



Incorporating creativity and interdisciplinarity in science teaching: the case of «Art & Science across Italy»

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on behalf of the A&S
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Creativity in science education

1° place: «*Ceci n'est pas un violon*»
Barbara Rondinella, Caterina Chiri, Damiano Chiarello
Liceo Scientifico "L. Da Vinci", Maglie



How the Arts contribute to Science education

Three levels in which arts improve learning and teaching of science [1]

- macro: how the subjects (science and arts) are structured and «packaged» in curricula
- meso: engaging learners through arts-related STS contexts
- micro: pedagogical practises drawing on the arts

[1] Can. J. Sci. Math. Techn. Educ. (2019) 19:219–236, <https://doi.org/10.1007/s42330-019-00057-7>

From STEM to STEAM

STEM: Science, Technology, Engineering and Mathematics

- STEM subjects viewed by students as lacking creativity and unrelated to images or aspirations [2]
- Not an integrated reality in high schools [3]

An example of 'macro' integration: STEM integration with Arts into a '**STEAM**' curriculum [4]

- Holistic and transdisciplinary teaching
- Alternative to conventional multidisciplinary views of STEM and Arts
- Avoiding artificial combinations (or separations) of subject disciplines

[2] Archer et al. (2013). ASPIRES Report: Young people's science and career aspirations, age 10 –14. King's College London

[3] Howes et al. (2013). Re-envisioning STEM education: Curriculum, assessment and integrated, interdisciplinary studies

[4] www.steamedu.com

Multidisciplinary teaching practices for science

Science seems like «learning a foreign language» [5]:

- uses symbolic and semiotic systems of representations
- gives specific meanings for everyday words (e.g. «work» in physics)

These communication modes can create
significant subject-specific barriers

Art and creativity can help students breaking down these barriers

Examples:

- Painting and drawing to communicate scientific ideas
 - improve observation and pattern recognition
 - enhance visual thinking
- Drama (role-play, movement etc) provides narrative alternative to expository text

The CERN-INFN Art&Science project

2° place: «*La melodia del caos*» [video](#) 
Giorgia Grattagliano, Alessia Renna, Aurora Barnaba.
Licei G. Galilei M. Curie Polo Liceale di Monopoli – Bari



Art&Science across Italy

- European project of the CREATIONS network (H2020)
- Organised by the Italian National Institute for Nuclear Physics (INFN)
- In collaboration with the European Organization for Nuclear Research (CERN)

*“If the Higgs boson had a colour,
what would that colour be?”*



Mandate: achieve wider student engagement with cutting-edge science [...] through the use of art as a universal language to approach, study, represent, and communicate scientific ideas and phenomena, irrespective of students' gender, educational performance, prior discipline knowledge, and dispositions towards science and the arts [6].

Structure of the project

3° place: «*Entropic Mechanism*»
Filippo Magentini, Edoardo Petrin, Mateo Cela
Liceo Scientifico Enrico Fermi di Padova



Structure: 4 phases over 2 years

1 – Educational phase (1° year)

- Seminars
- Museum visit
- Visit to Laboratories
- Round tables
- Photo/video contest
- Movies and doc.

2 – Creative phase (2° year)

- Group of 3 students design an artistic project.
- One scientific theme.
- No restriction or boundary.
- Any artistic form is welcome.

3 – Exhibition and competition (2° year)

- All artworks are shown at local exhibition
- From each city, the first 7 access the National competition
- Students act as guide/cicerone

4 – Master at CERN!

- Panel of experts (scientists and artists) select the best 8 artworks
- 24 fellowships for the A&S Master
- 5 days long



Status

4° place: «*Reale o non reale, questo è il dilemma*»
Gaetano Affuso, Matteo Peluso, Francesca Vincenzo
Liceo Scientifico Elsa Morante di Napoli

Status of the Art&Science project

- Project **started in 2016**
- 2nd phase of the **III edition** ended in June 2022
- About **10.000** students and **200 schools** involved, from 12 regions of Italy
- Many italian universities and research institutes involved
 - For the 1st phase, **seminars given on many art-science interdisciplinary** topics (ranging from particle physics to natural science, from architecture to literature and music)
 - In the 2nd phase, **tutors** from INFN, University, Academy of Fine Arts, Conservatories, to cover both scientific and artistic aspects



<https://artandscience.infn.it>



<https://www.facebook.com/artandscienceacrossitaly>



<https://www.instagram.com/artandscienceacrossitaly>



https://www.youtube.com/channel/UCXc2-O9622GSY-LrID8j7pQ?view_as=subscriber



<https://agenda.infn.it/event/24727/>

III Edition 2020 - 2022



Vittoria Mazzei, Giulia Caporale, Letizia Camerini

Liceo "XXV Aprile", Pontedera

Insostenibile pesantezza dell'essere

...la stessa contrapposizione ed equilibrio tra peso e leggerezza, gravitas e levitas
...si pongono sulla conoscenza e pongono le loro basi su leggi fisiche e calcoli

5° place: «L'insostenibile pesantezza dell'essere»
Vittoria Mazzei, Giulia Caporale e Letizia Camerini
Liceo XXV Aprile di Pontedera

III Edition – 2020/22



5653

STUDENTS



158

SCHOOLS



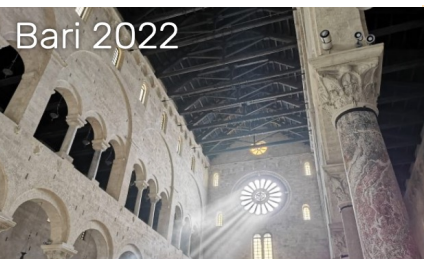
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EXPOSITIONS



27

SCHOLARSHIPS



Bari 2022

Dal 01/04/22



Cagliari 2022

Dal 15/02/22



Genova 2022

Dal 01/11/20



Frascati 2022

Dal 07/03/22



Lecce 2022

Dal 01/04/22



Milano 2022

Dal 06/02/22



Napoli 2022

Dal 30/04/22



Padova 2022

Dal 28/01/22



Pisa 2022

Dal 10/03/22



Potenza 2022

Dal 13/01/22



Roma 2022

Dal 22/03/22



Torino 2022

Dal 22/03/22

III Edition – 2020/22



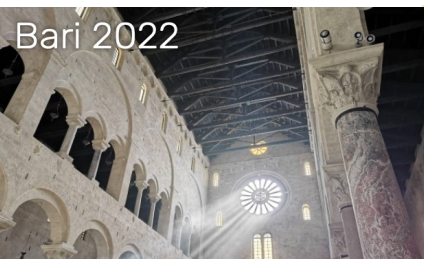
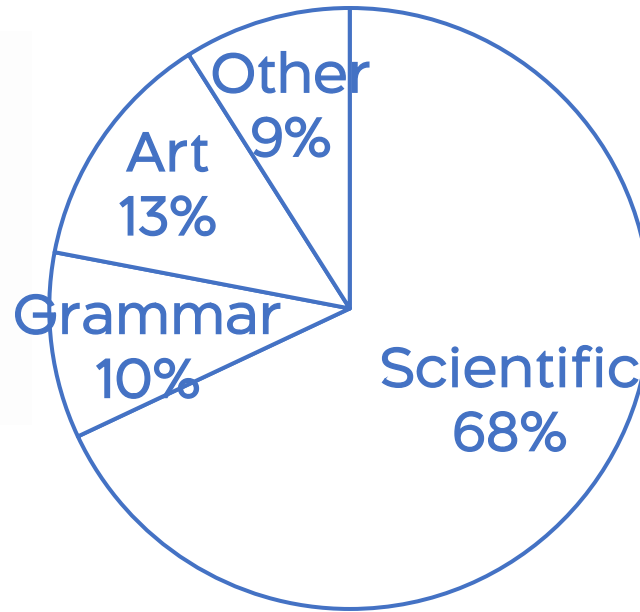
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III Edition – 2020/22



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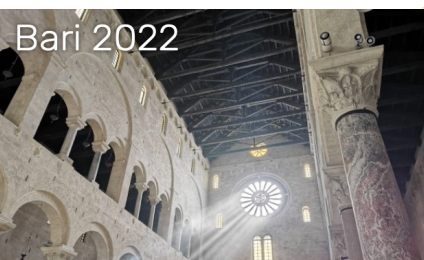


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SCHOOLS

MORE THAN 100 SEMINARS
(mostly remote)

<https://agenda.infn.it/event/24727/>



Bari 2022

Dal 01/04/22



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Dal 15/02/22



Genova 2022

Dal 01/11/20



Frascati 2022

Dal 07/03/22



Lecce 2022

Dal 01/04/22



Milano 2022

Dal 06/02/22



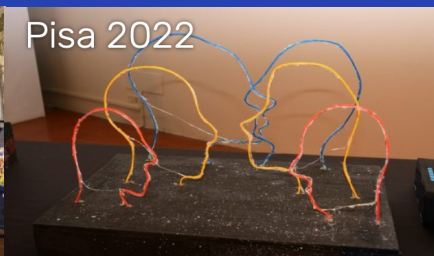
Napoli 2022

Dal 30/04/22



Padova 2022

Dal 28/01/22



Pisa 2022

Dal 10/03/22



Potenza 2022

Dal 13/01/22



Roma 2022

Dal 22/03/22



Torino 2022

Dal 22/03/22



July 10 – 16 from (Monday 14.30–20:00, Tuesday–Friday 10:00–20:00, Saturday 10:00–19:00)

Opening July 9 at 17

Colori e immagini della Scienza (Science colors and images)

Auditorium Enzo Biagi, Sala Borsa – *Piazza del Nettuno 3*, Bologna

The exhibition will display some of the works made by more than 200 students who won the local selection of the third edition of **Art&Science Across Italy**.

Art & Science Across Italy is a European project of the CREATIONS network (H2020) to promote the scientific culture among the young generations combining the languages of art and science.

Project by INFN and CERN

DATE AND TIME: JULY 10 – 16 at Auditorium Enzo Biagi during the opening hours of the Sala Borsa Library (Monday 14.30–20:00, Tuesday–Friday 10:00–20:00, Saturday 10:00–19:00)

FREE ENTRANCE

Exhibition web site: <https://artandscience.infn.it>

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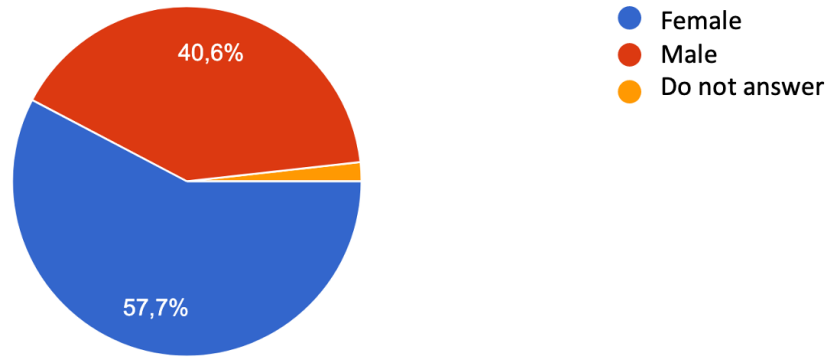


Results

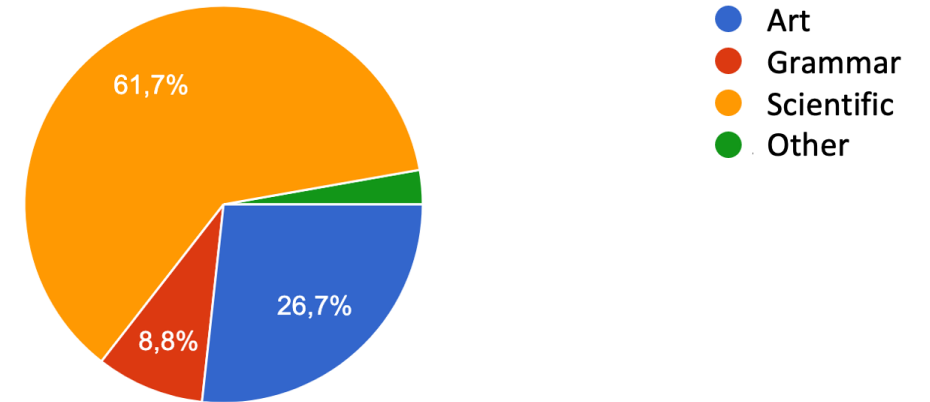
6° place: «*Interminati spazi, Materia e singolarità*»
Lara Giardina, Livia Ruello
Liceo Artistico Klee-Barabino - Genova

Numbers from II Edition: surveys

Gender

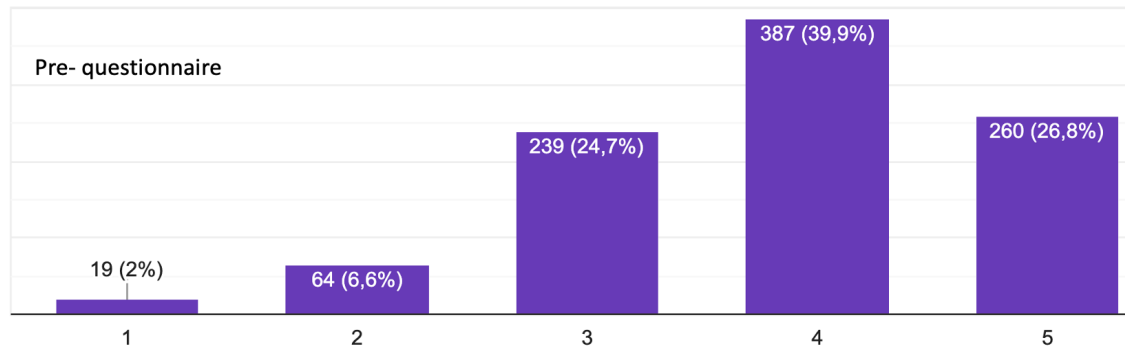


Type of Italian school



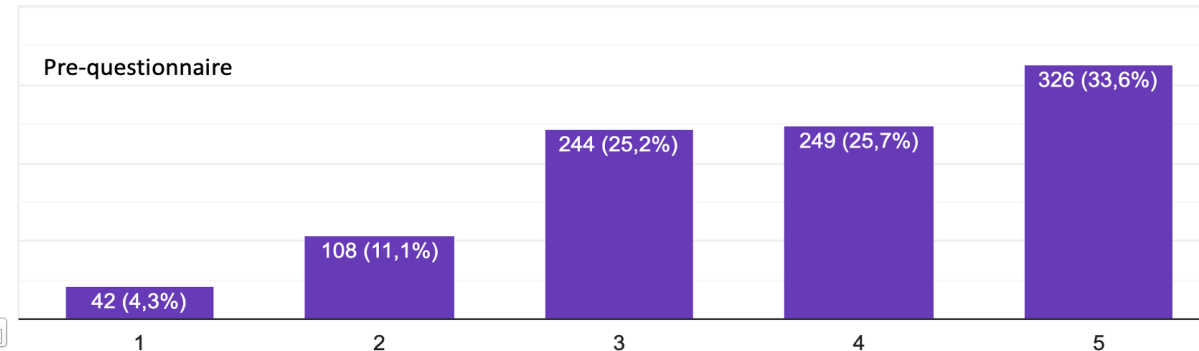
How much are you interested in Science?
(1 = not at all;5 = a lot)

Pre- questionnaire

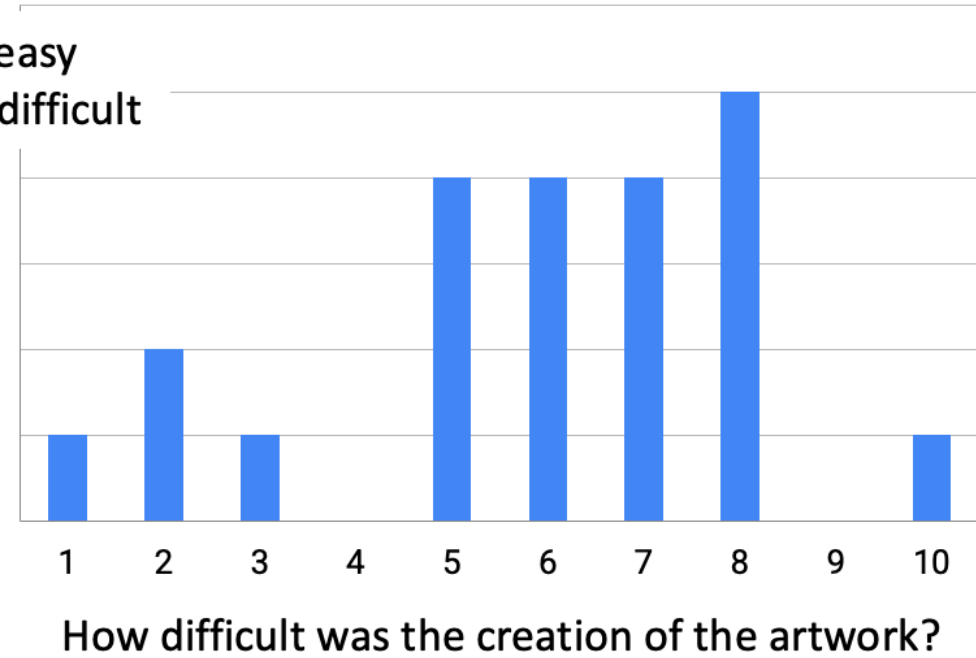
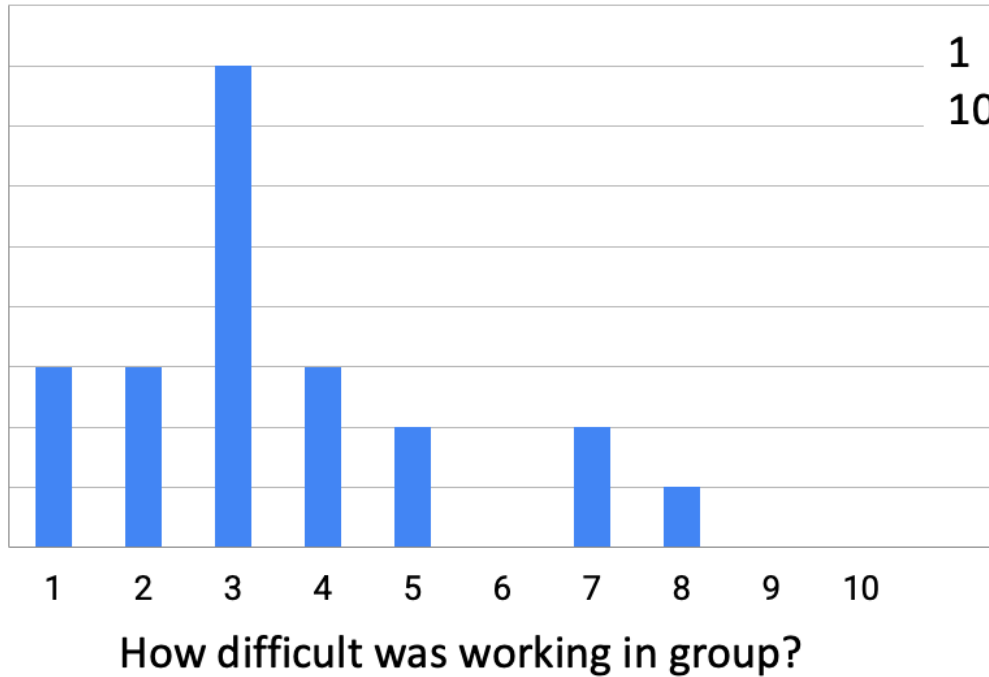


How much are you interested in Art?
(1 = not at all;5 = a lot)

Pre-questionnaire

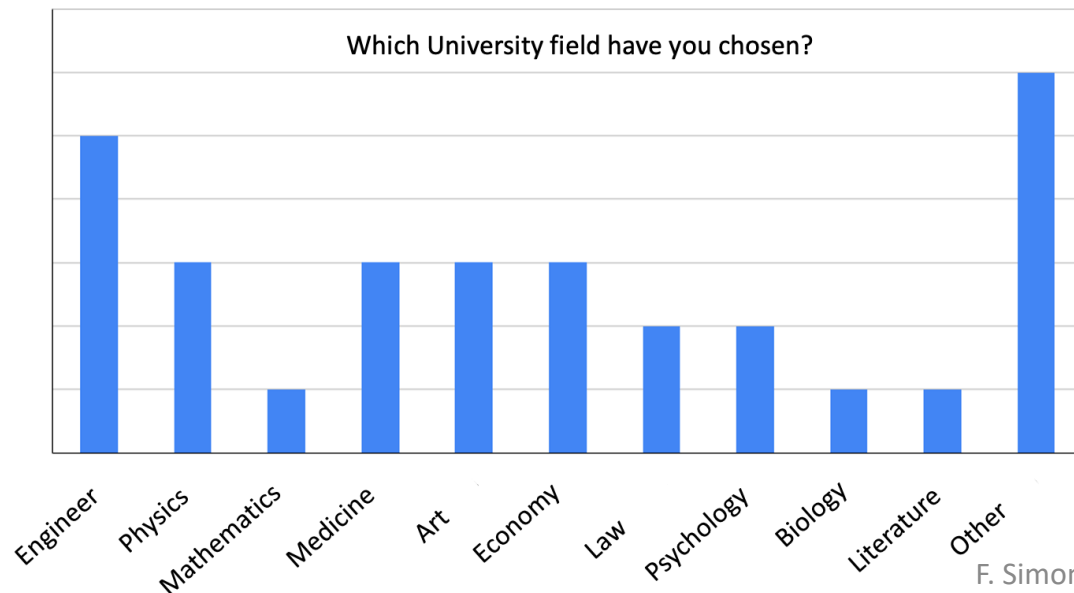


Numbers from II Edition: surveys (2)



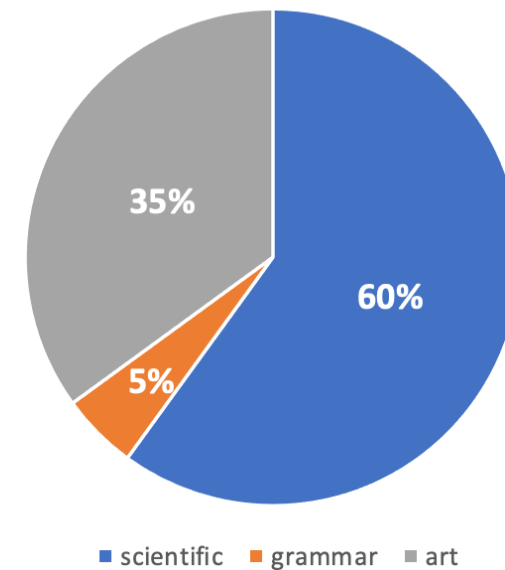
Numbers from II Edition: surveys (3)

- The type of high schools and the university field at which they were interested have been used to evaluate if the project engaged all the students to science regardless their attitude.
- Large variety of cultural interest; 10 were interested in scientific field, 3 in medicine, 2 in art, 4 in humanities.
- Comparing the type of school of the sample and of the winners with we can state that the two samples are compatible with a confidence level of 97.5%.
- All the students have the same probability to have success in the project regardless the type of high school.



F. Simone - Art&Science - ICHEP 2022

Winner of Nat. compet. by type of school



Conclusions and Perspectives

7° place: «Luna 14»

Alessia Biafora, Basmalh Badr e Crestina Shenouda
I.T.I.S. Renato Cartesio di Milano



Conclusions and Perspectives

- III edition in its final phase
- Unprecedented number of students involved
- Remote seminars allowed for large participation, will keep “hybrid” mode for the future
- Large interest for IV edition
- Effort to reach all types of high schools (large fraction from scientific-based high schools)



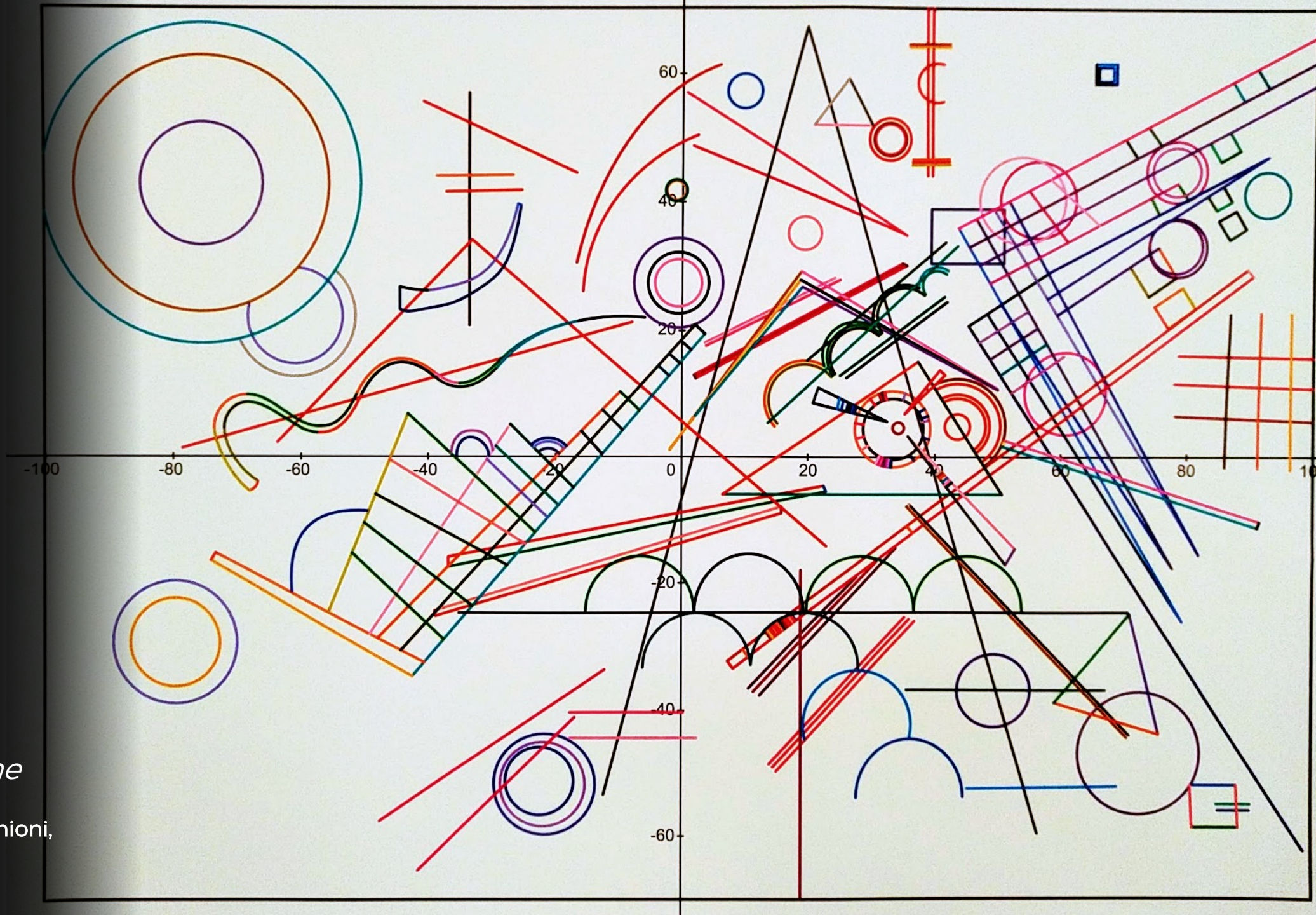
Conclusions and Perspectives

- The idea of using Art to attract students to the Science seems to work well.
- Students are engaged to design and build an artwork based on Science, regardless their attitude in science/art
- The competition, the working in group and the possibility to win a Master at CERN are clearly motivating them.



Thank you!

8° place: «*L'equazione
dell'Arte*»
Julien Caimi, Filippo Orecchioni,
Tommaso Andrei
Liceo Cavour di Roma



Analysis of I edition (2016 – 2018)

- Two-wave survey to capture differences before and after intervention
- Aligned with the overall evaluation framework of CREATIONS
- Results published in [6]
- Supporting evidence for the potential of hybrid STEAM learning environments to promote student creativity and science career motivation

