

**“Adotta scienza e arte nella tua classe”:
A science popularisation and educational project
for 2012-2013(*)**

M. TORRE

*Liceo Scientifico Paritario Alexandria - Via D. Orione 1, 15122 Alessandria, Italy and
Esplica - no profit - via A. Bottagisio 11, 37069 Villafranca di Verona (VR), Italy*

ricevuto il 9 Gennaio 2013

Summary. — The educational project *Adotta Scienza e Arte nella tua classe* (Adopt Science and Art in your class), on the science-art interconnection, is addressed to the Italian secondary middle and high school students. It proposes them to produce a piece of artwork inspired by the interpretation of a quotation among a hundred commented quotes by physicists, mathematicians, scientists, writers, artists, accompanied by an original short sentence by the student himself/herself. The artworks enter two contests, one based on the public vote (“I like”) in the social networks and the other on the evaluation of an expert jury. *Adotta Scienza e Arte nella tua classe* was first presented at the conceptual design stage to the Aplimat Conference, Bratislava, 2012, by the association *Esplica-no profit, Laboratorio per la divulgazione culturale e scientifica nell’era digitale*. Afterwards, the project design was fully defined. The classroom practices are supported by the document *100 + 1 frasi famose sulla scienza* (100 + 1 famous quotes on science), a collection of famous quotations by scientists and artists, expressly designed for the project. Each quotation is referenced and presented with an original comment. Another tool for the teachers to use in their classes is the interactive collection of *78 + 10 biografie* (78 + 10 biographies), a file gathering about 400 links to the biographies of the scientists and artists proposed in the *100 + 1 frasi famose sulla scienza*, selected taking into account the cultural levels of the students involved. These tools are meant as an incentive suggestion for the classroom practices to the teachers and students. The communicative strength of quotations and aphorisms on science by famous scientists, artists and writers is a universal value. The original comments

(*) This work is presented on behalf of the co-authors: Beatrice Boccardi, Veronica Cavicchi, Franco Luigi Fabbri, Giliola Giurgola, Marcella Giulia Lorenzi, Giovanna Parolini, Renato Sartori, Amerigo Solari.

are inspired to a philosophy based on the science-art connection, which strengthens the teaching practices and constitutes a challenge to the students to express their creativity by producing artworks. This article deals with the characterising features of the project *Adotta Scienza e Arte nella tua classe*, through the description of the teaching materials and an overview of the actual evolution of the project (updated in December 2012).

PACS 01.40.gb – Teaching methods and strategies.

PACS 01.40.-d – Education.

1. – Introduction

The concept design of the popularisation and educational project *Adotta Scienza e Arte nella tua classe*, addressed to the Italian secondary middle and high school classes, was presented for the first time at the XI Aplimat International Conference, Bratislava 2012 [1], by *Esplica - no profit* [2], that later defined it in every detail up to its final design [3]. The association *Esplica - no profit* deals with the diffusion and dissemination of culture—in particular science—through the programme *Banco Culturale*, following several different directions, promoting events of science popularisation for the young public on the media and for the schools. The main purpose of the project *Adotta Scienza e Arte nella tua classe*, is to make the young students aware that the indissoluble connection between science and art is a unique cultural and interdisciplinary thing. The history of civilization witnesses the intertwining of physics and mathematics with the arts. From the debate on the Golden Section, to Pythagoras' idea of the connection between music and mathematics, to our days with digital art and 3D graphic software, the artists have applied mathematical-physical concepts and scientific contributions in their creations [4]. Leonardo working in the arts, technology and science, Renaissance pictorial perspective relying on geometry, the discoveries of optics in the practice of the Divisionist and Pointillist painters, the speed represented on canvas by the Futurists: these are but a few examples from the visual arts [1, 4]. In the twentieth century, the works of M. C. Escher appearing on science magazines or chosen as the cover image for the book “Elementary Particles” by the Nobel prize Chen Ning Yang are not simply decorative elements. His works on the organization of the space-time were influenced by the theories of Poincaré and Penrose and constitute the visual representation of mathematical-physical concepts. Dalí, Seurat and many other artists have explicitly referred to the science-art connection in their works [4]. The research of the Max Planck Institute for the History of Science focuses on “natural sciences, social sciences, and humanities” and is exemplary for the importance it gives to the intercultural aspects of art, mathematics, physics, and biology [5]. We end this non-exhaustive list recalling the *Global Particle Physics Photowalk*, a photo contest on the experiments, machines and apparatuses at CERN, DESY, Fermilab, KEK and TRIUMF, in which photography becomes a means for physics popularisation [1, 4, 6]. Paul Feyerabend [7] has recognized a common creative uniqueness between science and art. The philosophy of *Adotta Scienza e Arte nella tua classe* is based on this steady relation that makes art an effective means for science popularisation. Providing the students with a sound basic scientific culture is one of the teachers' main tasks and the mission of the project is to help them reach this goal exploiting the great popularising strength of the bonds between science and art. Many Italian and European

school curricula ask the teachers to carry out an interdisciplinary teaching and base the assessment of the students' skills on their ability to make connections between the various disciplines. In addition, teaching creativity means to encourage thinking to go beyond the habitual solutions, to formulate new questions, to overturn established processes, to look at the world from different points of view. Creativity expresses an open attitude towards the experience, the acceptance of risks and contradictions, spirit of adventure, the predilection for complexity.

In agreement with this definition, in more recent times some of the features of the creative personality have been recognized as the constituent elements of a psychological aptitude to *problem-finding* [8], *i.e.*, the tendency to consider various possible approaches to the problem, to abandon the road taken should another appear best fitted to one's aim and never consider the attained results as final. This aptitude is a perfect link between creativity and the scientific praxis, on which *Adotta Scienza e Arte nella tua classe* 2012-2013 is based.

2. – Esplica - no profit

Esplica - no profit, Laboratorio per la divulgazione culturale e scientifica nell'era digitale, is a cultural association aggregating professionals, teachers, communication experts and researchers in different scientific fields, engaged in activities of formation and communication in science and culture. One of the missions of *Esplica - no profit* is to spread the conviction that there is no separation between “culture” and “scientific culture”; this is just a survival from the past in the Italian scholastic and academic tradition (and not only Italian). Therefore the goal of *Esplica - no profit* is to overcome and recompose this divide in the public perception of science and to spread the idea that a sound scientific education is necessary for everyone, and for the youth especially. It must be part of the cultural baggage of each young citizen, whatever his/her abilities, skills, future career and interests. *Science is for, and belongs to, everybody*, as the UNESCO declared at the Conference on science in the 21st century in Budapest, 1999 [9,10]. Becoming a scientist or a researcher is an ambitious goal and not an easy training course, to be undertaken with the awareness that not everyone will be able to accomplish it. Receiving a sound basic scientific culture, that makes it possible to understand how science affects our daily existence and everybody's future, that of the young in particular, is everybody's right and practicing it is not difficult. Acquiring a general scientific culture is useful and it can also be fun, as Carl Sagan said in his last interview [11,12].

Founded in 2010, *Esplica - no profit* carries out various cultural and educational activities in the field of science popularisation and of culture addressed to the general public, the young, the schools, and for lifelong learning. It also develops communication initiatives of scientific knowledge on 3D web platforms and cross-universe events, like those in the virtual world *Second Life*: the Cafè della Scienza, Adventure in Second Life, Beyond the Third Dimension, Scienza on the Road, Immersive Evenings. Other activities include *Science Reporter*, an initiative between the physical world and the virtual world of Second Life, in which the reporters sent to the Festival of Science in Genova (Genova 2010) and to the Infinitely Festival (2010, 2011, 2012, Verona), presented news and comments on the latest scientific research to the Italian communities in the virtual world. *Esplica - no profit* participated in the *e-book Festival in Fosdinovo*, Italy, selecting and coordinating publishers active on the virtual platforms, and in the annual meeting *Scientix* in Brussels on the role of science education. Recently, *Esplica - no profit* has collaborated to *In Treno con Albert*, or the science at theatre [13,14], lecture-shows

started in February, 2013, dealing with topics of modern science—relativity, the multi-dimensions, the dark matter, *etc.*—an innovative format in which each performance is preceded by a short scientific conversation with scientists and researchers. *Adotta Scienza e Arte nella tua classe* is the main project of *Esplica - no profit* for the period 2012 to 2014⁽¹⁾ [15].

3. – What is *Adotta Scienza e Arte nella tua classe*?

The project *Adotta Scienza e Arte nella tua classe* leads the students to familiarize with the bond between science and art in as widely a way as possible, providing teachers some tools to think on the similarities between artistic creativity and the scientific process. The project is divided into two distinct phases—one in the classroom and the other on the web and the social networks. The first step develops in the classroom, where the teacher introduces the students to the 100 + 1 *frasi famose sulla scienza*, a collection of famous quotations from scientists and artists of every time selected and commented expressly for the project. Through an interdisciplinary work, the teachers provide the necessary educational support, while each student expresses his creativity producing a graphic work inspired by the chosen phrase, accompanying it with a personal comment on the quotation itself. Then the teachers send the works produced under the project, in digital format, to *Esplica - no profit*, which publishes them on the web anonymously, to preserve the students' privacy and to ensure a fair selection of the best works.

The document 100 + 1 *frasi famose sulla scienza* collects quotations from scientists, artists, philosophers and historians of science, on scientific or artistic themes. Plenty of space has been granted to the relationship among science, art and philosophy (fig. 1). Most of the quotations refer to modern physics (quantum mechanics and relativity), a topic which is essential in teaching.

The decision to treat modern physics more fully with respect to classical physics has a strong educational value. It aims at helping the teachers in the secondary high school to face, at least qualitatively, some aspects of the present research—we know that, all too often, for various reasons, these topics are neglected. The teaching of quantum mechanics in the secondary high school is a much debated topic in the research on Physics Education at the national and international level. This topic is of particular relevance in Italy today, since the new curricula establish that in the “licei scientifici” (the scientific branch of the high school) modern physics be taught for three whole terms in the last two years of course [16]. At the same time, the cultural significance of modern physics, and of quantum mechanics in particular, must be enhanced as much as possible to become really part of the scientific cultural baggage of each student and of the society at large. That is why we have given the teachers a proposal that helps them, not only to move easily among the theories and results of modern physics, but also to make these subjects easier to teach.

⁽¹⁾ The project *Adotta Scienza e Arte nella tua classe* was first presented at the XI International Aplimat Conference, February 4th-6th, 2012, Bratislava (Mathematics and art section). After that, it was presented at the Città della Scienza (Naples) for the “Smart Education and Technology Days, Salone della Scuola Digitale”, March 28th-29th, 2012 (to download the poster and the flyers see [15]); at the XCVIII *National Congress of SIF* (Italian Physical Society), Naples, September 17th-21st, 2012; at the Città della Scienza (Naples) for the “Smart Education and Technology Days—3 giorni per la scuola”, October 10th, 11th, 12th, 2012; at the Conference *Comunicare Fisica* (Turin), October 8th-12th, 2012; and at the Conference of *AIF* (Association for the Teaching of Physics) (Naples), October 17th-20th, 2012.

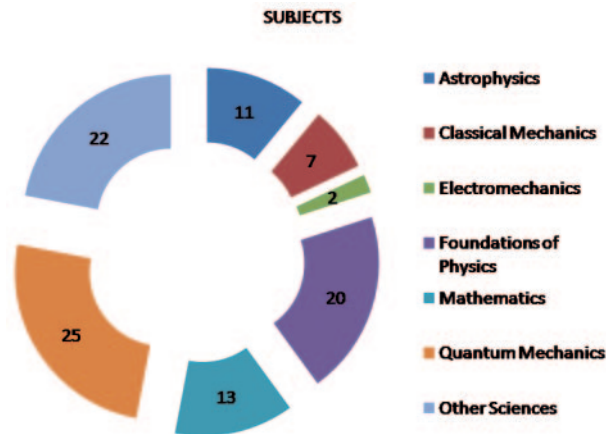


Fig. 1. – Distribution of the 100 + 1 famous quotations on science.

The document *100 + 1 frasi famose sulla scienza* has been compiled by a group of teachers and researchers sharing and participating their work at every stage: from the choice of the famous authors and the selection of the quotations, to the writing of the comments. The collection is an atlas with various configurations, perspectives and maps for the teacher to get ideas and suggestions for the classroom practices of the project [12]. The collection of famous quotations on science is accompanied by the document *78 + 10 biographies*, an Excel file with about 400 links to the biographical references of the scientists and artists mentioned in the *100 + 1 frasi famose sulla scienza*. For each scientist or artist two biographies in Italian and two in English have been chosen. Their selection has been careful, in order to pick the best biographies among the many on the web, proposing absolutely reliable narrations, but at the same time going beyond the conventional tale of the main facts of the authors’ lives, comprising also information on curious and fascinating aspects of their personal stories. These traits are the most didactically effective and lasting on the students’ memories and make the document innovative, compared to the biographies usually found in textbooks. The two documents contain numerous multimedia links, making them usable on an interactive whiteboard, so greatly increasing their didactic potential and, at the same time, satisfying the most recent guidelines of the Italian Ministry of Education about the innovation of teaching methods. Ancillary activities are strongly suggested to the teacher for being introduced as complements and integrations to the classroom practices. Teachers are encouraged to organize exhibitions, debates, seminars, public lectures in their schools, to which *Esplora - no profit*, if needed, will give an adequate organizational support and provide a web space to give them visibility. This encourages other schools participating in the project to implement similar initiatives, starting a virtuous circle.

Examples of possible topics of public initiatives might be the relationship between Science and Art, the recent scientific experiments often occupying the headlines, but also the perspectives that an educational choice in the field of science or technology opens to the students. These ancillary activities will give the students wishing to take a science degree the opportunity to meet personalities in science, researchers and professionals, who can provide them with guidance on career opportunities in research or in the industry, connecting them to working environments with a close and unbreakable bond with science, so representing crucial moments of the project.

From all the above, it is clear how these activities and *Adotta Scienza e Arte nella tua classe* as a whole correspond to the guidance purposes of the *Piano Nazionale Lauree Scientifiche* (Italian National Scientific Graduation Plan) [17] and of the *Decreto legislativo* (legislative decree) number 21, January 14th, 2008, *i.e.*, “to offer the students in the last years of high school the opportunity to learn about issues, problems and procedures distinctive of scientific knowledge, also as regards the working and professional fields, in order to identify interests and specific requirements, and to make informed choices in relation to a personal project” [17]. They also meet the demands of curricular innovation as for “the revision of the teaching-learning contents and methods in the field of the scientific disciplines at all school levels, also taking into account the new national guidelines for the first and the second cycle” [17].

In the second step, the project moves to the Internet and the students communicate with each other on the ongoing experience through the social networks. The graphic works must be an original creation produced individually by each student and *Esplica - no profit* will not accept artworks made by groups of students or in collaboration by the whole class. Each single student is the true protagonist of the project *Adotta Scienza e Arte nella tua classe*, who grasps instinctively the challenge of the communicative messages with his/her ability, with his/her precious individuality he/she pursues and achieves his/her maximum creativity, expressing it in an original and pure way.

To this end, *Esplica - no profit* is preparing some social networking tools, to project the scheme and its artworks beyond the local boundaries of the single class and the single school. In fact, the final step is the exhibition on Facebook of the works sent to *Esplica - no profit* in digital format by the contact teachers. For these works we will guarantee the anonymity and privacy of the students, associating to each of them a randomly generated code. In this virtual gallery, it will be possible to watch the artworks until September 1st, 2013, and the author receiving the highest number of “I like” will be celebrated in the final event. The results of the public vote will in no way affect the evaluation of quality by the expert jury (scientists, researchers, artists, art critics) that will proclaim the final winners basing solely and unquestionably on judgments of an aesthetic and artistic character, as well as of their relevance and originality in the presentation of scientific topics.

4. – The role of the teacher in *Adotta Scienza e Arte nella tua classe*

It is evident that, from the start of the classroom practices to the presentation of the artworks, the role of the teacher in the project *Adotta Scienza e Arte nella tua classe* is central and crucial.

The project valorizes the teacher’s role in the formation of the students’ cognitive processes: he encourages them to behave as scientists in everyday life, helps them to recognize science not only in far off things, but in every aspect of our lives and in our reflection on human existence, teaches them to draw conclusions from the phenomena critically observed. Only the teacher can convey the message that science is for, and belongs to, everyone. *Adotta Scienza e Arte nella tua classe* is an occasion, a starting point, the rest must spring from the teacher’s ability and the students’ creativity.

It is up to the teacher to adapt the classroom phase to the school level, the pedagogy followed in his school and the local specific situations and cultural needs. The teacher chooses among the 100 + 1 *frasi famose sulla scienza* those better fitting their course of study, the school curriculum and their own evaluation and view of the learning value of *Adotta Scienza e Arte nella tua classe*.

The teacher introduces the theme of the cultural link between science and other disciplines, following the example of the close relationship that always existed between visual arts and music on the one hand, and physics and mathematics on the other. The teacher can rely on the comments to the 100 + 1 *frasi famose sulla scienza* that, though briefly, offer lines of interpretation leading to various topics related to science.

The teacher, with his cultural and professional preparation, together with his interpretative and creative abilities, must be able to arouse his students' interest and lead them to catch the deepest learning meaning of the project, that is, science is for, and belongs to, everybody. The practices are very different: the project is developed by a single teacher, or in cooperation with one/ more colleagues, of science, art, mathematics and others, since it offers suggestions for many disciplines. One of the teachers deals with the historical part, the other with examples of the science-art connection. In several cases, the choice of the quotations is left to the students themselves, with the help of the grading system indicating a quotation as more suitable to the secondary middle or high school through a small icon. The artworks, too, are very different: made at home or in the classroom, created with traditional techniques or using a digital software. Some students make a plastic construction or extract pigments to produce fabric artworks and then submit a photo of them. Others plan to create artworks in the virtual world Second Life. Several of the first works received show the students' feeling for events that involve science, like the fire that has recently destroyed the Città della Scienza, Naples.

5. – The positive effects of *Adotta Scienza e Arte nella tua classe* on teaching-learning

The project *Adotta Scienza e Arte nella tua classe* undoubtedly pursues very ambitious and not easily conquered educational objectives, while meeting very high-quality targets. The first objective, as stated, is to spread the conviction that scientific education is of central importance for everyone, especially the new generations. Today, in the Italian schools, the most difficult objective for every teacher is to conquer the students' attention in an original way as well as suited to them: art is, for its natural appeal and its tie with science, one of the most effective tools for the popularisation of science and to start a cognitive process in the students, that can arouse a critical spirit and lead them to observe nature under every respect. *Adotta Scienza e Arte nella tua classe* combines scientific education with the interest for art and the creative potentiality of the students.

Adotta Scienza e arte nella tua classe offers an opportunity to reflect on educational technologies and on the meaning and placement of the new media compared to the traditional teaching methods. It is necessary that the Italian school as a whole undertakes a process of change of the concept of teaching-learning, taking into account the transformation brought about by educational technologies, with their subsequent adaptation to the new languages [18]. The introduction of cooperative learning methods has favoured a broad discussion on the teaching-learning strategies and on the teaching practices from an epistemological-cognitive point of view. The tools provided by educational technologies are not didactic per se, that is, they do not automatically produce knowledge, skills and abilities, but they can, and must, have a primary educational role in learning today. Their use is essential in a project addressed to the “digital native” generations of students. In fact, the learning methodology of the project is, also, strongly based on having the young communicate “out of the classroom” through the media more congenial to them.

Adotta Scienza e Arte nella tua classe can also achieve one more objective: to promote the students' creativity in every way, through the interdisciplinary use of the learning



Fig. 2. – Geographic distribution of the *Adotta* classes.

resources. This can be done training them into some specific *processes*, that is, triggering cognitive functions normally not activated. For example, a process involved in creative thinking is *restructuring*: the creative solution to a problem is to consider it from different points of view, in order for new relationships to emerge. Educating to creativity can also contribute to change “pathological” personality traits like obsession, conformity, acquiescence. The use of quotations from famous scientists and artists can be an original and innovative instrument from an educational and pedagogical point of view, virtually absent from any European education plan. The development of creativity—thanks to the integration that it operates between the divergent and convergent thinking, between spontaneity and control, emotion and intelligence, imagination and rationality—is characterized, therefore, as a stimulus to overcome two opposing dysfunctional tendencies: stereotypy and rigidity on the one hand, deconstruction and unreality of thought on the other [8].

6. – *Adotta Scienza e Arte nella tua classe on the web*

The start of the project has been very promising. The most recent update is of December 2012 [19]: *Adotta scienza e Arte nella tua classe* is under way in 40 schools of 27 Italian cities (fig. 2) in 11 Italian regions (Piemonte, Toscana, Lombardia, Puglia, Calabria, Campania, Veneto, Sicilia, Liguria, Marche, Basilicata). It involves 112 teachers and about 1600 students, distributed in 80 *Adotta Classes*—that are groups of students belonging to the same or to different school classes, aggregated for organizational reasons in accordance to the needs of the project.

While the first phase is going on until the end of the school year (June), we have started to receive a number of artworks, corresponding to about a fifth of the images we

expect. They are shown in two galleries in Facebook in the two categories – secondary middle [20] and high [21] school. So far more than 6000 “I like” have been expressed. The final event, 2013, September, will award a prize to the winner of the public vote and to the winner proclaimed by the expert jury. The best works in each school will receive a special mention.

7. – A short selection from 100+1 *frasi famose sulla scienza*

As an example, we present a few quotations selected from the 100 + 1 *frasi famose sulla scienza*, with their comments.

- [68] *The task is... not so much to see what no one has yet seen; but to think what nobody has yet thought, about that which everybody sees.*

Erwin Schrödinger (1887-1961). Austrian physicist. Nobel prize in physics, 1933. Quantum mechanics. Schrödinger equation. “Schrödinger’s cat” paradox.

Ref.: Schrödinger, Erwin, lecture at the Trinity College, Dublin, 1943. Later, the text of the lecture would form the base of his book *What is life?*, Cambridge University Press, 1944.

Schrödinger’s vision would lead him to an exceptional turning point. Niels Bohr (Nobel prize for physics in 1922) had proposed the first atomic model on the basis of Rutherford’s discovery, conjecturing the quantization of energy and of the angular momentum, outlining the hypothesis of quantum mechanics of corpuscular nature. De Broglie (Nobel prize for physics in 1929), extending to the matter the wave- particle duality introduced through Einstein’s hypothesis of photons, developed a theory implying the quantum-mechanical wave-like properties of matter. It was necessary to reconcile the two theories—both were correct, both were incomplete. Erwin Schrödinger was able to see what Bohr and De Broglie could not catch in their models: the existence of a single perspective uniting both theories. This is an example of how many of the great advances in science happen: changing the point of view, changing the concepts with which we look at the object, suddenly discovering an element impossible to perceive a moment before. Another change in vision on the same problem was subsequently implemented by Max Born, who reinterpreted Schrödinger’s equation as the equation of the probability waves. For this he was awarded the Nobel prize for physics in 1954. (V.C.) [12].

- [80] *With regard to invisible objects, the existence of the black holes and Heisenberg’s uncertainty principle excludes from the view of any observer a wide portion of the possible combinations of mass and dimension.*

John David Barrow (born 1952). Astrophysicist, British science writer. Anthropic principle, Theory of everything. Ref.: J. D. Barrow, *The artful universe*. Back Bay Books, 1995.

The sound and light frequencies that we cannot perceive, can be detected and represented from the appropriate instruments. But the fundamental limitation imposed on us by Nature, Barrow says, does not regard the tools. To “see” an object means “to expose it to a light with a wavelength of comparable size” and to record the photon of light reflected by the object itself. The black holes are “regions of space where the gravitational interaction is so strong that any object in the vicinity is hopelessly attracted and captured and... can no longer get away from it”. In the case of black holes there is no photon of light emitted towards us and they result invisible. The small wavelengths necessary to

see small objects must be equipped with vibrations and high energies, but these disturb the observed system. This paradox is expressed by Heisenberg's uncertainty principle, according to which it is not possible to measure simultaneously the position and the speed of a particle. What we do not see changes both the image of the "familiar" universe and our concept of vacuum space. The visible constitutes only the smallest part of the cosmic landscape, while the physical vacuum does not mean nothingness, but a space inhabited by matter which for now is not directly observable and, perhaps, inhabited many other things. (B. B.) [12].

– [63] *One paints with his brain, not with his hands.*

Michelangelo Buonarroti (1475-1564).

Italian sculptor, painter, architect. Sistine Chapel Frescoes. Palazzo Farnese. Piazza del Campidoglio. *The Pietà. David. Mosè.*

Ref.: Lettera a Monsignore... , 1542 in *Le lettere di Michelangelo Buonarroti*, edited by Gaetano Milanesi. Firenze, Le Monnier, 1875, <http://archive.org/stream/laletteredimich00buongoog#page/n381/mode/2up>.

Michelangelo thinks that a painting is produced from the head of the painter, not from his hands, because even before painting it, he sees it in his imagination. Each painter has his technique, that is, the practical means he uses to express his art. In itself, no technique is better or more advanced than another: we can only assess whether it is more or less suitable to represent the individual artist's imagination. The painter, and the artist in general, must also express his theory, his "aesthetic ideal". The contribution of the intellect is indispensable to the work of art. The artist, like the scientist, does not create his work out of nowhere, but accomplishes it according to the sensations he receives and that his mind processes. Both are always in search of innovative ideas, new sources of inspiration for extraordinary discoveries or creations. Creativity, ideas, inspiration and emotion characterize not only the arts, but also the scientific disciplines. (A. S.) [12].

8. – Conclusions

The project *Adotta Scienza e Arte nella tua classe* is based on the integration of knowledge in the practices and on the science-art connection, on the students' education to creativity and on the deformalization of school learning. The project is in an advanced stage and several artworks are already online. To join the project or for further information and contact you can visit the website www.esplica.it or write to adotta@esplica.it.

We conclude with a quote from Claude Lévi-Strauss: "*Man is not like a character climbing a ladder who, with each new movement, adds a step to those he has already conquered. He is rather like a dice player who, whenever he throws his dices, he sees them spreading on the carpet, ever combining in a different way or like the chess knight, that has always various progressions at his disposal, but never in the same direction*" [22]. The project *Adotta Scienza e Arte nella tua classe* hopes to provide the students with some unpredictable moves to pursue positively the way of culture, and in particular of scientific culture.

REFERENCES

- [1] FABBRI F., PAROLINI G., SARTORI R., BOCCARDI B. and GIURGOLA G., “Adotta Scienza e arte nella tua classe” a project of mathematics and physics popularisation in the Italian middle and high school, in *Aplimat 2012, XI International Conference, Bratislava 7-9 February 2012*, http://www.aplimat.com/volume_5_2012/Journal_volume_5/Number_1/Fabbri_Parolini_Sartori_et_al.pdf.
- [2] www.esplika.it.
- [3] http://www.esplika.it/images/stories/DOCUMENTI_ASS/adtt-totaladotta-130512-dv-008-002.pdf.
- [4] http://www.esplika.it/images/stories/DOCUMENTI_ASS/Fisica_Matematica_Arte_Incontri_e_Lontananze_febb2012.pdf.
- [5] <http://www.mpiwg-berlin.mpg.de/en/index.html>.
- [6] <http://cdsweb.cern.ch/journal/CERNBulletin/2011/07/News%20Articles/1327589?ln=en>.
- [7] FEYERABEND P., *La scienza come arte* (Laterza) 1984.
- [8] ANTONIETTI A. and PIZZINGRILLI P., “Come sviluppare la creatività nei bambini: le indicazioni di un programma di ricerca”, *Synergies Europe*, 4 (2009) 151-166.
- [9] <http://unesdoc.unesco.org/images/0012/001207/120706e.pdf>.
- [10] <http://unesdoc.unesco.org/images/0011/001181/118131e.pdf>.
- [11] www.youtube.com/watch?v=jod7v-m573k, www.youtube.com/watch?v=uDKSZ0-aACk.
- [12] BOCCARDI B., CAVICCHI V., FABBRI F. L., GIURGOLA G., LORENZI M. G., PAROLINI G., SARTORI R., SOLARI A. and TORRE M., 100 + 1 *Frase famose sulla scienza*, Esplica - no profit, 2012.
- [13] More information and materials: <http://www.esplika.it/component/content/article/212>.
- [14] In Facebook: <http://www.facebook.com/pages/Esplika/145597725474432?fref=ts>.
- [15] http://www.esplika.it/images/stories/DOCUMENTI_ASS/adotta_flyer-disegna3-adtt280412-dv-001-10.pdf; http://www.esplika.it/images/stories/DOCUMENTI_ASS/_adotta_flyer_adotta_adtt300412-dv004-10.pdf; http://www.esplika.it/images/stories/DOCUMENTI_ASS/adotta-posteradottaverticalsienzaadtt160812-dv007-12.pdf.
- [16] http://nuovilicei.indire.it/content/index.php?action=lettura&id_m=7782&id_cnt=10497.
- [17] Linee guida del Piano Nazionale Lauree Scientifiche, MIUR, scaricabili dal sito www.progettolaureescientifiche.eu.
- [18] IANNICELLI C., *Tecnologie didattiche*, in “Didattica con la LIM”, Anitel – Associazione Nazionale Tutor e-Learning, 2011, <http://www.anitel.org/anelit>.
- [19] BOCCARDI B., CAVICCHI V., FABBRI F. L., GIURGOLA G., LORENZI M. G., PAROLINI G., SARTORI R., SOLARI A. and TORRE M., Adotta scienza e arte nella tua classe: where are we now? The story of a successfully teaching project (about science and art), in *Aplimat 2013, XII International Conference, Bratislava 5-7 Feb. 2013*.
- [20] Secondary middle school: <http://www.facebook.com/photo.php?fbid=560810663953134&set=a.560808720619995.1073741826.145597725474432&type=1&theater#!/photo.php?fbid=325601690875792&set=a.325405687562059.1073741828.296771240425504&type=1&theater>.
- [21] Secondary high school: <http://www.facebook.com/photo.php?fbid=560810663953134&set=a.560808720619995.1073741826.145597725474432&type=1&theater#!/photo.php?fbid=560808777286656&set=a.560808720619995.1073741826.145597725474432&type=1&permPage=1>.
- [22] LEVI-STRAUSS C., *Razza e Storia* (Einaudi, Torino) 1968.