NEW FRONTIERS IN SCIENCE COMMUNICATION

INNOVATIVE MODELS, METHODOLOGIES, SKILLS FOR THE DIGITAL TRANSITION IN THE FIELD OF SCIENCE COMMUNICATION

SC+

EDITORIAL

Global challenges and the imperative of cooperation

GREEN IN THE LAB

DOING IS LEARNING
Creative learning paths, integrated approaches and unusual teaching methodologies

SPECIAL

We are better together!

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NEW FRONTIERS IN SCIENCE COMMUNICATION

2024 April - June

The SCI-CO+ Magazine

This web platform is part of the Project "SCI-CO+ - High Professional Skills for Advanced Science Communication" (Agreement No. 2022-1-IT01-KA220-VET-000086033), funded under the European Erasmus+ Programme. The information and views set out reflect only the views and opinions of the authors (producers and the European Commission cannot be held responsible for any use that may be made of the information contained therein. This platform can be used for public use, subject to the acquisition of specific access credentials. No content may be used for commercial purposes. None of these materials may be used for commercial purposes.

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Sustainability is at the heart of the EU Programs. The SCI-CO+ Project adopts solutions that are environmentally friendly. This publication is and electronic magazine printed just in a limited number of copies for dissemination purpose.
Digital edition is available on www.SciCoPlus.org and www.SciCoPlus.eu

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Sci·Co+ High Professional Skills for Advanced Scientific Communication

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In this issue...

The processes of innovation in the communication of science do not only derive from the evolution of the technologies used but also from the methodologies and strategies that this evolution entails. In the previous issue we dealt with this topic from a general point of view. Starting with this issue, through articles on experiences of great interest, we will enter into the heart of the subject without neglecting the educational and social aspects that strongly affect the world of science communication. In the first group of articles we will address precisely these topics.

In the article **Digital Devices, Albedo and Scientific Citizenship in Contemporary Schools**, the importance of strengthening scientific citizenship in an increasingly technological and hyper-connected world is emphasised. In particular, a number of educational projects and methodological approaches for teaching STEM subjects are described that help build bridges between the contemporary world and accredited knowledge. The ESERO educational programme is one of these, and the educational resource *"The Earth under the Cover"* and the *"Albedo"* App are discussed. Together, they enable classroom activities of authentic research on climate change, practices that also investigate our actions and possible adaptations, thus educating students to a proactive attitude that calls them to a sense of responsibility and to believing that a sustainable future built together is possible. The article **Doing is Learning**, on the other hand, addresses the issue of introducing new creative learning paths, new integrated approaches and new didactic methodologies; in particular, examples are described that have been realised with integrated methodologies to face contemporary educational challenges, both in the school and extracurricular spheres, where users andstudents are called upon to act with collaborative and/or *hands-on* activities.

With the article **Science Podcasting** we address more specifically the use of technological innovations in science communication; it deals with the use of modern communication tools for a global, diverse and inclusive narrative. More specifically, the article describes an interesting experience of the use of podcasting, an emerging form of audio communication that has gained momentum and popularity in recent years because it is highly accessible to audiences all over the world; for this very reason, science podcasting can be conceived as an excellent opportunity to share stories, convey information and engage the public in the world of STEM. In addition to the strictly technical aspects, the article focuses on the science podcast *When Science Finds a Way*, recently launched by Wellcome, a global charitable foundation that supports science in solving urgent challenges to people's health.

This issue's SPECIAL - entitled **Together we are stronger** - is dedicated to the topic of women's work in the various digital technology sectors. In the dynamic and ever-changing landscape of these sectors, women continue to be under-represented. To address this inequality and enable women to succeed in these fields, various strategies and approaches have been used in recent years, and the creation of dedicated communities and services can foster this growth. The Swedish experience of Anett Kansanen from Hive & Five, a digital innovation agency in Sweden, goes precisely in this direction by responding to the professional need for networking in her field, which prompted her to take action by creating the *Techtalks network*, an inspirational network for women in the Borås Region and surrounding areas who are engaged in the technology sector. The motto of this network is *"From the digital present to the digital future!"*

The last two articles are two important insights into the digital transition in science communication. The first, as the effective title **ASTRONOMY-CO+** suggests, is a description of the evolution of the communication of astronomy over the last sixty years. As the article points out, astronomy is one of those areas of science in which the relationship with the general public, citizens, young people, has become increasingly consolidated, making *Citizen Science* a very dynamic reality. Moreover, it is an area of science where the digital transition has played a primary role in fostering scientific communication for inclusive purposes.

The closing article describes the Sci-CO+ Project's in-depth study of **advanced technologies for scientific and cultural communication** and the role of technologies for a digital transition increasingly at the service of citizens and knowledge. In particular, it illustrates the role that advanced technologies are playing in the evolution of communication in the field of science and cultural heritage and how advanced communication is bringing about profound changes in the relationship between people and the work of the human mind and spirit.

Global challenges and the imperative of cooperation

by Luigi Amodio

The days that I am writing this paper, for the third edition of this magazine, are probably among the most difficult that humanity has been going through for many decades. And the news, unfortunately almost always bad, is now updated by the hour, showing us new violence and atrocities on unarmed populations, diplomatic failures, radicalisation of positions and new enmities.

In the background, accelerating climate change is increasingly evident, which will cause new natural disasters and, consequently, new migrations and new political crises in the world that everyone once believed, blatantly wrong, had reached "the end of history" and a phase of globalisation based on peace, cooperation, development and growth. All of this, however, it should be remembered, while in other parts of the world – especially in countries that are now called the "Global South" - wars, political instability and poverty have never really stopped.

In science fiction movies, when faced with a global enemy, which can be compared to the reality equivalent of climate change, there always comes a time when the "big guys" on Earth put aside their national interest and, after a whirlwind of phone calls or a big conference at the United Nations, they decide solemnly, perhaps relying on the superhero of the day, that the monster or the alien or the asteroid that threatens life on Earth, will be stopped by a common will and effort. But unfortunately, we are not in a movie, no matter how catastrophic; in our reality people prefer to fight each other rather than join forces and try - albeit against the backdrop of a historic geopolitical redeployment, which will transform the world that came out of World War II – to respond, as humanity, to the common enemies: climate change, hunger, inequality, the diseases old and new, emerging and re-emerging, even in countries that once thought themselves immune.

These are naive words, I know, but I believe that everyone must do their part, as much as they can. And this is precisely why I think that the scientific community, both the research community and community of science communicators, must now look beyond and throw its heart over the hurdle. I understand, and how could I not, the invitation that has often come from students, intellectuals, activists, academics to suspend, at this time of crisis, the collaboration and joint work with the corresponding Russian and Israeli communities. I understand it, I repeat. But I do not share it. And I do not share it because - without any yielding to metaphysics - I am firmly convinced that science (...that language "written in mathematical language, and the characters are triangles, circles, and other geometrical figures, without which it is impossible to humanly understand a word of it'...) and above all its practice, must never be never be interrupted, even in the most acute moments of conflict.

The shared language of science and research can and must, in fact, help to keep open channels of communication even with the 'enemy', because after all, it is with the 'enemy' that one can then negotiate and perhaps seal an armistice. We have many examples of this in even recent history and even in current events, such as the mission to the International Space Station, which saw the Russian, American and European astronauts in orbit, even after the invasion of Ukraine. Samantha Cristoforetti herself declared at the time: "Everyone here on the Space Station is sad about the ongoing conflict in Ukraine, but I think it is important that we all continue to work together".

Let's start from here and try - even though I know it is very difficult - to keep this window of dialogue in our projects, in our activities, in our research. Perhaps it will not be nothing; perhaps, instead, it will make a small contribution to that new order of peace and development that we all desire.

P.S. This article reflects my personal opinions and do not necessarily reflect the views of the institutions involved in the SciCo+ project.
I also take this opportunity to inform you that from 1 September 2024
I will no longer work for the City of Science and will be engaged in new professional challenges. I wish the entire SciCo+ community to continue and successfully conclude this important project.

Luigi Amodio is the Director of the Science Centre of Città della Scienza

DIGITAL DEVICES, ALBEDO AND SCIENTIFIC CITIZENSHIP IN CONTEMPORARY SCHOOLS

by Rossella Parente and Valentina Di Sarno

This article emphasises the importance of strengthening scientific citizenship in an increasingly technological and hyper-connected world. In particular, some educational projects and methodological approaches to the teaching of STEM subjects are described here that help build bridges between the contemporary world and accredited knowledge. The ESERO educational programme is one of them. Also covered are the ESERO educational resource 'The Earth under the Lid' and the 'Albedo' app that enable authentic climate change research activities to be conducted in the classroom. These practices investigate our actions and possible behaviour adjustments by educating students towards a proactive attitude that calls them to a sense of responsibility and to believing that a sustainable future built together is possible.

Calm above the storm, an image taken by a satellite of the European Space Agency - ESA
European Space Agency - ESA

IN A SOCIETY OF KNOWLEDGE AND TECHNOLOGICAL DEVELOPMENT

The scientific and technological progress of a country contributes to the well-being of its citizens and the wealth of the nation. In this society of knowledge and technological development, science education also helps one to orient oneself in an increasingly fast-paced and connected world. And it goes without saying that the need for scientific and technological knowledge is growing more and more, both in basic and vocational education, so much so that we talk about *scientific citizenship*. Young people, however, consider science distant from them, uninteresting and unfashionable, even harbouring an inordinate passion for all small but high-tech devices such as smartphones and tablets. For these reasons, educational programmes and approaches to teaching STEM (Science Technology Engineering Mathematics) subjects that are in step with the times become indispensable.

APPROACHES TO TEACHING STEAM TODAY

Educational activities therefore require teaching-learning approaches that establish links between real phenomena and disciplines, build coherent and lasting knowledge, overcome learning difficulties, and create interest in science and technology. Approaches to teaching such as:

• Real-Word Learning - RWL | students using real-world data sets that they collect, analyse, represent, interpret;

• Project-Based Learning - PBL | students working on complex tasks by coordinating in collaborative design, conducting research, participating in decision-making;

• Inquiry-Based Learning - IBL | students ask questions, make hypotheses, carry out tests, perform experiments, build models;

• Bring Your Own Device - BYOD | students using personal electronic devices to access information on the web, use apps, take quizzes, join social communities;

• Responsible Research and Innovation - RRI | students working on projects that are easily accessible to all by aligning the process and results with society's values, needs and expectations.

THE ESERO EDUCATIONAL PROGRAMME

The ESERO (European Space Education Resouce Office) educational programme uses Space as an extraordinary context to promote innovative teaching and learning in STEM subjects. The national ESERO Italy programme involves museums, such as Città della Scienza (Science City), science centres and schools that support ESA (European Space Agency) and ASI (Italian Space Agency) in the dissemination and knowledge of STEM subjects (www.esero.it.). Between January and December 2023, the ESERO Italia team organised and implemented training events for primary and secondary school teachers, both online and in-person, reaching 725 teachers from 20 regions. ESERO also promotes new skills required in the world of work by providing key solutionsto address contemporary and future challenges such as climate change.

THE EARTH UNDER THE LID, AN EDUCATIONAL RESOURCE OF THE ESERO PROGRAMME

Greenhouse gas emissions from human activities, which have amplified the natural greenhouse effect, are largely responsible for recent climate change. In particular, global warming is causing many changes in all components of the Earth's climate system: from ice to vegetation, from the atmosphere to the oceans. You can investigate the greenhouse effect in the classroom with "The Earth Under the Lid" (https://www.esero.it/risorse-didattiche/leffetto-serra-e-le-sue-conseguenze), one of the educational resources made available by ESERO Italy. ESERO teaching resources are multimedia resources for primary and secondary schools that can be carried out in the classroom independently. The activities proposed by "The Earth under the Lid" are laboratory experiments and interpretations of satellite images that allow a better understanding of the overall effects of global warming, integrating and enriching the school curriculum.

SMARTPHONES AND THE ALBEDO OF OUR CITIES

Albedo influences the Earth's surface temperature: surfaces that have higher albedo, absorb less radiation andtend to heat up less
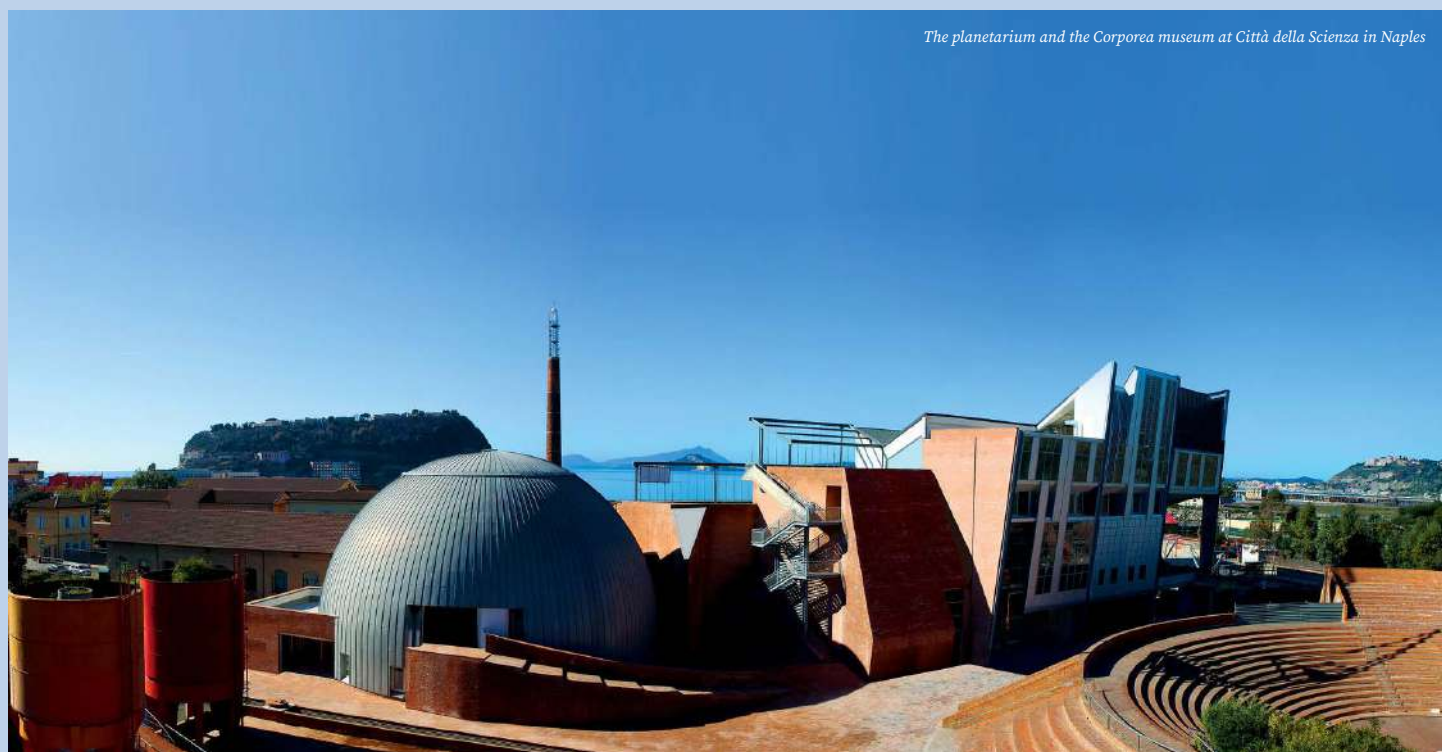
The planetarium and the Corporea museum at Città della Scienza in Naples

than those that have low reflectivity values. Albedo is a physical quantity that indicates the fraction of incident radiation that is reflected. The value of albedo depends on the surface area on which the radiation strikes, as well as the wavelength of the radiation. Albedo values range from a maximum value of 1 (ideally, total reflection from a white surface) to a minimum value that is 0 (ideally, total absorption from a black surface).

Albedo is also the name of a free app that measures the physical quantity albedo using the light sensor of your digital device (tablet or smartphone). With the Albedo app, both the total fraction of reflected radiation and the red, green and blue reflected fractions of incident light can be measured. The app is easy to use, requires a grey photo paper for calibration, and stores all measurements saved in the 'Library'.

Using smartphones or tablets, digital devices much loved by our young people, students can measure the albedo of parts of the school structure such as the courtyard, flowerbeds, building walls, terrace, roof. These values can be very different depending on the different materials and colours used in the construction of the school's exterior and interior spaces. With the data in hand, the students can submit a proposal for a building renovation plan for the school to the school head, with adjustments, and indications that also take into account the measured albedo values.

OUR YOUNG PEOPLE FACING THE FUTURE

Our cities, teeming with activities of all kinds, are a major and ongoing source of greenhouse gas emissions and are responsible for about 70 per cent of energy consumption. Across the European Union, cities and towns are trying to reduce emissions and adapt to climate change through smart and participatory planning of targeted activities.

In this article, we have identified some methodological approaches to the teaching of STEM subjects. We have chosen to talk about an ESERO resource and an app, both free of charge, which allow us to investigate what we can do and what adjustments are possible, on a small and medium scale. This is so that our students are trained in a pro-active attitude that calls them to a sense of responsibility but above all to a belief that it is possible to build a sustainable future together.

A treasure hunt with digital devices in the science centre Città della Scienza
Città della Scienza

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A screenshot of the free reflectance app Albedo by Thomas Leeuw

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DOING IS LEARNING

Creative learning paths, integrated approaches and unusual teaching methodologies

by Barbara Avella e Mauro Crepaldi

This paper presents examples of integrated methodologies to address contemporary educational challenges, both in and out of school, where users, students and pupils are called upon to active-ly participate in collaborative and/or hands-on activities.

In education, as well as in the practice of science dissemination, a high degree of plasticity is required in adapting personal modes of content delivery to the cultural conditions in which each generation constructs its learning path.

Fifteen years ago, this resulted in the construction of multimedia educational products that attempted to curb the already visible difficulty of the new generations in maintaining high attention spans without constant emotional and sensory stimulation.

This clip for **learning about the circulatory system** (https://gat.to/0zsct) is a good example of the effort to exploit the combination of video, sound and rhythm with a text to be sung all together to the notes of the official World Cup anthem of the time, with the encouragement of active participation by students and the involvement of multiple sensory channels (visual, auditory and kinaesthetic) to enhance the learning experience.

Today, augmented and virtual reality technologies and the epochal upheaval of the introduction of generative artificial intelligences allow us to create truly immersive products of high graphical quality, even if they are not always accompanied by the same care in content.

The wow effect, so sought after because it is essential to the emotional activation of the student, is exhausted in a matter of seconds and cannot be repeated as effectively. Thus it happens that we witness the construction of didactic objects that are always new and accompanied by stimulations that are each time more engaging than the previous ones.

However, this is not the only way to effectively propose the practice of both popularisation and didactics of science.

In that strategic laboratory (because it can follow a pupil's educational journey for years), privileged (because it does not have to account for an immediate financial re-

Novel Engineering. An example of a realised product.

turn) and creative (out of necessity, given the chronic lack of resources, facilities and personnel), that is the school, alternative ways are already being tried out to increase the chances of educational success. These initiatives can be an inspiration for other contexts such as museums, science and technology cities.

A paradigmatic example that can be reproduced in the context of both curricular and extracurricular teaching activities, easily adaptable to the age of the participants, completely inclusive, strongly interdisciplinary and made with readily available material, is presented in the workshop [ADD NAME OF WORKSHOP] to give an insight into the vastness of the **solar system** (https://gat.to/fav40).

The possibility of keeping the object, the end result of the experience, is incredibly powerful: we have seen it presented with enthusiastic explanations and ill-concealed pride, even months later, with many children preserving it for years.

In other realities, by customising the back of the ribbon with one's own logo (obviously no longer in simple paper but plasticised), one could create 'unique' gadgets at a laughable cost and with enormous potential. The same logic can be applied to the reproduction of famous scientific experiments.

If, on the other hand, more time is available for didactic actitivieis, then it becomes advantageous to use the combination of individual demonstrations and experiments in the creation of a single artefact or installation that can also be realised in a collaborative and interactive manner involving learners/users.

In this case, the playful element of **Pinball** (https://gat.to/l9hfr), a game of which students are at most familiar with some digital version, is used to create a mechanical adaptation linking the basic physics elements under study (Fig. 1 - the spring, the inclined plane, the force of gravity, etc.) and a Role playing activity (https://gat.to/y3vby) with

the four characters (Archimedes, Galileo, Newton and Hooke) who theorised about their properties and laws.

Virtual and physical (Phyrtual or firtual in the definition given by Alfonso Molina, scientific director of the Fondazione Mondo Digitale) constantly chase and intersect in the daily experience of the new generations (with the IoT (Internet of Things) in the first place) and the skill of the professional ,whose role is that of trainer, to understand when and how to favour one, the other or fuse them together.

So what would traditionally be (and has always been) the creation of a simple model of the Earth-Moon system, with its beautiful coloured polystyrene spheres suspended on improbable rotating supports or attached with 'invisible' nylon thread in a diorama with a 'celestial' background, can, more profitably, become a coding educational path.

In this digital example of the **Earth-Moon System** (https://gat.to/8mrio) we see the final work of a small group of fifth grade students with Scratch, an age-appropriate block programming environment.

The job is relatively simple, but to do it you need to have acquired the ability to select the images to insert them into the programme, studied the relative motion of the Earth-Moon system and learned how to translate it into code so that the computer can reproduce its movements 'exactly' as they are in reality, respecting the correct number of Earth rotations in relation to a complete orbit of its satellite (mensuration), the constant view of the visible side of the Moon, etc.

If one wants to bring storytelling and science closer together, then the **Novel Engineering** activity (https://gat.to/iptg3) deserves special mention, i.e. the careful reading of an engaging text proposed by the trainer (i.e. previously identified by the teacher or chosen by the students, depending on their age) in which a problematic situation is presented that can be solved using a physical, mechanical or electronic artefact that the readers are called upon, in groups, to realise (Fig. 2).

Possible solutions must be extrapolated from the analysis of locations (no point in looking for wood if the story is set in the South Pole), attention to the historicisation of events (no clocks if the story takes place in ancient Rome) and respect for the characteristics of the characters (a 'particularly thrifty' person would not try to solve the problem by simply buying everything, even if he could).

In this example (https://gat.to/8lp16) applied to A. Wilsdorf's book 'Eugenia the Ingenious', it is well understood how the skills and competences acquired in previous classroom experiences (such as floating or the construction of simple electrical circuits) were implemented, but it is in the conception and construction phases of the artefact that the real 'momentum' of learning is developed.

If resulting from a shared solution, the added value of the 'engineering challenge' will (also) enhance the ability to work together, be an incentive for creativity and (perhaps) stimulate entrepreneurship, support critical analysis and promote the overcoming of gender stereotypes, but the important thing is that the whole process is made an integral part of the learning experience and the automatic learning-by-doing is realised in a real end product.

In conclusion, this small selection of didactic activities that are part of an open, shared and plural system of educational agencies, demonstrates the wealth of approaches (from Quiz-forms to STEMAIs) that are necessary to prepare young people no longer to face the world as we know it today, but to offer them the tools (logical, analytical, adaptive and relational) for a world that we can only, and vaguely, imagine.

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Mauro Crepaldi, teacher and trainer in the logic-mathematics-informatics field. He is co-author of the book 'Fondazione Mondo Digitale, Cittadinanza digitale integrata e sostenibilità alla primaria. Proposals for disciplinary and digital learning units', Edizioni Centro Studi Erickson, Trento 2023.

A case study of the Wellcome Trust's new science podcast, When Science Finds a Way. Written by a former project manager of the podcast.

SCIENCE PODCASTING: USING MODERN COMMUNICATION TOOLS FOR GLOBAL, DIVERSE, AND INCLUSIVE STORYTELLING.

by Gillian Barber, PhD

Podcasts are an emerging form of audio communications that has been gathering momentum and popularity over the last number of years. This modern communications tool is not only highly accessible to audiences across the globe, but it is also highly accessible for content creators from any background or interest. With this in mind, science podcasting can be conceived as an excellent opportunity to share stories, pass on information, and involve audiences in the world of STEM.

In this article, we focus on the new science podcast recently launched by Wellcome – *When Science Finds a Way*.

We will walk through the necessary steps of conceptualisation and development that lead up to publishing a science podcast intended for a global audience, and we emphasise the use of inclusive processes when communicating through podcasting. This article is written to be informative and reflective, in the hopes of encouraging others to try science podcasting themselves.

Podcast cover art as appearing on podcast listening platforms.
© Wellcome

WHO ARE WELLCOME?

Wellcome is a global charitable foundation that supports science in solving the urgent health challenges that face everyone. They fund ambitious research around the world to transform our understanding of life, health, and wellbeing.

An important part of Wellcome's work is to communicate this research in an inclusive, engaging, and informative way. Science podcasting as a new and modern format of communications was chosen as an ideal method of delivery.

In June 2023, Wellcome successfully released the first episodes of an 11-part series of their new podcast, *When Science Finds a Way*[1]. Their host, Alisha Wainwright, meets researchers and experts from around to world to speak about their work. The podcast transports listeners to where the research is taking place by hearing from real people at the centre of these health challenges.

WHY CHOOSE SCIENCE PODCASTING?

Science podcasts are for everyone and can be delivered by anyone. The only pre-requisites are big ideas and a motivation to communicate them.

Science podcasting has become a rapidly evolving and exponentially growing field for science communication. There have already been hundreds of English language science podcasts published, most of which are hosted by scientists[2]. Science podcasts represent an accessible and engaging medium to digitally connect experts with regional and global audiences in a more intimate and personable way. Listeners choose to turn on and engage with a host, and what they have to say. This connection can foster the feeling of building relationships and even drive the formation of online communities[3].

DEVELOPING A PODCAST

The following segments of this article will guide the reader through a general overview of developing a new science podcast.

Identifying the Podcast Audience

Like any communications project, a target audience (or 'publics') should be defined early on. This contributes significantly to the general direction and style of information delivery. It also allows the team to reflect on the 'why' - why is this podcast being created? For the *When Science Finds a Way* podcast, Wellcome hoped to communicate the wide range of research that Wellcome holds an interest in to researchers and professionals working in health and policy. It also aimed to inspire younger generations to pursue this kind of work in the future. Additionally, the podcast format means that anyone in the general public can easily listen in and learn about ground-breaking research happening all around the globe.

Host, Alisha Wainwright in conversation on the podcast.
© Wellcome

Selecting a Podcast Style

One of the most popular podcast styles is when a host invites a guest to speak on the podcast. These are generally semi-structured interviews in the format of casual conversation which leads to an interesting discussion. Wellcome's podcast adapted this approach by inviting researchers to speak about their work.

To ensure a more inclusive and complete narrative, a series of voice clips from those with '*lived experience*' were incorporated into the episodes. Researcher, P.J. Casey, describes lived experience as the 'what it's like' of being human, which can only be understood from an inside perspective[4]. These voice clips ranged from individuals who may have taken part in a study, to those having first-hand experience of the research topic. All clips shared the individual's side of a story and their feelings.

For example, in the first episode, Alisha interviews an expert from India on the topic of anti-microbial resistance. During this discussion, the listener intermittently hears clips from two individuals based in Kenya. One clip is from a patient who describes his experience with antibiotic resistance, and the other of a doctor grappling with the implications for treating his patients.

FINDING A PODCAST HOST

Choosing a personable host is crucial to the success of a new podcast. Alisha Wainwright was chosen for Wellcome's podcast because of her science background and her experience in acting. But most important in a host is a positive character, and Alisha has been described as having a warm personality by her listeners. A report by Voices noted that 54% of podcast listeners feel they know the personalities of their favourite podcast hosts very well[5]. As the listener grows to know the host, a relationship can form which fosters a certain level of trust in the host and the information they communicate. This is particularly relevant for science podcasts, and so care must be taken to honour this trust by providing quality content.

Global Stories, Diverse Storytellers

Storytelling plays an important role in generating engaging communications, conveying information, and working through understandings of concepts[6]. When delivered well, a harmonious relationship can grow between the listener and the speakers, where the listener feels personally involved.

For Wellcome's global and diverse audience it was necessary that the stories should reflect this. Each episode of *When Science Finds a Way* travels across the world to hear experiences directly from researchers and those on the ground.

Ma Magwaza, a farmer in the Kwa-Zulu Natal province of South Africa and a contributor to crop diversity research – Episode 10.
© Wellcome, Credit: Waldo Swiegers

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Publishing Podcasts

Dissemination strategies are an integral part of podcasting. Most podcasts are published through a podcast hosting service. An RSS feed is created by uploading a podcast and the service then distributes the episodes to popular platforms where listeners can find it, such as Apple Podcasts or Spotify. The *When Science Finds a Way* podcast was uploaded to LibSyn, however there are numerous hosting services, many of which are free to use.

As a podcast with global listenership, audience research was conducted to determine what listening platforms are most often used in countries of interest. Apple and Spotify are largely known to be the major listening hubs for podcasts[8], however there are other platforms that are popular in specific regions. For example, Gaana is a popular platform in India. More inclusive and widely distributed dissemination is achieved by adding these platform destinations to the hosting service.

Imagery that Represents

When creating the marketing material for the *When Science Finds a Way* podcast, diverse and representative imagery was crucial. Local photographers were hired from the countries where guest speakers lived to capture a snapshot of their lives in their home environments. Hiring these local photographers presented many logistical challenges, such as requiring more time

and project management resources. However, the podcast team felt it was important for the graphic storytelling of the podcast to be created by those who live in and experience each respective country.

FINAL REFLECTIONS

As an increasingly popular medium of technology, science podcasting represents an enormous opportunity to digitally reach individuals. As podcasts are easy and free to access, they should be considered as a feasible path to reaching and engaging with different audiences, in particular for younger generations in Europe[9].

Through quality storytelling and creating a listening experience that facilitates trust, we can communicate valuable knowledge-sharing and learnings in a genuine manner.

So why not give science podcasting a go?

Gillian Barber, Post-doctoral researcher, Trinity College Dublin. Research consultant - Science Commu-nication & Education. Former public initiatives manager at Wellcome.

WE ARE BETTER TOGETHER!

by Anna Gunnarsson

I met up with Anett Kansanen from Hive & Five, a digital innovation agency in Sweden, and had an interesting conversation about digital transformation. In this article, the necessity of networking, especially for women is further discussed. Anett has identified a professional need for networking in her line of business; this made her go into action creating the Techtalks network, an inspiring network for tech women in Borås and the surrounding areas. From the digital present towards the digital future!

Anna Gunnarsson is a science teacher, working at Navet science center in Sweden as a project manager and developer.

In the dynamic and ever-evolving landscape of different fields within the area of digital technology, women continue to be underrepresented. To address this disparity and empower women to succeed in these fields, networking is essential. In this article, we'll explore why networking is crucial for women in the digital technological field and how it can contribute to professional growth and knowledge.

CREATING SUPPORTIVE COMMUNITIES

Networking provides women with opportunities to connect with like-minded peers, mentors, and allies. It also empowers women in digital technological professions by fostering confidence, self-esteem, and self-efficacy. By engaging in networking activities, women have the opportunity to share their expertise, contribute to professional discussions, and assert their presence in male-dominated circumstances. In Borås, networks like this have started their journey; gathering people from many different workplaces; creating new possibilities.

WHY TECHTALKS IS AN IMPORTANT MEETING PLACE

Networking is crucial when it comes to the development of digital knowledge, for both men and women. But as we know that women in digital technological professions have less access to networks that can support their role in a male - dominated field, it is necessary for women to sometimes meet each other without men. The women who gather in the TechTalks network are important as role models and clearly show engagement in their field. They show each other how it is possible and necessary to dare being important, to do important things and tell others about it without hesitation.

ESPECIALLY IMPORTANT WHEN GETTING TOGETHER

It must be very much ok to not know everything. Too share knowledge and be part of a thelifelong learning process. This is even more obvious when meeting young female students (from digital programs in the University), called IT-girls. Meeting them really shows that there are different things to be learnt when there is a variety of experiences in the room - as long as we are open to doing so. With every conversation, there is something new and interesting to dive into, and you never know who is going to deliver the best inspiration!

AREAS OF PARTICULAR INTEREST FOR THE NETWORK

Artificial Intelligence (AI) -particularly in the many ways AI will have an effect on our workplaces. For example, how AI functions can measure and evaluate job performance, collecting employee data from smart watches. It is also interesting to follow how companies will be able to develop using AI functions on local data; the limitations for this are more or less dependent only on our current server capacities. What will happen when there is a change in that? We are not yet using AI to replace people in their line of work, but the possibilities of AI function sure challenges what we, right now, think is normal.

Cybersecurity - presents a multitude of challenges in today's digital age. Constantly evolving cyber threats, the interconnectedness of devices through IoT (Internet of

Things), and the expansion of remote work and cloud computing all contribute to increased vulnerabilities. And the shortage of skilled cybersecurity professionals makes it hard to keep up. The situation requires comprehensive strategies to mitigate technical vulnerabilities, manage human factors, and ensure the playing by the rules. Effectively tackling cybersecurity threats is essential for safeguarding sensitive data, protecting critical infrastructure, and maintaining trust in digital systems.

Hyperautomation - he advanced automation strategy that combines technologies like robotic process automation, AI, and machine learning to automate repetitive tasks and streamline complex processes in order to, for example, handle a wide range of tasks previously performed only manually. By integrating these technologies, hyperautomation enables organisations to adapt quickly and to make work easier, faster, and more accurate.

CONCLUSION

In conclusion, networking is essential for women in digital technological professions. By creating supportive communities, accessing resources and opportunities, receiving mentorship and guidance, empowering themselves, breaking barriers and fostering collaboration and innovation, women can overcome challenges together, achieve their goals, and contribute to the advancement of digital technology in these unique and impactful settings. As we continue to strive for greater gender equality within the digital, technological professions, networking is a powerful tool for women to connect, learn, grow, and lead in the digital age.

Hive&Five
is an innovation
agency,
creating
new digital ways
of doing business
with companies
and organisations;
always searching
for new services
and new customers
who will explore
digital
possibilities!

The first TechTalks network
Anett Kansanen

ADVANCED TECHNOLOGIES FOR SCIENCE AND CULTURAL COMMUNICATION

Technologies for a digital transition increasingly at the service of citizens and knowledge

di Tom SAVU, Alfredo TROIANO, Giuseppe D'ANGELO

Concept museum online exhibition.
By Treety (AdobeStock_471857885)

S cience communication plays a pivotal role in bridging the gap between scientific advancements and public understanding. Effective communication of scientific concepts inspires the next generation of scientists. This article explores how advanced technologies are transforming science communication. The same is happening in the world of cultural heritage, where advanced communication is bringing about pro-found changes in the relationship between people and the product of the sciences and arts.

INTRODUCTION

Communication is undergoing a huge change fueled by technological advancements that allow for very advanced digital transition processes. This is particularly happening in the field of Science Communication. Innovations such as augmented reality (AR), virtual reality (VR), virtual museums, holography, geolocation are revolutionising the way scientific concepts are presented, understood, and used by the public.

When we talk about "scientific" communication, we tend to think, mainly, of that carried out in Science Museums and Science Centres[1]. In general, however – and we'll use this point of view in this article – we can also think of scientific communication in other sectors, in particular that of cultural heritage in which Museums and Sites (archaeological, religious, artistic, architectural, etc.) represent many contexts in which works of the human mind are shown and, sometimes, acted upon by the people, in a multiplicity of ways. This essay explores these digital technologies that are shaping communication in a deeper way, improving accessibility, interactivity and immersion and, at the same time, helping us to reflect on the theme of the reproducibility of a work of art or an artifact and the meaning of these new ways of consumption.

Technology does not aim to replace or eliminate the on-site visit, but rather to enrich and improve the user experience, also adapting it to one's generational, social and cultural profile. This process also aims to "extend" the experience itself, with a "pre" of construction of the visit and a "post" of reflection and sharing of one's experience through social media, which today represent the true social model of reference.

DIGITAL ADVANCED TECHNOLOGIES OVERVIEW

Below is an overview of the digital technologies that are emerging in the world of communication.

Augmented Reality (AR)

Augmented reality (AR) refers to a technology that superimposes images, videos, or other computer-generated digital content onto the real-world environment. Unlike virtual reality (VR), which immerses the user in a fully digital environment, AR enhances the real world by overlaying digital information on top of it.

The technology typically relies on devices such as smartphones, tablets, or specialised AR glasses that are equipped with cameras, sensors, and screens. These devices capture the real-world environment and integrate real-time digital content into it, allowing users to interact with physical and virtual elements simultaneously.

AR has applications in various fields, including gaming, entertainment, education, healthcare, retail, and manufacturing. Examples of AR experiences include interactive educational simulations, immersive gaming experiences, navigation assistance, virtual try-on of retail products, and maintenance guidance in industrial settings.

Augmented reality has a wide range of applications in science communication, spanning various domains such as education, outreach, visualisation, and storytelling. One of the main advantages of AR lies in its ability to make abstract or complex concepts tangible and accessible through interactive visualizations. For example, AR applications can render three-dimensional models of molecules, celestial bodies, or geological formations, allowing users to manipulate and explore them in real-time.

AR also offers innovative opportunities for public outreach and engagement in science

centers, museums, and public spaces. Interactive AR exhibits can captivate visitors by providing dynamic and personalized experiences that cater to different age groups and interests. For example, visitors to a natural history museum can use augmented reality-enabled devices to unlock additional exhibit information, participate in scavenger hunts, or interact with virtual creatures overlaid on real-world environments.

Despite its potential, the widespread adoption of augmented reality in science communication faces several challenges and considerations. Technical constraints, such as hardware limitations, software development costs, and interoperability issues, can be an obstacle to creating and implementing AR experiences. Additionally, ensuring the accuracy and credibility of AR content is crucial for maintaining the integrity of science communication. Communicators must carefully check and verify the information presented in AR applications to avoid misinformation or misinterpretation.

Additionally, with the use of AR technology comes concerns about privacy, data security, and ethical implications, especially in public spaces or educational settings. Balancing the benefits of augmented reality with ethical considerations requires careful attention to user consent, data protection, and responsible design practices. In addition, closing gaps in digital literacy and ensuring equitable access to AR technology is essential to promote inclusivity and mitigate disparities in science communication.

In addition, the effectiveness of AR in science communication depends on user acceptance and adoption. Educators, scientists, policymakers, and the general public need to recognize the value of AR as a tool for enhancing learning, engagement, and public understanding of science. Investing in training, professional development, and infrastructure to support the integration of AR into educational programs and outreach initiatives is essential to realise its full potential.

Virtual Reality (VR):

Virtual reality immerses users in computer-generated environments, providing a fully immersive sensory experience. In science communication, virtual reality allows users to explore inaccessible places, simulate experiments, and experience scientific phenomena firsthand. VR simulations can transport users to microscopic realms, distant planets, or historical events, fostering a deeper understanding of scientific concepts. Virtual reality also facilitates collaborative learning experiences, allowing users to interact with virtual environments and interact with peers and experts in real-time. Virtual reality has the power to promote public engagement with science by creating emotional connections and fostering empathy. By immersing users in virtual environments, virtual reality can evoke visceral reactions that resonate on a deeper level than traditional mediums. For example, projects such as "Underwater Earth" use virtual reality to transport users to coral reefs threatened by climate change, allowing them to witness the beauty of these ecosystems and the urgent need for conservation efforts. Such immersive experiences can evoke empathy and inspire action by making complex scientific questions tangible and relatable.

Additionally, virtual reality can be used to tell compelling stories that humanise scientific research and highlight its social impact. By incorporating elements of narrative storytelling, VR experiences can captivate audiences and convey the human side of science. For example, documentaries like "The Click Effect" use virtual reality to immerse viewers in the lives of marine biologists who study communication with dolphins, providing a first-hand look at the challenges and triumphs of scientific exploration. By bridging the gap between scientists and the public, virtual reality has the potential to foster a culture of curiosity and appreciation for the scientific process.

While virtual reality has immense potential for science communication, it also poses several challenges that need to be addressed. One of the main concerns is accessibility, as VR hardware can be expensive and require technical expertise to set up and operate. In addition, there is a risk that VR experiences exacerbate existing inequalities if they are not designed with a diverse audience in mind. To ensure equitable access, developers must prioritize accessibility features and consider the needs of users with different backgrounds and abilities.

Additionally, there are ethical considerations surrounding the use of virtual reality in science communication, particularly with regards to privacy, consent, and the potential for misinformation. As VR experiences become more immersive and persuasive, there is a risk of blurring the lines between fact and fiction, leading to the spread of misinformation or manipulation. It is essential for content creators to adhere to ethical guidelines and transparently communicate the limitations of VR simulations to users.

Virtual Museums:

Virtual museums digitise cultural and scientific collections, offering immersive experiences that can be accessed from anywhere in the world. In science communication, virtual museums offer curated exhibits, educational resources, and interactive experiences that engage audiences from all backgrounds. Users can explore artifacts, specimens, and exhibits related to scientific discoveries, fostering curiosity and appreciation for the natural world. Virtual museums also support inclusivity and accessibility, adapting to different learning styles and accessibility needs.

The evolution of virtual museums can be traced from their early beginnings as static web pages to the immersive digital environments we see today. In the early days of the internet, museums began digitizing their collections and creating basic websites to display images and information about their exhibits. These static web pages provided users with limited interactivity and served primarily as online catalogs or virtual tours, offering a glimpse into the museum's collections but lacking the immersive experience of a physical visit.

As technology has advanced, virtual museums have evolved to incorporate more interactive features and multimedia elements. The development of 3D modeling and rendering techniques has allowed museums to create virtual replicas of their galleries and exhibitions, allowing users to navigate virtual spaces and explore objects from different angles. Interactive multimedia content, such as videos, audio guides, and interactive displays, has been integrated into virtual museum experiences to improve engagement and provide additional context and information.

The advent of virtual reality (VR) and augmented reality (AR) technologies has fur-

Immersive educational applications in AR and VR can help students.
http://tinyurl.com/286ktufd

Immersive educational experience using holograms.
https://www.hypervision.co.in/

ther revolutionised the concept of virtual museums, offering users immersive and interactive experiences that simulate the feeling of being physically present in a museum environment. Virtual reality allows users to put on headsets and explore virtual museum spaces in 3D, interacting with objects and environments in a way that closely mirrors real-life experiences. AR applications overlay digital content on the user's physical environment, allowing them to interact with virtual exhibits overlaid on the real world using a smartphone or tablet. Today, virtual museums continue to push the boundaries of technology and innovation, incorporating cutting-edge technologies such as artificial intelligence, haptic feedback, and spatial processing to create even more immersive and interactive experiences. These advancements have transformed virtual museums into dynamic platforms for education, entertainment, and cultural preservation, giving users around the world unprecedented access to the treasures of our collective heritage.
Some case studies and examples of virtual museums may include:

Atlas of the Digital Universe of the American Museum of Natural History
https://www.amnh.org/research/hayden-planetarium/digital-universe

Virtual tour of the Smithsonian National Museum of Natural History
https://naturalhistory.si.edu/visit/virtual-tour

Zooniverse, a virtual museum platform that hosts a wide range of citizen science projects in disciplines such as astronomy, biology, ecology, and climate science.
https://www.zooniverse.org/

iNaturalist, a virtual museum platform that engages users in documenting and sharing observations about biodiversity, including plants, animals, fungi, and other organisms.
https://www.inaturalist.org/

Virtual art museums where different aspects of human artistic creations are shown and often explained, mainly from an educational point of view. The twenty most advanced can be found here:
https://ecobnb.com/blog/2020/03/online-museums-free/

While virtual museums offer exciting opportunities to engage the public and democratise access to cultural and scientific resources, there are also challenges related to technological requirements to ensure inclusivity and accessibility. These challenges include hardware limitations, internet connectivity issues, and software compatibility issues.
The development of quality content is crucial in virtual museums as it has a direct impact on the effectiveness of information transmission, the maintenance of user engagement and the guarantee of educational value. Striking a balance between accuracy, accessibility, and engagement is essential to creating a meaningful and impactful virtual museum experience.

Holography:
Holography is a technique that allows for the creation of three-dimensional images called holograms. Unlike traditional photographs, which only capture the intensity of light, holograms record both the intensity and phase of light waves, allowing them to recreate the look of a scene from multiple perspectives. This results in realistic visuals that appear to float in space, providing viewers with a sense of depth and realism.
The concept of holography was first proposed by Hungarian-British physicist Dennis Gabor in 1947, although it took several years to develop the necessary technology. Gabor's original idea was to improve the resolution of electron microscopes by using coherent light sources, but it was later realised that his technique could also be used to create holograms.
The breakthrough in holography came in the 1960s with the invention of the laser, which provided a stable and consistent light source needed to create high-quality holograms. In 1962, researchers Yuri Denisyuk in the Soviet Union and Emmett Leith and Juris Upatnieks in the United States independently developed practical holographic techniques using lasers. This paved the way for the commercialisation of holography and its widespread adoption in various fields.
Throughout the second half of the twentieth century, holography found applications in areas such as art, security, and data storage. Artists such as Salvador Dalí and Roy Lichtenstein experimented with holographic imagery, while industries used holograms for authentication and counterfeiting. In the 1980s and 1990s, there was also interest in using holographic storage media for digital data, although this technology ultimately failed to gain widespread adoption due to cost and practical limitations.
In recent years, holography has seen a resurgence of interest fueled by technological advancements, particularly in areas such as augmented reality (AR) and virtual reality (VR). These developments have enabled the creation of interactive holographic displays that can be used for entertainment, education, and communication. In addition, research continues into new techniques to produce holograms more efficiently and at lower cost, suggesting that holography will remain an important tool for visual communication in the years to come.

Geolocation:
Geolocation technology uses GPS and location-based services to provide contextual information to users based on their physical location. In science communication, geolocation enhances field experiences by providing real-time data and information on local ecosystems, geological features, or astronomical events. Mobile applications use geolocation to offer guided tours, interactive experiences, and citizen science initiatives, allowing users to explore the natural world and contribute to scientific research.

NFTs (in the context of cultural heritage)
Non-fungible tokens[2] (NFTs) are cryptographic tokens that represent "certificates of ownership" or "certificates of authenticity" of a digital asset or unique content, such as artwork, music, videos, or even virtual real estate. In the field of cultural heritage, NFT technology has the potential to revolutionize the way we perceive, distribute, and store digital representations of cultural artifacts, historical monuments, and artistic creations.
NFT technology can guarantee the following aspects.
Ownership and authenticity: NFTs can serve as digital certificates of ownership and au-

thenticity for digital representations of cultural artifacts. By minting NFTs for specific digital artworks or historical objects, institutions can provide verifiable proof of ownership and provenance, thereby combating issues related to counterfeiting and unauthorized duplication.

Monetization: Cultural institutions and creators can monetize their digital assets by selling them as NFTs on blockchain-based marketplaces. This allows artists, museums, and other stakeholders to tap into new revenue streams by offering digital reproductions of artworks, historical documents, or virtual tours as limited-edition NFTs.

Accessibility: NFT technology can improve accessibility to cultural heritage by facilitating the digitisation and distribution of rare or inaccessible artifacts. By tokenising cultural assets as NFTs, institutions can make them accessible to a global audience, thereby democratising access to heritage – both scientific and cultural – regardless of geographical location.

Interactivity: NFTs can enable interactive experiences with cultural artifacts through blockchain-based platforms. For example, NFTs can be programmed to unlock additional content, behind-the-scenes footage, or interactive elements related to the cultural object they represent, thus enriching viewer engagement and understanding.

Storage: By tokenising cultural assets as NFTs, institutions can create immutable records of these assets on the blockchain, ensuring their long-term preservation and retention. NFTs provide a decentralised, tamper-proof means of documenting the provenance and history of cultural artifacts, thereby contributing to their ongoing preservation efforts.

However, it is important to note that the application of NFT technology to the field of cultural and cognitive heritage placed in digital form, also raises some challenges and considerations, including issues related to copyright, intellectual property rights, cultural appropriation, and the environmental impact of blockchain technology. As technology continues to evolve, stakeholders in the cultural heritage sector will need to navigate these complexities while also taking advantage of the potential benefits that NFTs offer for the preservation and dissemination of cultural heritage.

Virtual reality, people and technology - Close up of hands with transparent tablet pc computer and earth planet hologram. - AdobeStock_484142101

CONCLUSIONS

In conclusion, advanced technologies are revolutionising science communication, offering innovative tools to engage, educate, and inspire audiences around the world. Augmented reality, virtual reality, virtual museums, holography, and geolocation enable immersive, interactive, and accessible experiences that foster curiosity, understanding, and appreciation for scientific knowledge. As these technologies continue to evolve, it is essential to prioritise inclusivity, accessibility, and accuracy, ensuring that everyone has the opportunity to engage and contribute to the wonders of science. By harnessing the power of advanced technologies, we can create a society that is more informed, curious, and scientifically educated.

Although great strides have been made by the academic world regarding the inevitable presence of technology in the fields of science and culture communication, the gap still remains high, the issues are still numerous and the future prospects are still very uncertain.

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Giuseppe D'Angelo is an expert in training and innovation. He holds the role of Advisor in the SCI-CO+ Pro-ject.

[1]*In the Science Museums, are shown to the public: scientific and technological equipment, devices, products of science but also materials for historiographical narratives of science and technology, reconstructions of environments, living beings, human beings, natural environments, etc. In the Science Centre, science is also simulated, in action, and experienced through an active relationship with the public.*

[2] *Token is a (textual) indicator consisting of groups of inseparable characters, called "lexemes", that designate unique indicators recorded and protected in a blockchain, i.e. a "shared ledger", with the function of representing a digital object, certifying the ownership of an asset or allowing access to a service. Apart from NFTs, there are also "Fungible Tokens", the most well-known example of which is "electronic coins".*

WHERE WE STAND

by Giuseppe D'Angelo

A GENERAL VIEW OF THE STATE OF THE ART OF THE PROJECT AT THE HALFWAY POINT

The general framework of the activities carried out by the Project after the fifteenth month of activity is presented.

The SCI-CO+ Project is halfway through. Great goals have been achieved and equally significant results are nearing completion.

In this issue of our column we want to provide a general description of the state of progress, keeping in mind the paradigm on which the SCI-CO+ Project is based and on which the proposal under the Erasmus+ Programme has been built*: if we want the digital transition to allow us to obtain innovative solutions in the multidisciplinary field of scientific communication, in particular in Science Centres and Science Museums, which guarantee high standards of effectiveness and efficiency and at low development costs, then it is necessary to apply a multi-level approach that does not neglect any of the reference aspects.* These aspects were described in the first issue,which we recall here: the plan of **theoretical and methodological foundations**, the plan of **competences, knowledge and reference skills** and the plan of **specialisation and updating.**

Starting from the basic paradigms of Communication Science and Information Science, we have identified and built the **SciCo+ Model** (which we talked about in depth in the previous issue). Subsequently, the topic of the **application methodologies** necessary to make the SciCo+ Model usable was addressed; these concern the three areas of development of an advanced SciCo initiative: *Project, Design, and Implementation.* These three areas have been associated with the following methodologies:

- **Methodology for the SciCo+ Project Manager,** the set of innovative methods and techniques for the *Development and Management of Scientific Communication Systems and Projects.*

- **Methodology for Authoring and Designing SciCo+ Materials,** aimed at the *conception, design and development of materials for scientific communication.*

- **Methodology for Expert in SciCo+ Storyteller,** aimed at *writing and storing advanced/digital scientific narratives.*

The theme of **Skills** able to apply these methodologies has been addressed at the same time; indeed, their study has been anticipated with respect to the declination of the Methods. This is because, as we have amply described in the article "*Paradigms, Models, Methodologies*" published in the previous issue of the magazine, the *pedagogical question* becomes a central aspect for a correct introduction and use of a new Paradigm and the Models connected to it. We would like to remind you that the SCI-CO+ Project has provided a specific *Professional Profile* corresponding to each of these methodologies:

- the **SciCo+ Project Manager;**

- the **Expert in Authoring and Design of SciCo+ Materials;**

- the **Expert in SciCo+ Storytelling.**
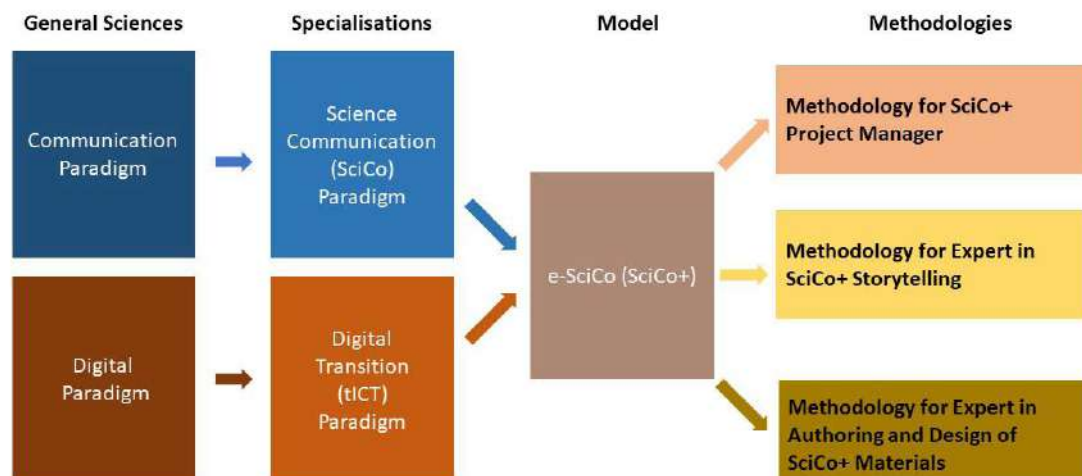
From Paradigm to Professional Profiles. First phase.

From Paradigm to Professional Profiles. Second phase.

The **Construction of a Professional Profile** is a very complex and delicate process both from a formal and procedural point of view. The complexity of the process is due to the many facets that affect a profession that is characterised not only by the needs of knowledge, skills and abilities acquired by those in the role,but also by the characteristics and needs of the "*environments*" in which the profession sits and interacts. As is well known, these environments and their representatives are called, with a very effective expression, *Stakeholders*. Therefore, the process of building a new professional profile involves not only those who have to express that profile and it's starting skills but also those who will have to interact with that profile. The reality of stakeholders represents a further degree of complexity because their expectations are closely linked to the level of perception and evaluation they have regarding the changes to which a new professional profile must respond. To put it more simply, in the case of the *digital transition in the Science Communication sector,* the needs for new professionalism that the reference environments can manifest are strongly linked to the level of perception and awareness that these stakeholders have of the transformations that underlie the digital transition in their sector.

To consider these multiple and intersecting reference planes, the SCI-CO+ Project has perfected and applied a specific methodology for the **Design and Development of a Professional Profile** that makes the process not only complete but also standard, so that it can be used in different productive contexts of the same sector but also in different countries. This methodology is based on a *parametric internal description of a Profile and its external evaluation through a field survey with stakeholders*.

The *parameters* that in the methodology used by the SCI-CO+ Project describe a professional profile are the parameters articulated on three classes of descriptors variously articulated.

General aspects of the profile: Brief description, Role objectives, Workplace, Responsibilities, Management of information flows, Activities.

Content: Diagnosis, Design. Organisation and management, Administration, Promotion and dissemination, Supervision and control, Other.

Skills Required: Knowledge, Competencies, Skills.

Using these descriptors, the SCI-CO+ Partnership has developed an **Initial Proposal for each profile**. This proposal, at the time of writing this article, is being submitted to the reference Stakeholders who have been identified, as a priority, in the following realities: Science Centres, Science Museums, Museums / Cultural Institutions, Publishing Houses, Universities, Research Centres, Schools, Professional Training Institutions, Scientific Documentary Production Companies, Companies Producing Teaching Materials and Devices, Advanced ICT Companies, Public bodies, associations. The field survey is carried out using *Interviews* and *Focus Groups*: both these activities are carried out using the same techniques and operational tools so as to make the results obtained in each of the Partnership countries (Ireland, Italy, Portugal, Romania and Sweden) compatible.

While this phase of field investigation is being carried out, as many general schemes of the reference methodologies of the SciCo+ Model have been elaborated starting from the initial drawings of the three professional profiles. Following the investigation phase, the final design of the three professional profiles will be reached and, at the same time, the final development of the three methodologies. These very important results will be described in two separate articles in subsequent issues of this magazine SC+.

Finally, the Project has reached the first level of implementation of the SCI-CO+ System which, it should be remembered, represents the technological and organisational infrastructure that will allow the creation of the SCI-CO+ Community and the provision of information and training services for this community. We will also give a full account of this very important result in a subsequent issue.

Giuseppe D'Angelo is an expert in education and innovation. He holds the role of Advisor in the Sci-Co+ Pro-ject.

27 OCTOBER 2023 - 9 MAY 2024
HEILBRONN - GERMANY
YOU AND YOUR BRAIN.
A GOOD TEAM

From 27 October 2023 to 9 May 2024 at the Experimenta Science Center, in the city of Heilbronn in Germany, you can visit the exhibition "Du und dein gehir. Ein gutes team" (You and your brain. A good team) created by the Heureka Science Center in the city of Vantaa in Finland. Through 25 interactive exhibits, distributed over 600 square metres, it will be possible to experiment with the main functions of the brain and discover how to take care of it. By taking part in a team game (from 2 to 5 people) you will be able to see first-hand the importance, for the correct functioning of the brain, of social cooperation and physical activity, but also of sleep, relaxation and fun!

https://www.experimenta.science/gehirn/

7 DECEMBER 2023 - 15 JUNE 2024
TRENTO - ITALY
# QUANTO.
THE REVOLUTION IN A LEAP

In the wake of the great success of Oppheneimer, a multi-award winning film at the 2024 Oscars, quantum mechanics sparks interesting debates: it has becomes very clear how much it has laid the foundations for the definitive transition from the old to the new world. Continuity is replaced by discontinuity, certainty is replaced by probability: the vision of the world is upset and with the application of quantum mechanics to nuclear physics we leave the restricted field of pure research to enter that of "big things",   as he would have said shortly thereafter Fermi . But what is quantum mechanics? Is it possible that its the scientific implications of its application were only the "cause of an evil from which we could no longer free ourselves"?

Well, to find out you need to visit QUANTO. THE REVOLUTION IN A LEAP, an exhibition created by Muse (Science Museum of Trento) in collaboration with INFN (National Institute of Nuclear Physics). A visionary journey that retraces, in five stages and, characterisszed by specific key words, the history of quantum mechanics.

The first two stages immediately highlight the transition from the macroscopic world, represented by the physical concepts of bodies and light, to the microcosm, a reality made up of atoms and subatomic particles, as an input for the development of revolutionary technological innovations: from lasers to resonance magnetic, from entanglement to quantum computers. A significant "leap", to return to the title, from the basic principles of the classical physics of the late nineteenth century to the more complicated and apparently paradoxical laws of quantum theory, in order to highlight its concrete impact on society and the lives of all of us.

"Yet no one can really understand it," said R. Feynman in 1965. , which is why QUANTO tries to decode the complexity of the topic through what are the typical approaches of digital experiential learning: in the third and fourth stages, in fact, multimedia and interactive installations, immersive scenography, research tools of yesterday and today, physical and digital exhibits, allow the public to carry out interactive experiences by experimenting with the founding ideas of quantum theory, as well as to understand the background, participating in the debate between Einstein and Bohr and observing the most significant experiments that characterisszed the Twentieth century and beyond.

Finally, the exhibition concludes with the quantum cosmos, the last stage dedicated to the cosmos and the macroscopic manifestations of quantum mechanics contained therein, such as, for example, the turning on of stars.

This is aA new conception of the universe and, therefore, a paradigm shift that shows an unsettling reality and that leads to dealing with contradictions, paradoxical concepts and the acceptance of uncertainty: after all, everything is quantum, including the matter we are made of, you just need to find out.

https://www.muse.it/events/quanto-2023/
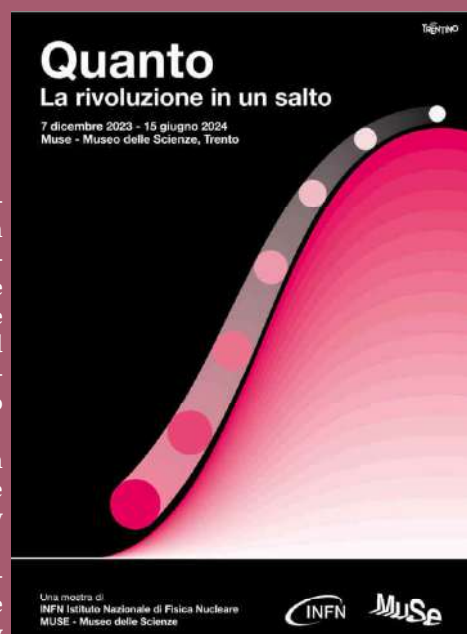
6 MARCH - 30 JUNE 2024
NAPLES - ITALY
FACCIAMO UN ESPERIMENTO! An interactive exhibition for all ages

"I don't know what image the world has of me, but I see myself as a child playing on the seashore, and from time to time enjoy discovering a smoother pebble or a more beautiful shell than usual, while in front of me lays out, unexplored, the immense ocean of truth"
(Isaac Newton).

For all those who still feel wonder and interest in the mysteries of nature, who want to discover how the world around us is made, who want to experiment without having to passively accept what it is taught to them and, why not, for those who want to spend a few hours role playing a scientist, FACCIAMO UN ESPERIMENTO! is underway at Città della Scienza: an interactive exhibition that aims to unravel the apparent complexity of the phenomena that follow one another before our eyes every time we carry out actions, even apparently trivial ones.

When you are little, it is instinctive to dismantle toys to understand how they work and, where the right skills have not yet been developed, to fill your parents' heads with a thousand "whys". Well, to understand the physical phenomena linked to the perception of reality it is necessary, first, to reactivate this curiosity, and then to retrace the experiences of those who, without any other tools other than their own reasoning, managed to lay the foundations of the monument emblem of human rationality that is "classical physics".

Through interactive expedients for informal learning, therefore, Città della Scienza re-proposes some of the iconic experiments of the Science Gym (an integral part of the Museum that burned down in 2013), integrating them with new proposals and renewing them through the adoption of modern scientific exhibits. A real "library of experiments", on the model of the Exploratorium of San Francisco, for which F. Oppenheimer wanted a museum that was not static and simply visual, but rather a place where science was within the reach of anyone who wanted to experiment. In the case in question, the exhibition moves from the classic hands-on exhibits, in which concrete interaction is carried out using levers and cranks, to exhibits of pure perception, in which intuition and reasoning are used to address issues such as acoustics, fluid dynamics, optics, gravity, meteorology, as well as optical illusions and cinematic or animation devices.

So, from an inert visitor to a real researcher: an exhibition that urges us to always ask ourselves questions, to never take anything for granted, to face everything with a healthy and good dose of scepticism. Starting from the observation of a phenomenon, we come to understand the laws that regulate it and, therefore, to classify it. After all,

"Felix qui potuit rerum cognoscere causas" –
"Happy is he who has been able to know the essence of things"
(Virgil, Georgics, II, 489).

https://www.cittadellascienza.it

16 MARCH - 28 APRIL 2024
PADOVA - ITALY
SCIENCE GETS BEAUTIFUL - BETWEEN PERCEPTION AND REALITY

From 16th March to 28th April 2024, the former Marcellus Cathedral in Padua will be the setting for 'Sperimentando,' an event organized by Cnr now in its 22nd edition. The National Research Council (Cnr) is the largest public research institution in Italy, the only one under the Research Ministry performing multidisciplinary activities.

The exhibition will gather a review of the most surprising and engaging exhibits displayed in Cnr-branded shows such as "The Wonders of Science," "Laser. Light beyond the Horizon" and "AQUAE. The Future is in the Ocean."

The main topic of this edition is perception, which will be investigated by showing and experiencing firsthand unusual phenomena, or phenomena that seem to go against common sense but find a solid explanation in science. Optical illusions, mirror games, and materials with unusual properties are the elements that characterise this interactive exhibition, which brings visitors of all ages closer to and involves them in the world of science and technology, making learning a fun discovery, but without sacrificing scientific rigor.

https://www.cnr.it/it/evento/19053/ll-cnr-a-sperimentando-2024-con-la-mostra-la-scienza-si-fa-bella-tra-percezione-e-realta

16 MARCH - 28 APRIL 2024
PADOVA - ITALY
SPERIMENTANDO 2024.
SCIENCE THAT AMAZES

SPERIMENTANDO renews itself this year for its XIII edition by addressing a new theme: "Science that amazes". In particular, all the phenomena that surround us that still manage to involve and amaze both adults and children in their appearance, sometimes even appearing paradoxical. Yet, on closer inspection, they always conceal a scientific basis. The task of this edition is to collect these phenomena from various fields of knowledge and show everyone, through the typical interactivity of a large laboratory, how science can justify them.

For the **natural sciences**, there is the possibility of exploring a world full of imperceptible living forms, capable of resisting the most extreme conditions, adapting their genetic makeup, in order to obtain a biodiversity able to allow the continuity of the species. It is precisely from this extraordinary variety of organisms, and from nature in general, that man often draws inspiration for innovative artisanal and/or technological solutions. The sections addressed in this area are: "**Animals that amaze**", "**Plants that surprise**", "**Nature that teaches**".

Chemistry induces the wow effect in the viewer through "magic", the result of chemical reactions that are not particularly complicated: salts capable of predicting the weather, stringy polymers, electrochemical cells made of plates, metal atoms that emit coloured lights. With chemistry, there is an alchemical-historical time-line conceived, an itinerary to follow to retrace the evolution of the equipment used by chemists in various laboratories. The sections in this area are: **"The wonders of chemistry", "The chemists' alphabet", "Chemistry and laboratory stories"**.

With **physics** we reach the pinnacle of amazement: thanks to the extraordinary participation of the Communication Unit of the CNR of Genoa , by reproducing electrical, cynical and kinematic phenomena, this exhibition allows visitors to understand how a wire, which passes through a sphere, can flow freely through it or lock the ball in a certain position; how two hands placed on different metals can generate a direct current; how it is possible to create holograms or paintings with figures that follow us as we move, and much more. In particular, the relevant sections are: **"Journey into electromagnetism", "Balance and movement", "Plays of light", "Exploring fluids and waves", "CNR: science becomes beautiful – between perception and reality".**

Finally, art is addressed: it is possible, through the perspective and illusionistic devices of trompe l'oeil, to deceive by creating the illusion of landscapes that do not exist. In the section **"Wonderful Art!"**, ad hoc workshops are dedicated, again this year, to the presentation of conservation techniques for artistic assets.

https://sperimentandoaps.wordpress.com

15-26 APRIL 2024
GOTHENBURG - SWEDEN
VETENSKAPS FESTIVALEN 2024

This festival is one of Europe's leading popular science events, bringing together all school levels and the general public. It is a meeting place for knowledge, inspiration, and new perspectives. Participation in the festival can be done either on site or through digital events.

https://www.vetenskapsfestivalen.se/

16-18 APRIL 2024
STOCKHOLM - SWEDEN
SETT-DAYS

The leading meeting place for innovative and lifelong learning.
In a time of rapid societal change and increasing uncertainty in the world, it is more important than ever that you stand strong in your professional role. At SETT, we not only give you the tools to navigate this changing landscape, but also the chance to actively contribute to positive societal development.
At SETT, we believe in the power of collaboration and reflection. By bringing together leading thinkers and practitioners, we create an environment where conversations about education and innovation can take place. SETT is the meeting place where we search together for answers on how to move forward, beyond screen time.

https://www.settdagarna.se

18-19 APRIL 2024

STOCKHOLM - SWEDEN
DIGITAL FUTURES OPEN RESEARCH DAYS

Shaping a sustainable society through digital transformation.
Digital Futures is a cross-disciplinary research centre that explores and develops digital technologies of great societal importance. It was jointly established in 2020 by KTH Royal Institute of Technology, Stockholm University and RISE Research Institutes of Sweden, based on significant long-term support of a Strategic Research Area by the Swedish Government.
The vision of Digital Futures is to shape an economically, environmental and socially sustainable society through digital transformation.

digital futures
https://www.digitalfutures.kth.se

APRIL TO JUNE 2024

ONLINE
EXPLORING STEM FUTURES: SFU SCIENCE AL!VE STEM SPEAKERS SERIES

Simon Fraser University (SFU) presents the SFU Science Alive STEM Speakers Series, connecting Grade 8-12 students with STEM experts. This virtual platform offers insights into university studies and career options in STEM fields. Featuring diverse topics like critical care nursing and mechatronic systems engineering, each session showcases cutting-edge research and real-world applications.
Guest speakers share personal career journeys, fostering dialogue and mentorship opportunities. Conducted over Zoom on select Saturdays, the series is free, ensuring accessibility to all aspiring scientists and engineers. Stay updated via the monthly newsletter and embark on a journey of exploration with SFU Science Alive.

13-14 MAY 2024

ALL OVER THE COUNTRY - ITALY
PINT OF SCIENCE ITALIA RETURNS: A BREW OF KNOWLEDGE AND DISCOVERY

Pint of Science Italia returns in person on 13th – 15th May 2024, offering an exciting opportunity to delve into the realms of space exploration, stem cells, and even the secrets behind the taste of beer.
For many, scientific research may seem like something out of science fiction, with topics that might appear distant from our daily lives. However, scientific discoveries are continuously unfolding, leading to fascinating inventions that will shape our future.

Yet, how often do you have the opportunity to truly understand how these discoveries are made and what they mean? Pint of Science brings some of the brightest researchers to your local bar to discuss their latest findings and breakthroughs directly with you.

The festival, taking place on 13th – 15th May 2024 across Italy, offers a unique platform for anyone interested in science to sip on a good beer and engage in conversations about the latest advancements in research.

So, grab a pint and join us as we unravel the mysteries of science, one sip at a time. Whether you're a seasoned scientist or simply curious about the wonders of the universe, Pint of Science Italia promises an enlightening and enjoyable experience for all.

https://pintofscience.it

https://sciencealive.ca/stem-speaker-series

8 MAY
8 SEPTEMBER 2024
MADRID - SPAIN
THE SCIENCE OF PIXAR

At the Caixa Forum in Madrid from 8 May to 8 September 2024 it will be possible to visit the exhibition ''La Ciencia de Pixar'' (The Science of Pixar): an interactive exhibition to immerse yourself in the fabulous world of animated films and discover the secrets of science and technology behind many famous successful cartoons.

The exhibition, divided into 8 areas (modelling, rigging, surfaces, sets and cameras, animation, simulation, lighting and rendering), through physical and digital interactions, videos and interviews, will show the importance of STEAM disciplines in the creative process and production of Pixar films.

https://caixaforum.org/es/madrid/p/la-ciencia-de-pixar_a164499855

13-15 JUNE 2024
BOLOGNA - ITALY
WE MAKE FUTURE (WMF)

We Make Future (WMF), an international fair and festival on technological and digital innovation, is the largest Italian event dedicated to topics such as innovation, technology, digital, environment and education.

From 13th to 15th June 2024, at the BolognaFiere location, the WMF - We Make Future will welcome speakers and personalities from around the world to talk about technological and digital innovation through inspirational talks, educational interventions, case studies and testimonials.

AI & Digital-Tech experts, researchers, creators, institutional representatives, activists, journalists and Open Innovation stakeholders will share from the stages of the next edition of WMF- We Make Future the lines of future development of the global society through the conscious, sustainable and inclusive use of the tools of technological and digital innovation. Indeed, the festival's commitment - encapsulated in the words We Make Future - is to build a future under the banner of education, employment and innovation. Together with young people, students, startups, companies, NPOs and institutions, the festival continues throughout the year, through initiatives and events widespread over Italy and abroad, for the inclusive and sustainable development of the country by spreading the culture of innovation and working on numerous themes that it declines through the symbolic image of 100 Steps: the distance to be bridged, together, for a better Future.

8 JUNE 2024
ALL OVER THE COUNTRY - USA OHIO
NASA STEM KIDS VIRTUAL EVENT: ARTEMIS MISSION TO THE MOON

NASA Glenn's STEM Engagement program is set to host the NASA STEM Kids Virtual Event: Artemis Mission to the Moon on 8th June, 2024, from 10:00 to 11:30 a.m. ET. Aimed at kindergarten to fourth-grade students in the United States, this event seeks to spark interest in STEM fields through engaging activities and insights into NASA's Artemis mission.

The event offers a glimpse into Artemis, NASA's plan to return humans to the Moon by 2024. Participants will engage with STEM professionals, explore virtual tours of NASA Glenn's facilities, and partake in live STEM activities designed to ignite curiosity and creativity.

Registration opens on 8th April and closes on 10th May, 2024. Participants need an internet-connected device (webcam optional), and parental involvement is required throughout the event.

Join NASA Glenn in inspiring the next generation of innovators and explorers through the Artemis Mission to the Moon event.

https://www.nasa.gov/nasa-stem-kids-virtual-events-at-glenn/

https://www.wemakefuture.it/

SCI-CO+ Magazine

2024 July-September n°4

NEW FRONTIERS IN SCIENCE COMMUNICATION

INNOVATIVE MODELS, METHODOLOGIES, SKILLS FOR THE DIG-ITAL TRANSITION IN THE FIELD OF SCIENCE COMMUNICATION

SC+

" Curiously, today there is a lot of talk
about participation, understood as a tool
for democratic development, but rarely is there talk
of disclosure as an essential condition
for understanding and thus for participation. "

Piero Angela