

# Art as a Resource for Scientific Learning

Bruna Giunta



**Abstract:** During the COVID-19 pandemic, thousands of pupils and teachers stayed at home and were forced to adapt to online teaching from scratch due to the ongoing demand measures imposed by COVID-19. The online mode of teaching was approached differently from school to school, and teachers were often faced with complex situations alone while waiting for the entire education system to adapt. A great deal of effort was required of them, also necessitating the use of various ICT tools and resources to implement new approaches to teaching and learning, thereby developing skills that they did not necessarily already possess. In addition to achieving teaching objectives, teachers were also required to maintain contact with pupils to facilitate social integration. From this emergency, many questions were posed to the education system and the social system in general, and various measures were taken to address the gaps and prevent future problems resulting from social distancing.

**Keywords:** Art, Distance learning, Erasmus +, Science, STEAM, Three-Stage Model.

**Abbreviations:**

Officers Training Academy

## I. INTRODUCTION

The pandemic challenged the entire global setup, and the school system had to face a radical change, from both organisational and social perspectives.

Schools, like other institutions, were called upon to be more flexible to enable the entire structure to overcome the gap created by social distance, so as not to hinder the cognitive and social development of pupils.

The period of isolation was a harsh shock in everyone's life, marked by changes in habits, a lack of human interaction, fear of relating to anyone, and a sense of forced isolation, which triggered, especially in younger generations, a sense of despair and intense social depression.

All the usual moments of gathering and sharing were experienced more artificially and distantly, and this certainly affected both the students and the teachers.

The fundamental value of education essentially passes through the work of those who act as vehicles of knowledge and learning, of those who are called upon to continually stimulate the new generations. In response to the COVID-19 crisis, governments worldwide took immediate measures to close schools, aiming to contain the spread of the virus.

Specifically, schools in all project partner countries faced essential challenges. The studies behind the project writing reveal, with discouragement, how teachers and students have experienced these pandemic years.

For example, statistics show that the use of ICT among Italian teachers is lower than the European average. The recent situation has highlighted the challenges faced by the Italian educational system, which has had to adapt to distance teaching with limited technological skills among its teaching staff (OECD Report on Coronavirus Education Country Note - Italy).

Even Cyprus, despite boasting one of the most developed infrastructures in the European Union, does not utilise technology in education as extensively as other countries. (British Journal of Education Technology).

In Slovenia, on the other hand, the association ZASSS (Zveza aktivov svetov staršev Slovenije) complained about the lack of social contact between children during the pandemic, which caused psychological and learning motivation problems due to the absence of professional and live explanations of the new teaching material.

In contrast, Finland's research and studies conducted during the project suggest that teachers possess undisputed technological expertise and tend to favour experimental methods, given their access to numerous resources.

## II. II WHAT IS OTA?

OTA is a project funded by the European Union through the Erasmus+ Programme - Cooperation for Innovation and Exchange of Good Practices.

It is based on and involves four European countries (Slovenia, Finland, Cyprus, and Italy) collaborating in the development of a methodology that aims to encourage and stimulate learning in STEAM subjects by leveraging digital potential.

Specifically, the partner organisations are: Izobrazevalni centre Geoss d.o.o. (Slovenia), which coordinates the entire project; Narodna Galerija (Slovenia); Osnovna šola Litija (Slovenia); INNOVADE LI LTD (Cyprus); HEUREKA (Finland); and CESIE (Italy).

The OTA project emerged from a pressing need during a particularly challenging moment of the pandemic, which prompted the scholastic institution to radically overhaul its approach to the educational field. Schools, like other institutions, have been called upon to be more flexible to allow the entire structure to overcome the gap created by social distancing, thereby not hindering the cognitive and social development of pupils.

Although the project was conceived to address a need that arose during the COVID-19 pandemic and respond to the need to transition teaching online, as the project's name suggests, the work of the partners enabled the creation of a product that can also be used

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offline, thereby providing teachers with a solution.

With an excellent teaching tool in whatever context, they may find themselves.

As a first step, the partner countries involved in the project analysed the science curricula of classes in which students are aged between 12 and 14.

This was a fundamental step because it enabled a comparative study of the school systems of the four countries involved, creating a common ground on which to build the next steps.

After defining the standard curricula, a survey was created and administered to identify the challenges faced by science teachers about online teaching and the new needs that arose.

This was followed by focus groups with teachers from the four countries involved to gather even more information and produce as coherent a national report as possible.

The survey was a significant milestone in identifying the needs of the target group, as it provided the consortium with direct insight into the difficulties that teachers and pupils faced when teaching online.

It was crucial to gain insight from those who deal with problems within formal educational institutions on a daily basis, especially during a sensitive time, as online teaching has been and continues to be.

The survey of teachers, educators and school leaders sought to take into account the work that these figures do within the school as a whole. It investigated the 'technical' difficulties that teachers of natural and scientific subjects faced when teaching online, as well as their emotional states and mental well-being.

It was explored whether and how distance learning had changed teachers' perspectives on their students and their profession, to assess, among other things, the degree of flexibility they were called upon to exercise due to this radical educational change.

Additionally, teachers were asked to respond specifically to individual curricular topics. Thanks to the creation of the standard curriculum mentioned above, the partners investigated, through their country's teachers, which topics had been the most difficult to transmit and learn online.

It was thanks to this analysis that the topics on which the activities were then developed were identified.

Finally, the last section of the survey was designed to collect teachers' opinions on the STEAM interdisciplinary approach, which was crucial to understanding the predisposition and attitudes of the teachers interviewed regarding the use of art in their teaching. In each country, an in-depth analysis was conducted to compare the different curricula, school systems, experiences, and opinions of primary and secondary school teachers regarding online teaching and the STEAM approach.

A total of 196 teachers were interviewed across the four countries, and the data emerging from this analysis fully confirm the less-than-optimistic social framework mentioned above.

The data, however, also allow us to perceive signs of a change in perspective that indicate the objectives of the OTA are entirely in line with the current historical period.

Even though the vast majority of the teachers interviewed (Fig. 1) for the survey declared unfamiliarity with the STEAM method, except Finland, which seems to

be more familiar with the subject, during the conducted interviews and focus groups, all nations noted a very high level of interaction between art and science subjects.

**Table-I: The Table Shows the Answers for Each Country to Question 69 of the OTA Survey**

	Slovenia	Cyprus	Finland	Italy
Never/ Rarely	70%	74%	50%	77%
Yes/ Someti mes	30%	26%	50	23%

Have you ever used the STEAM interdisciplinary approach to teach your subject?

OTA responds to two imperative needs: to find a creative way to manage classes interactively with diverse and online materials, and to utilise clear and structured resources that do not burden teachers but are readily available for use.

Reinventing a profession such as teaching, which involves switching from a traditional method where students have the opportunity to learn, socialise, and experiment, to a virtual mode, has been quite complex. The lack of readily available online tools and materials has created several problems in managing students and stimulating their interest virtually. As highlighted by one of the teachers interviewed by a partner of OTA, direct contact between pupils and teachers was crucial in that disorienting period, and technology allowed them to work quickly to ensure distance learning and experiment with a new and alternative language to the traditional one.

Time management during distance learning also generated considerable concern and stress for teachers as they adapted the broad curriculum to a new way of teaching it. The analysis conducted for OTA revealed a strong interest among teachers in utilising ready-to-use materials. As mentioned, teachers are already overworked and thinking about extra materials that take into account, for

For Example, the possibility of having some students online and others in attendance is very challenging.

For OTA, it is essential to offer teachers and students innovative tools and materials that allow them to use "art as more than just an illustrative example".

The majority of interviewed teachers (Fig. 2) believe that using a creative approach could make their lessons more interesting for students, not for the final result but for the cognitive process that accompanies the students.

**Table-II: The Table Shows the Answers for Each Country to Question 71 of the OTA Survey: Do you Think that using a Creative Approach Could Make your Lessons more Interesting for Students?**

	Slovenia	Cyprus	Finland	Italy
Poorly	6%	3%	2%	/
Much	94%	97%	98%	100%

When combining science with art, the aim is not to assess a project made by the student or their ability to draw; art can be used as a tool to achieve aims and results, not as an end in itself.

With an interdisciplinary STEAM method, as promoted by OTA, students will not only be "receptors" of knowledge, but will also be able to create knowledge thanks to the experiences, empirical, that they will make; students will



be an active subject in the learning process, with greater motivation to learn and greater probability of realising their potential and abilities.

As Albert Einstein said: “Where the world ceases to be the scene of our hopes and wishes, where we face it as free beings admiring, asking, observing, there we enter the realm of Art and Science... common to both is love and devotion to that which transcends personal concerns and volition”.

Schools have had to manage and face a real revolution in thinking. The teaching and OTA sectors want to intervene in this reversal of conditions by proposing the “revolution” of STEAM methodology and combining it with the need to introduce and exploit online teaching.

### III. THEORETICAL BACKGROUND

#### A. Methodology

The OTA methodology is emerging from a three-stage model, which emphasises the importance of science in society, an interdisciplinary STEAM approach, the specifics of online teaching and learning, and resource-based learning.

Experiential learning, creative problem-solving, small-group working, and teacher-led large groups. Using the OTA methodology also involves implementing elements of informal education, overall staying in line with the curriculum.

The philosophy of “education through science” advocates for educating students through a societal perspective to learn the science knowledge and concepts essential for understanding and addressing socio-scientific issues within society. It encourages creativity, communication skills, and other personal skills (such as initiative), as well as the development of social values related to becoming a responsible citizen and pursuing science-related careers [1].

The THREE STAGE MODEL (TSM) was an instructional innovation of the PROFILES project [2] which aims to arouse students’ intrinsic motivation undertaken in a familiar, socio-scientific context (scenario), to offer a meaningful inquiry-based learning environment (inquiry), and to use science learning in solving socio-scientific problems (decision-making).

The three stages are:

1. Scenario
2. Inquiry
3. Decision-making.

i. *Scenario*: In this stage, pupils’ intrinsic motivation should be aroused. This should be accomplished by presenting pupils with an issue that is relevant to their lives and worthy of greater appreciation. The scenario should be carefully set, drawing from pupils’ everyday lives, a surprising phenomenon in nature, or a socio-scientific issue. The initial motivation forms a key launching platform for the intended science learning. It should establish a foundation for scientific questions or other relevant inquiries related to the topic.

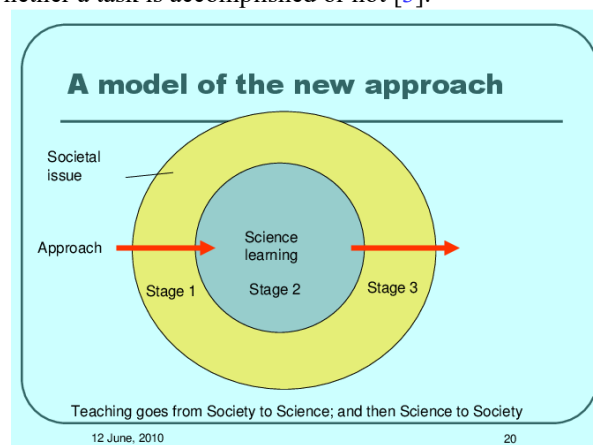
ii. *Inquiry*: should sustain motivation, set in Stage 1. It should meet learning outcomes through inquiry-based learning and enhance pupils’ social engagement through collaborative teamwork. Consolidation is also part of Stage 2 and includes presentations of the findings, discussions of the relevance and reliability of the outcomes, and

interpretation.

iii. *Decision-making*: the consolidation in this stage is meant to give acquired science ideas relevance by including them back into the socio-scientific scenario, which provided the initial pupil’s motivation. Pupils reflect on the issue. It can be formed as an argumentation debate, role-playing, or discussion to derive a justified, society-relevant decision or consideration that is seen as reasonable by the class.

Rather than the students being stimulated to learn by the teacher, the subject matter or external pressures, e.g. examinations, PARSEL strives to promote self-motivation by the students having an inherent desire to

Study the module. It attempts this by relating to students’ needs and desires. A critical component is assessment, which should move forward beyond simply determining whether a task is accomplished or not [3].



[Fig.1: Rannikmäe, M., Teppo, M., & Holbrook, J. (2010). Popularity and Relevance of Science Education Literacy: Using a Context-Based Approach. *Science Education International*, 21(2), 120]

How does the OTA project fit into the methodology above?

By exploiting the letter “A” in the STEAM acronym. Art serves as an access point to science, enhancing its value and making it more effective. When we discuss art, we broaden our scope, as the field of artistic expressions presents many different forms. The creative expressions that pupils can experience can come from various fields of art: e.g. painting, drawing, collage, sculpture, own video art, computer art or other forms of art, not necessarily from the field of visual arts (such as poetry or other creative writing, creation of music) or combination of different artistic expressions (e.g. art projects, installations).

In implementing the activities proposed by OTA, pupils will be able to express their artistic talents. For this reason, special attention was given to the materials they will use, which must be easily obtainable (preferably those found at home) and not expensive. The use of artwork in school lessons offers several possibilities. Art can be used as a starting point for the whole lesson in the motivational phase, it can illustrate the core of the lesson topic or present the problem itself. It thus becomes the fundamental tool of the OTA methodology, the starting point. The incorporation and treatment



of a specific art form in school depend on how a particular lesson is structured. It is essential, however, that teachers emphasise the essentiality of art. It should not be left as something obvious or underestimated, but discussed with pupils and lead them to see and understand the underlying combination of natural sciences and art.

What, in the eyes of the pupils, may seem a simple union of two separate school subjects must take on a new meaning.

Art and science will no longer appear as two distinct and even incompatible entities. Still, they will be the expression of a common language that uses different symbols that are mutually compatible.

In the research article "Hands-On Math and Art Exhibition Promoting Science Attitudes and Educational Plans," written by Helena Thuneberg, Hannu Salmi, and Krist Fenyvesi, we can read about the benefits of using the STEAM approach in education. They are highlighting the imagination, which allows pupils to see things in different ways. Imagination is supposed to be enhanced by art, artistic expressions, and the act of making art itself. The aesthetic aspect of art evokes an emotional response, which in turn supports the cognitive component of learning. The possible negative experiences and feelings that can occur during learning can be alleviated by providing pupils with similar experiences and activities.

The purpose of the OTA project is to increase pupils' motivation and interest in science subjects in their everyday classes, which they experience on a daily basis. The project aims to achieve this purpose by using art as a teaching tool in science.

The STEAM methodology aims to revolutionise the traditional concept of teaching because it substantially changes its connotations and the position of those involved.

The classical face-to-face approach develops its potential in the dual relationship between teacher and student, where the established relationship is one-to-one and hardly open to others.

This methodology challenges the traditional vertical and hierarchical teacher-pupil relationship by proposing a more inclusive approach, where circular knowledge is established, leading to learning that is more equitable, flexible, and interactive.

With the use of the interdisciplinary STEAM method, students will not only be "receptors" of knowledge, but will also be able to create knowledge thanks to the experiences, empirical, that they will make; students will be an active subject in the learning process, with greater motivation to learn and greater probability of realising their potential and abilities.

Art, science, and technology are creative and generative activities which together convey the purpose of an innovative and interdisciplinary approach to research and teaching.

In the traditional method of teaching, students are often required to adapt to the complexity of studying specific subjects, which can lead to a decline in interest in the class.

or have difficulty keeping up with other classmates; on the other hand, it is certainly not easy for teachers to make up for the gaps of some without sacrificing the learning of others.

An interdisciplinary method such as STEAM, based on a

student-centred system, allows the student to approach the complexity of the subjects of study in different ways and from various points of view that might seem more straightforward to him, and also encourages the acquisition of a set of skills that are functional to the personal growth of the student.

The change from traditional education lies precisely in this: in emphasising and stressing the interests, skills and learning styles of each student.

Additionally, it allows teachers not to be alone in this teaching process and to diversify the language with which they explain the concepts.

The STEAM approach enables students to explore their learning styles, connect subject matter with their interests, discover new learning approaches that work best for them, strengthen their self-confidence, analytical ability, and critical thinking, as well as their autonomy in acting.

Thuneberg writes, "Since the creative element and the aesthetic component are the intrinsic core of art, combining art with learning mathematics offers an additional dimension to concretise mathematical concepts..."<sup>8</sup>

It is using art, then, that abstract matters such as science, especially mathematics, are given a concrete character. Art is one way to provide such concretisation as it is a visual form, thus more concrete, or so it seems.

## IV. RESULTS

The tangible results of the OTA project will be a teaching tool to support teachers.

After a status report on the four countries involved and the development of the methodology, the partners created more than 100 activities on the topics for which teachers were asked to provide their opinions in the first survey phase.

All the activities are designed to respond to the method that inspired the OTA methodology, namely, the three-phase approach.

## V. CONCLUSION

The students will be able to approach the study of science by incorporating artistic elements as a bridge between the curriculum and everyday life.

Art as a means of learning and not as a result! This is the innovation of OTA.

Like any product created with European funding, this will be available for download from the project website <https://ota-project.eu/> at no cost and without restrictions.

## DECLARATION STATEMENT

I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
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- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
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**Bruna Giunta** is a project manager at CESIE. For many years, she worked in the field of education, particularly in projects aimed at countering school dropout and social exclusion. She has developed her competencies by working in local as well as international cooperation projects. She seeks to develop innovative teaching strategies that highlight the crucial role of schools in children's education.

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