between humanistic and scientific knowledge.

They are **two distinct forms** of **knowledge** among which, however, there is **correlation** and **interpenetration**;

**two cognitive acts**, based respectively on **intuition** and **reason**, which correspond to different optics, to **different ways** of experiencing reality.
Dividing science and art is unnatural: these "two cultures" are actually the one.
MATHEMATICS IS EVERYWHERE..

In nature

In painting

In architecture
THE PROPOSED METHOD

The methodological procedure on how to introduce the arts into scientific subjects in national school curricula has been undertaken recently with Italian secondary school students (first and second cycles) with 13-16 years-old.

The proposed method, piloted with students, is based on a well-structured methodology inspired by Singapore’s approach.
From the Singapore approach, we used the three phases structure (concrete, pictorial and abstract).

The Singapore’s approach is defined as the Concrete to Pictorial to Abstract approach (CPA).
**ARTS INTRODUCTION**

*Arts* were introduced as a **means** to manipulate the objects, to recognize mathematics formula/concepts, to **re-create** a new art-work on the base of the concept studied.
1° phase “Concrete”: Students constructed specific objects.

2° phase “Pictorial”: Students learnt how to recognize maths in the art.

3° phase “Abstract”: Students created their art work starting from the maths formula studied.
STUDENTS PROFILE

Total sample: 130 students from secondary school (First and second grade)
SOME RESULTS

BEFORE

Mathematics is abstract

<table>
<thead>
<tr>
<th>Agree</th>
<th>57,70%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disagree</td>
<td>42,30%</td>
</tr>
</tbody>
</table>

AFTER

Maths is not something abstract

<table>
<thead>
<tr>
<th>Agree</th>
<th>93,10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral</td>
<td>6,90%</td>
</tr>
<tr>
<td>Disagree</td>
<td>0,00%</td>
</tr>
</tbody>
</table>
**Before**

**I like to attend math class**

- Disagree: 46.90%
- Neutral: 16.90%
- Agree: 36.20%

**After**

**This method makes maths study more fun**

- Strongly Agree: 87%
- Agree: 7%
- Neutral: 4%
- Disagree: 1%
- Strongly Disagree: 1%
SOME RESULTS

Maths concepts are clearer...

- Excellent: 63%
- Good: 29%
- Satisfactory: 4%
- Fair: 3%
- Poor: 2%

+ Cleanness

Motivation for maths study

- Strongly Agree: 73.85%
- Agree: 17.69%
- Neutral: 6.92%
- Disagree: 1.54%
- Strongly Disagree: 0.00%

+ Motivation
VIRTUAL MUSEUM

Virtual Museum “Mathematics and Arts”

This presentation introduces some final outputs of a PhD research work «Mathematics education, Western and Eastern teaching approaches combined with the Arts» carried out by Michela Tramonti, PhD Institute of Mathematics and Informatics - Bulgarian Academy of Sciences, Sofia (Bulgaria)

Research objectives

1. Exploiting the possibility to find a combination between Western and Eastern approaches in mathematics teaching/learning.
2. Finding in the arts the result of this integration.
3. Demonstrating the objectives above intends to encourage a meaningful learning in the development of the science competences, to improve the school performance and higher interest towards a future perspective in the scientific field.

Institute for Computer Science and Control, Hungarian Academy of Sciences, (MTA SZTAKI)

in collaboration with Institute of Mathematics and Informatics – Bulgarian Academy of Sciences from Bulgaria
VIRTUAL MUSEUM

Drop

Authors: Denise Migliori, Ilde Ciccone, Elsa Palmeroni, Gada Nardone, Nuncia Parola
Title: Drop
Tool used: hand-made
Class: Secondary school – Second cycle
School: Istituto Tecnico Commerciale “Arturo Bianchi” – Terracina (Italy)

The hand-made drawing was realized according to the symmetry criteria with respect to a vertical axis, represented by the red line in the figure.
CONCLUSIONS

- The gathered data reveals that the use of art-works, as means and tool of learning of other subjects, like mathematics, offers students the way to go beyond the pure theory and to apply knowledge in the surrounding world.

- Art, as a creative element, supports students in the development of the ability to introduce innovations continuously without being afraid of them.

- Integrating art into learning not only permits to involve students into the educational process better (out-of-box thinkers), but it also helps to develop citizens of the world with views large enough to embrace all the complexity of the actual reality.
Thank you for your attention!

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