The International Movement for Leisure Activities in Science and Technology

"Levitating" by Xuanzhi Du

MILSET Journal of Science **Engagement**

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EDITORIAL BOARD

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LETTER FROM THE EDITORS

We are very glad to present the 7th issue of the MILSET Journal for Science Engagement (JOSE), a periodical where we seek to collect and capitalize the best experience in the field of STEAM education, which our international community has passionately nurtured.

We are extremely proud that the Feature article of this issue is provided by Dr. Ramon Ferreiro Gravie, an internationally recognized educator and psychologist. Dr. Ferreiro is also an expert in science education and the author of numerous monographs that have been the source of knowledge for many MILSET leaders. His contribution is very practical: a methodology to develop critical thinking and scientific argumentation for young people, which can be mastered and implemented as described in the article.

The topic of this issue, *STEAM activities in the new normal: real, virtual, remote*, is mainly covered in the *Best Practices* section. Members and partners of our movement from different countries, including Indonesia, Costa Rica, Kuwait, Mexico, Namibia, Russia, and Taiwan, describe how they were able to adapt their events and programs to the new realities, which of the new virtual tools mastered in the COVID-19 era continue to work effectively, and what new challenges in education we are currently facing and how they are being solved. In addition, the section contains

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articles that discuss science promotion from different angles: the article by Sorina Leu from Romania about her personal pedagogical experience, and the article by Driss Louaradi dedicated to the Bee Museum, which he founded in Morocco.

The STEAM Focus section is dedicated to new approaches to promote some scientific disciplines; this time we have included astronomy, chemistry and biology. Experts from Chile, Serbia and Belarus present their findings to make these topics more accessible and inspiring for students.

The MILSET Impact section highlights the key milestones and remarkable individuals who have shaped the history of our movement. In this edition, we feature an exclusive interview with MILSET Honorary President Jean-Claude Guiraudon, commentaries on the MILSET Strategic Plan 2024–2029 introduced by Reni Barlow, Chair of the Strategic Planning Committee, and a heartfelt tribute to one of our founding members, Eng. Adnan Almeer President of MILSET Asia and a long-standing member of the MILSET Executive Committee whose recent passing has deeply touched our global community.

We are confident that mutual enrichment of experience in working with young people in important scientific areas contributes to sustainable development and leads to mutual understanding among young people from different countries.

THE THREE-COLOR TECHNIQUE FOR DEFINING CONCEPTS

Abstract: *This article presents a validated technique for defining academic, applied research, and scholarly concepts for young students at our University. In addition to adopting or critically assessing the definitions of expert authors, students must be able to express their theoretical position with scientific rigor, which fosters the explicit communication of their critical thinking. The "Three-Color RFG Technique" is based on the approaches of Hegel, Vygotsky, Davydov, Bruner, Ferreiro and Wittgenstein, among others, and constitutes a useful resource for developing critical thinking and scientific argumentation of young people who do research.*

Keywords: *Thought; Definition of Concepts; Definition Techniques; 3 Color RFG Technique; Quality Criteria.*

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INTRODUCTION:

The objective of this article is to present a scientifically validated technique for defining concepts as an alternative that also contributes to precise thinking and improves communication.

Human life is impossible without thinking, nor without feeling, and certainly without acting. Thinking, feeling, and acting constitute a dynamic unity that allows human beings to fully develop. Any attempt to overvalue one over the other, or to separate them, leads to a limited, reductionist, and therefore incomplete interpretation of the human dimension (HEGEL, 2010; FERREIRO, 2018, 2022; VIGORSKY, 1977; WITTGENSTEIN, 2012).

Through thinking, we generate ideas, relate them, define concepts, formulate theories, discover laws, invent procedures, identify and solve problems, and have our own mental representations of the phenomena of objective and subjective reality. But first and foremost, it is necessary to define the object of study—in other words, what we are "talking about," what ideas arise in our minds about the object in question, and how we express them; scientists call this concepts (FERREIRO, 2018; 2022).

THE CONCEPT

The concept is the basic form of human thought, a minimal unit of knowledge that expresses the general and essential characteristics of things and phenomena (facts, events, occurrences, processes) of reality, which distinguishes one object from another to use it consistently (DE GORTARI, 1972; WITTGENSTEIN, 2012; COPI and COHEN, 2005). The concept is human thought expressed in terms, that is, in words. The concept is to human thought what the cell is to the organism and the atom is to matter, that is, its structural and functional unit.

The concept is obtained from the analysis and generalization of countless isolated facts, abstracting from what is considered secondary, from non-essential properties, and prioritizing the fundamental characteristics that characterize it as such and distinguish between one from another, within the context of a given culture (FERREIRO, 2012, 2018, 2020).

A concept is not only a result, but also a mental process, an intellectual activity, that allows us to define the object of knowledge, whether because it interests us or because we need it to make a decision, solve a problem, consider a project, or, among many other things, to understand the situation we face, give it meaning and significance, and communicate correctly (FERREIRO, 1980, 1986).

A notion or construct, as a concept is also called, is a manifestation in our mind of an element of reality that we need to name and distinguish from others to be able to use it for a specific purpose. Concepts evolve over time and in the contexts they belong to. Hence, the way we express concepts changes according to the historical and cultural moment, but also to the extent to which we express them when communicating with them.

A concept is the basic unit of human thought that expresses the general and essential characteristics of things and phenomena. This allows us to distinguish one object from another and use it accordingly. However, whether they are

concepts of specific objects, such as "chair," or of traits or qualities, such as "beauty," both can be defined, that is, expressed, in words. In both cases, we use words to express the representation or mental referent we have of them (WITTGENSTEIN, 2012).

THE DEFINITION OF CONCEPTS

Writing is a form of language, a tool for expressing thought and constructing knowledge and feelings associated with the object of study, such that the structure of the mind, human consciousness, is shaped by the activity and communication of the person who learns and grows.

The definition of terms, that is, of concepts, is the expression, verbal or written, of the idea or object, of its meaning, which distinguishes it from any other, no matter how close or similar, in order to differentiate it and "treat" it as such, as what it is. Furthermore, the definition of the term is required for the concept as such to exist, be recognized, and assist in the understanding and transformation of reality.

The definition of concepts helps to deeply understand what is being studied and researched. At the beginning of a research topic it is necessary to specify the definitions of the concepts involved in the study because this helps considerably to know not only what we understand as such but also and among other things to express it, to communicate to others what we understand about it (VIGOTSKY, 1977; HEGEL, 2010; BRUNER, 1990; DAVIDOV, 1972), all of which helps us to specify the remaining components of the research design.

TYPES OF CONCEPTS DEFINITIONS

There are two types of definitions among others. One is called "Conceptual" definitions, and the other is called "Operational" or "working" definitions. But both must include the essential, the invariant characteristics, the totality of what is common to the object of definition that distinguishes it from its closest and most similar counterparts. Conventionally, we understand "conceptual" definitions to be those given by experts on the subject, which we usually find in recent scientific articles or textbooks, or in works by the classics. While we understand "operational" definitions to be those that each of us develops as we process information about a topic, make observations, and exchange ideas with others, all of which helps us mentally form what we understand by the object in the process of construction.

TECHNIQUES FOR DEFINING CONCEPTS

There are several ways or means to define concepts, including: using synonyms, through dialogue, formal play, or through techniques such as brainstorming, hyperonyms, and the one we propose: the RFG "three-color" technique, or three components, by Dr. Ramón Ferreiro Gravié.

WORKING OR OPERATIONAL DEFINITIONS

The operational definition of a concept allows each of us to specify what we understand by a given thing, to understand it in depth given the variables and perspective we take as a reference,

and, most importantly, to accurately communicate what we are calling or recognizing as the object under study.

There is no concept in everyday life for which we do not have a mental representation. For example, each of us has a concept of friendship, a friend, a colleague, a sibling, or even a family, a partner, love, or democracy. In expressing each of these, we define it and name the defined object a "concept," that is, the object expressed in words.

School, academic, and scientific work require precision in the concept being studied or researched through writing, which is a form of language, a system of signs, and a very valuable tool. We propose the three-color technique, also known as the RFG strategy, alluding to its creator, Dr. Ramón Ferreiro Gravié of Nova Southeastern University in Miami, to teach doctoral students how to define, in their own words, each term involved in their research and theses. This technique also contributes to the cognitive independence of the subject who applies it and to the development of cognitive operations and functions that help specify, through written or verbal language, the essence of the object of study (FERREIRO, 2012, 2018, 2020, 2022).

THREE-COLOR RFG TECHNIQUE FOR DEFINING CONCEPTS

The operational definition of a concept involves three important steps:

1. Specify a determinant
2. List the attributes of the object being defined
3. Express the complement

All three steps are equally important, although they must be completed in that order. Finally, review and improve the wording of the prepared statement.

STEP ONE: SPECIFY THE DEFINITIVE

Specifying the definitive means placing the object of definition within a more general category that contains and encompasses it. The definitive answers the question: What is it? Or, What does it consist of? And it's about a character. Who is it? We express the determinant with a term that identifies the essence of the object or phenomenon we are defining. There are concepts that allow more than one determinant, and all are correct, but we must select the one that best expresses our intention in the cultural context in which we are investigating.

An example: we want to define "dog." A possible determinant is "animal." "Dog" is an animal. Animal is the larger category in which we place dog, and it is therefore the determinant we use to define what we are understanding by "dog." But we can also state: "Dog" is a living being." "Living being" is also a possible determinant of the concept of "dog," just as valid as "animal." Another possible and also correct determinant of "dog" is "quadruped," or "quadruped animal." Another could be "vertebrate," or "mammal." In other words, it is suggested to brainstorm possible determinants of the object of definition, and then select the most appropriate one based on the referent from which we want to express it.

STEP TWO: LIST THE ATTRIBUTES

Listing the attributes means making a list of the features, properties, qualities, or attributes that characterize the object

we are trying to define. Specifying the attributes answers the question: What is it like? What is it characterized by? What does it have or possess that makes it unique? In other words, what makes it how it is and not something else. Attributes are the elements that are part of the definition of a concept and allow us to distinguish it from related concepts that share the same determinant.

For example, the concepts of "table" and "chair" share the same determinant: furniture. The attributes we use in the definition are what allow us to distinguish which one we are referring to or which other:

- A table is a piece of furniture that has four ends and a flat surface on it.
- A chair is a piece of furniture that has four ends, a seat, and a backrest.

Attributes specify the notion of something, distinguishing one from another. The more essential attributes mentioned, the better. Although we should always make a list first (brainstorm) and then select the most relevant ones. Good definitions are concise, and express the essential meaning of the "object" we are referring to in about 30 words.

STEP THREE: EXPRESSING THE COMPLEMENT

Expressing the complement means expressing the utility, use, importance, or functions of the object being defined. The complement answers the questions "why?" and "what for?"

While it is important to specify the determiner and attributes, it is also important to state the complement. For example: A chair is a piece of furniture that has four legs, a seat, and a backrest and is used for sitting.

In the previous definition of the concept of chair, the complement is "used to sit." Of course, there are other possible complements to use when defining the concept of chair, but this will depend on the author's interests and, among other factors, the intentions and context in which the concept is defined.

When we have the three components of a definition, we "assemble" the statement through which we express the concept, that is, we define it, taking care to avoid repeating some terms, avoiding the possibility of others being imprecise, etc., and taking care to ensure the length of the definition: the shorter the better. It is also important to comply with the "Quality Criteria" to correctly and rigorously express the definition we construct.

To be able to produce good operational working definitions, it is of course necessary to read extensively, process information, observe, reflect, and, among other things, exchange ideas with colleagues. We must also consult, of course, how well-known authors define these concepts, as well as think and write.

Let us also remember that we conventionally call the definitions given by other authors Conceptual Definitions, and the ones we write Operational Definitions.

We will be authentic, independent researchers, and academically better teachers, to the extent that we nevertheless take into consideration the definitions of different authors. We are able to rigorously develop our own definitions, which we call "operational."

The RFG three-color technique helps

us clarify what we understand by each of the terms we use. This will be reflected in the clarity with which we express our ideas and write about them, making ourselves better understood and also establishing our position and criteria regarding the object of study, discussion, and analysis (FERREIRO, 2012, 2018, 2020, 2022).

Of course, a good operational definition is not achieved with a first draft; it must be done over and over again until we see that we correctly meet the quality criteria.

QUALITY CRITERIA

Among the quality criteria or indicators of a good operational definition of a concept are:

1. Begin the definition like this: "The concept is...", or: "The concept consists of..." For example: The chair is... or, The chair consists of...
2. Next, and in the order in which we expressed it, state the DETERMINER, write the ATTRIBUTES, and finally, the COMPLEMENT.
3. Express it in approximately 30 words, taking care to maintain the order of the components: determiner – attributes and complements.
4. Write a single sentence. Do not use the "period" or the gerund.
5. Identify in the written definition the three components or parts of the structure of an operational definition.

In the training stage, mastering the technique, we suggest using colors to identify the three aforementioned components, whose presence lends rigor to the definition developed. We suggest using red to identify the determinant, blue for the attributes, and green for the complement. Let's look at the definition of the term "concept" using Dr. Ferreiro's three-color technique:

"The concept is the basic unit of human thought that expresses the general and essential characteristics of things and phenomena in reality, allowing us to distinguish one object from another and use it accordingly."

As we can distinguish, we begin by stating, "The concept is...". We immediately include the "determinant," then the "attributes," and finally the "complement." A single statement, approximately 30 words.

QUALITY CRITERIA FOR CONCEPTUAL DEFINITIONS

Conceptual definitions are, by definition, those provided by other authors. Indicators of "reliability" include:

- Authors recognized in the scientific literature.
- Definitions that appear in books by prestigious publishers or articles in indexed journals.
- Sources from the last 10 years (except those provided by classic authors on the subject).
- The text of the definition must be presented in quotation marks, and the source must be fully stated.
- The source data must be recorded in APA format, or in the citation system used by the institution.
- Use of a file or template to save conceptual definitions or use applications such as Zotero to

document information searches.

- List the best definitions found from recognized authors in the prestigious sources consulted, those that best express the essence of the concept in the theoretical context in which you are working or are interested in placing it.

QUALITY CRITERIA FOR OPERATIONAL DEFINITIONS

Remember that "operational or working" definitions are those written by the student or the professor based on their conceptual reference and cultural experiences.

When beginning the definition process:

1. Make sure you understand the technique, each of its parts: determinant, attributes (properties, characteristics), and complement.
2. Search the subject in reputable sources and reliable electronic search engines, read and process the information necessary and sufficient to understand it in depth: take notes, visualize it using, for example, a mind map or concept map.
3. Follow the RFG strategy for operational definition of concepts.
4. Begin the definition like this: "X is..." or "X consists of..."
5. Write a single affirmative statement of approximately 30 words.
6. Avoid abbreviations and repetition of terms already used in the definition.
7. Be precise and concise.
8. Avoid descriptions of procedures, algorithms, and sequences of steps or stages.
9. Highlight the determiner first, then the attributes, and finally the complement.
10. Brainstorm in writing or mentally about possible determiners for the definition you want to construct.
11. Remember that a determiner is a term that expresses or places the object of definition in a category that includes or encompasses it. For example, if we define "dog," it could be: animal, or mammal, or even quadruped.
12. Use three types of colors to distinguish the components of a definition during the technique appropriation phase: red (Determiner), blue (Attributes), and green (Complement).
13. Name the definition with a single term, simple or compound, in the singular.

Upon completion of your draft, verify the content of your constructed definition with several reputable sources, use a fraud detector like Turnitin (a "free" version), read it aloud, share it with close colleagues, get their feedback, and revise it as many times as necessary before publishing it.

During the technique's appropriation phase, be sure to use the three indicated colors. Experience during the technique's validation showed us that the level of acquisition and incorporation of the technique into a mental routine is better and faster if colors are used, although this may stop being done when you define terms "automatically" when you evoke or need to refer to them using them.

During the technique's appropriation phase, be sure to use the three indicated

colors. Experience during the technique's validation showed us that the level of acquisition and incorporation of the technique into a mental routine is better and faster if colors are used, although this may stop being done when you define terms "automatically" when you evoke or need to refer to them using them.

PARTIAL CONCLUSION

Empirical evidence, both during and after the validation process of the "RFG Three-Color Technique" in hundreds of students at different school levels, shows that its conscious appropriation contributes to the writing of academic papers with a greater level of focus and a better conceptual approach to the topic. These papers include definitions from leading authors on the subject and their own definitions of key terms. This allows, among other things, a better analysis of the topic in question, helping them compare their position with that of others and gain a deeper understanding of the object of study. It also contributes to greater fluency in verbal communication, with two notable characteristics: confidence and terminological precision when writing and presenting on the topic. Interestingly, and no less important, are the testimonies of how students extrapolate and use the technique in informal, work-related, social, and family conversations. The research on this subject continues, now the focus of interest is to specify the impact that the appropriation and use of the technique has on the development of critical thinking in subjects who are authors of definitions with high levels of precision and conciseness.

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THE INTERNATIONAL DAY OF SCIENTIFIC CULTURE: BUILDING GLOBAL ENGAGEMENT IN TIMES OF CRISIS

Abstract

In the context of interrelated global crises—climate, health, digital inequality—the International Day of Scientific Culture (IDSC) emerges as a collective initiative to promote public engagement with science. Launched in 2020 by a coalition of institutions across Latin America, the IDSC promotes activities that range from social media campaigns to interactive workshops and public lectures. With more than 400 participating organizations in 52 countries over a five-year period, the IDSC has become a growing platform for scientific citizenship. This article reflects on its evolution, achievements, and future challenges in shaping a global, inclusive, and critical scientific culture.

Keywords: *scientific engagement, science communication, scientific culture, MILSET, citizen science*

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INTRODUCTION

The rise of complex and intersecting global challenges, including pandemics, climate change, political instability, and the proliferation of misinformation, has revealed vulnerabilities in how societies engage with science. These challenges expose a critical need to strengthen scientific culture as a tool for societal resilience and informed civic action (Scheufele & Krause, 2019). The International Day of Scientific Culture (IDSC) was established in 2020 to serve as a global catalyst for enhancing scientific awareness, particularly in regions that have historically been underrepresented in science diplomacy and education.

SCIENTIFIC CULTURE AS A CIVIC IMPERATIVE

Scientific culture refers to the collective ability of citizens to understand, value, and critically assess scientific information. This includes familiarity with scientific processes, openness to evidence, and the capacity to apply scientific reasoning in daily life. Promoting such culture is fundamental to counteract the rise of anti-scientific movements and to safeguard democratic societies (Stocklmayer, 2013). Public trust in science correlates strongly with effective communication, transparency, and access to inclusive science education (National Academies of Sciences, Engineering, and Medicine, 2017).

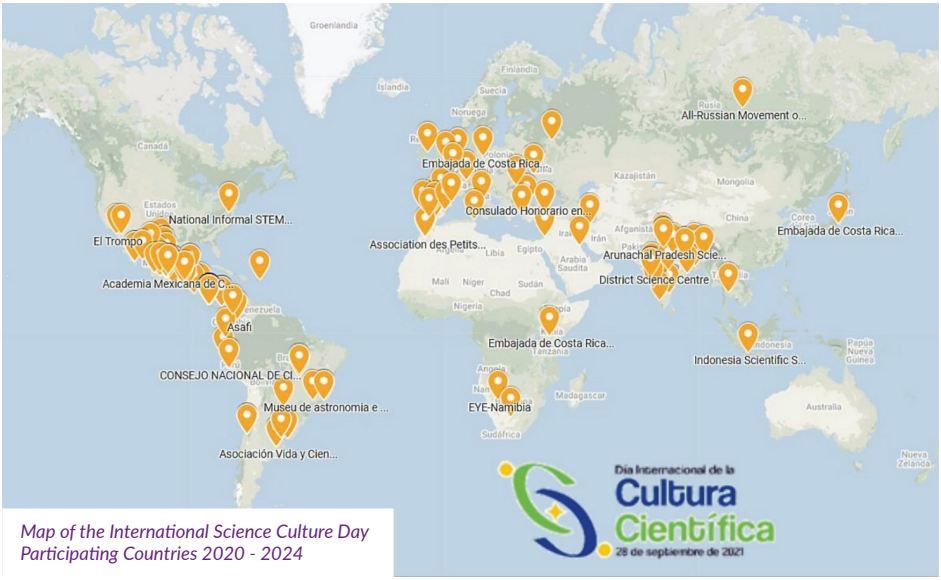
Scientific literacy is not only a pedagogical goal but a foundational pillar of a healthy public sphere. The ability to distinguish between evidence-based knowledge and misinformation is increasingly critical for social cohesion and

AFRICA	AMERICAS	ASIA	EUROPE	OCEANIA
Algeria	Argentina	India	Belgium	Australia
Egipt	Brazil	Indonesia	England	
Kenya	Chile	Israel	France	
Morocco	Colombia	Japan	Germany	
Namibia	Costa Rica	Jordan	Ireland	
R. of South Africa	Cuba	Kuwait	Italy	
Tunisia	Ecuador	Lebanon	Netherlands	
	El Salvador	Malaysia	Portugal	
	Guatemala	Palestine	Romania	
	Honduras	Philippines	Russian Federation	
	Mexico	Saudi Arabia	Scotland	
	Panama	Thailand	Spain	
	Paraguay	Türkiye	Switzerland	
	Peru		Ukraine	
	Puerto Rico			
	U. S. A.			
	Uruguay			

International Day of Scientific Culture
September 28th
2020-2024

Institutions in 52 countries
+ 10 international organizations

List of the International Science Culture Day Participating Countries 2020 - 2024



Map of the International Science Culture Day Participating Countries 2020 - 2024

Promotional Banners used by MILSET for the International Science Culture Day

NASA Astronaut Sonny Williams send a message from the International Space Station inviting to participate at the International Science Culture Day

global cooperation. Strengthening scientific culture fosters collective problem-solving in response to challenges such as climate adaptation, pandemics, or the ethical use of emerging technologies, including artificial intelligence (Wynne, 2006).

THE BIRTH AND EVOLUTION OF THE IDSC

The IDSC was launched on September 28, 2020, a date symbolically tied to the premiere of "Cosmos" by Carl Sagan—a landmark moment in global science communication. This grassroots initiative was coordinated by SOMEDICYT, MILSET, and allied Latin American institutions, including the Laboratorio Nacional de Nanotecnología (LANOTEC-CeNAT, Costa Rica), the Fundación para el Centro Nacional de Ciencia y Tecnología (CIENTEC, Costa Rica), the Red Mexicana de Talleristas de Ciencia (Mexico), the Fibonacci Innovación y Cultura Científica (México), the RED Nacional de Actividades Juveniles en Ciencia y Tecnología (Mexico), and international partners.

Despite launching during the COVID-19 pandemic, the IDSC quickly mobilized science communicators, youth networks, universities, and cultural institutions across nine countries. Activities ranged from virtual panel discussions and digital storytelling to hands-on science kits and collaborative exhibitions. By 2024, more than 412 organizations in 52 countries—spanning five continents—had joined the initiative, collectively organizing over 1,550 science engagement activities.

These activities included planetary visits, science fairs, roundtables, webinars, live astronomical observations, TikTok challenges, infographics, and interactive

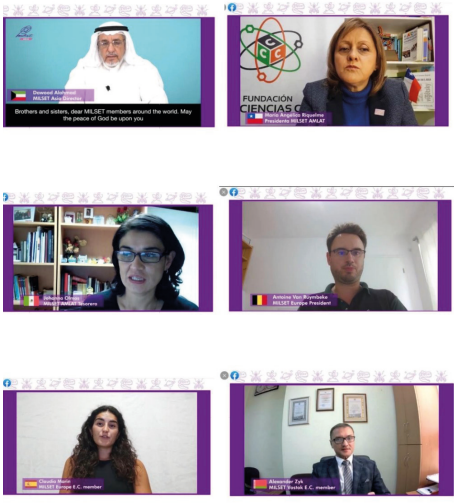
games, among other activities. Many were delivered in multiple languages, incorporating diverse cultural perspectives on scientific thought and application (Patiño-Barba et al., 2021).

IMPACT AND GLOBAL PARTICIPATION

The IDSC has grown into a decentralized but coordinated effort that bridges formal and informal science education. Its accomplishments include:

- Global Reach: With 400+ institutional partners and hundreds of thousands of participants, the IDSC represents one of the most rapidly expanding science culture initiatives worldwide.
- Audience Diversity: Activities have engaged stakeholders across sectors, students, teachers, researchers, families, indigenous communities, and policymakers, through formats tailored to regional needs.
- Thematic Breadth: Events cover topics such as space science, biotechnology, climate change, artificial intelligence, and ethics in science, emphasizing their relevance to both local and global contexts.
- This multiplicity aligns with the view that science is not monolithic but relatively culturally and socially embedded. Encouraging participation from the Global South, particularly Latin America and the Caribbean, has helped rebalance traditional narratives about where and how science is practiced and shared (Massarani & Merzagora, 2014).

Ivan Smirnov from Russia, MILSET Vostok Treasurer; Montserrat Ramírez from Mexico, MILSET Volunter; Driss Louaradi from Moroco. MILSET Africa President and Renata Melo from Brazil, MILSET Volunteer participating in a debate about the International Science Culture Day



Dawood Alahmad from Kuwait, MILSET Asia President; María Angélica Riquelme from Chile, MILSET AMLAT President; Johanna Olmos from Mexico, MILSET AMLAT Treasurer; Antoine Van Ruymbeke from Belgium, MILSET Europe President; Claudia Marin from Spain, MILSET Europe Executive Member and Alexander Zyk from Belarus, MILSET Vostok Executive Member participating in a debate about the International Science Culture Day

MILSET participating at the International Science Culture Day

MILSET promoting the International Science Culture Day "Science makes your life better"

FUTURE PERSPECTIVES

While the IDSC's success is evident, several ongoing challenges remain:

- Sustainability and Recognition: Formalizing the IDSC as an annual UNESCO-recognized event would provide legitimacy and long-term support.
- Equity and Access: Bridging the digital divide, especially in rural and low-income areas, is crucial to ensure equitable access to scientific culture.
- Evaluation Metrics: Future iterations must adopt robust impact assessment methodologies to document behavioral, cognitive, and attitudinal changes resulting from IDSC participation (Bucchi & Trench, 2021).
- Integration with Policy: Collaboration with educational ministries, science and technology councils, and local governments can reinforce institutional backing.

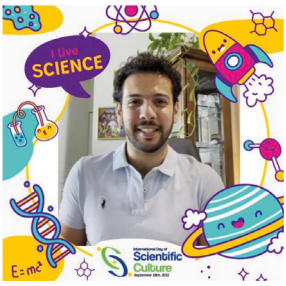
Advancing a global culture of science requires sustained investments in public engagement, teacher training, and localized science communication strategies. Multilingual outreach, youth leadership, and the inclusion of traditional and indigenous knowledge systems will enrich the movement's diversity and effectiveness.

MILSET AT ISCD

MILSET is an organization participating in this initiative since the first edition in 2020. In 2021, to contribute to this important day, MILSET presented several short videos where personalities from the different regional offices discussed how scientific culture answers to different questions. These are two of them: Why is it important that science is integrated into people's culture and daily lives?, What does it mean to be a scientifically educated person?

MILSET Executive Committee represented by Mr. Driss Louaradi from Moroco participating at the International Science Culture Day

MILSET Volunteers represented by Viviana Purcarea-Ciulacu from Romania participating at the International Science Culture Day



MILSET Youth Advisory Committee represented by Hamzah El Hassani from Jordan participating at the International Science Culture Day

In 2022, MILSET invited MILSET Authorities, the MILSET Youth Advisory Committee and some volunteers to talk about why it is important that science is integrated into people's culture and daily lives, and how MILSET has impacted in scientific culture. During 2023, MILSET created banners at social networks inviting its members to join the celebration and Mr. Stefan Dochev from Bulgaria recorded a message that unites others from all around the world.

In 2024, MILSET established contact with NASA and a message from the astronaut Sonny Williams was recorded from the International Space Station inviting to participate at ISCD and Monika Raharti from Indonesia was invited to participate with a video for the worldwide opening ceremony.

Some countries joined this initiative through a MILSET invitation such as Romania, Mexico, Algeria, Namibia, Russia and others.

CONCLUSIONS

The International Day of Scientific Culture (IDSC) represents a strategic, inclusive and dynamic response to the urgent need for scientific literacy and civic empowerment in the 21st. century. As an initiative that transcends borders, cultures, and disciplines, the IDSC demonstrates the power of collective action in making science more accessible, participatory, and responsive to global and local challenges.

By mobilizing civil society, academic institutions, governments, and youth networks, the IDSC not only celebrates science, but also actively redefines the relationship between knowledge and citizenship. Its sustained success in reaching diverse audiences and adapting to global crises proves its relevance as a long-term platform for science engagement and social transformation. Looking forward, the consolidation of the IDSC will require deepened international cooperation, strategic alliances with policy-making bodies, and enhanced evaluation practices that can track the impact of its activities over time. Institutional recognition, such as inclusion in international observances by organizations like UNESCO, would amplify its legitimacy and open new pathways for funding, integration, and innovation.

Ultimately, the IDSC embodies a vision where science is not confined to laboratories or experts, but to something to be shared, celebrated, and owned by all. In an era marked by uncertainty, complexity, and interdependence, building a robust, inclusive, and culturally sensitive scientific culture is not merely desirable, it is essential. The IDSC offers a compelling model of how this can be done: collaboratively, creatively, and globally.

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ORGANIZING THE MILSET ONLINE ASIA EXPO-SCIENCES 2024

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Abstract

The MILSET online Asia Expo-Sciences 2024 implied a series of challenges to organize a regional science fair online. One of those challenges required reaching a large audience with limited time and tools. Another important one had to do with turning technical limitations into practical innovation. Finally, regardless of all possible limitations, building a meaningful experience for participants online was the main goal to be met.

Keywords: *Virtual Events, MILSET Asia, STEM Education, Intellectual Property, Digital Literacy, Science Communication, Online Platforms*

Hawra Asherif from Kuwait Receives the Ulzahan Award for Excellent Girls during the MILSET ESA 2024

THE CHALLENGE

In 2024, MILSET Asia, which customarily organizes Expo-Sciences Asia (ESA) every two years since 2020, found itself in a critical situation when both candidate members that had submitted proposals to host the event withdrew due to external circumstances.

We had to quickly find a solution because cancelling the event was not among our options. This determination of keeping this tradition stemmed from our conviction that this event meant a lot to teachers, students and institutions across Asia. We had to act quickly, and the only way forward was to make the event online.

GOING ONLINE AGAIN

MILSET Asia already had considerable experience with virtual events. We had organized several successful digital events during the COVID-19 pandemic, notably the World Virtual Summit. These previous experiences paved the way for us to move with promptness, clarity and decision. The online option was still different and needed meticulous preparation. ESA is not just a webinar or a conference, rather it is an exhibition, a celebration, a spirit; it's a gathering of ideas, creativity and scientific spirit. The pressing question at that time was how we could recreate that dynamic spirit online.

We first turned to the MILSET global registration system, but it was mainly designed for in-person events. Thus it was a must for us to make the necessary amendments to fulfill our needs.

THE CUSTOMIZED PLATFORM

We registered a dedicated domain: *esa.milsetasia.org*, and with the support of our IT office team, we created a fully customized

digital space tailored to our needs.

Participants had the flexibility to register individually or as teams. Instead of uploading videos directly to our server, which would have slowed the platform, we asked students to upload their project videos to an online platform and share the link. By uploading video links from their own social media platforms—such as YouTube or Instagram—participants were not only able to showcase their projects during the Expo, but also benefit from increased visibility and traffic to their personal or team channels. This approach empowered them to expand their digital presence, engage a broader audience beyond the event itself, and potentially grow long-term followers or supporters interested in science and innovation. Through this approach we eased technical pressure and minimized server strain.

We added a custom showcase page to the website where each project had a "like" button and a counter. We also developed an automated messaging system, statistical dashboards for organizers, and a certificate generator to issue digital certificates instantly.

A VIRTUAL SCIENCE FESTIVAL

The Expo was held from **November 27 to 24, 2024.** We designed the schedule to reflect the major components of an in-person Expo as follows:

DAY 1. Opening ceremony with speeches from MILSET Global and MILSET Asia, a look back at previous editions, and scientific lectures from Dr. Abdullah Al-Mutawa (Kuwait University) and Suaresh Batari (Nepal Astronomical Society).

DAY 2. Technical workshops led by Kuwaiti engineers from the Ministry of Electricity and Water, and a YCC workshop by Dr. Abdul Latif Al-Yaqout and Dr. Israa Al-Issa (MILSET Mexico).

DAY 3. A lecture on hydroponics by Dr. Fawaz Al-Qurayan, a data security session by Dr. Ashraf Radwan, and a final workshop on AI by Dr. Al-Mutawa.

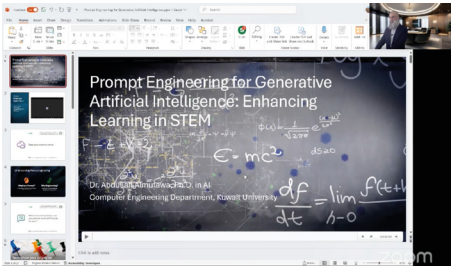
The Expo was available in both English and Arabic, ensuring regional accessibility and broader understanding.

OVERCOMING THE HURDLES

Turning a face-to-face event into a virtual one is not an easy task. Consequently, we faced many challenges along the way. One immediate challenge we confronted was digital literacy among participants. In fact, many of them were not acquainted with tasks such as filling in online forms or submitting project links. To overcome this issue, we designed simple video tutorials and created WhatsApp groups to answer their questions promptly and clearly.

Another concern was protecting intellectual property rights (IP), since student projects were hosted on our servers. To tackle this issue, participants were asked to sign disclaimers asserting that the projects were their own creation, and we included a clear pop-up reminder about IP policies before

Young Citizens Conference organized in the framework of the ESA 2024



The Prompt Engineering for AI: Workshop by Dr. Abdullah Almutawa

anyone could submit their work. As a result, some projects had to be excluded because they failed to meet these requirements. Additionally, we did not have enough time to maintain the cyber security of our website so our IT team made tremendous efforts day and night to keep everything on the right track. Lastly, managing data from hundreds of participants and projects was challenging; we relied heavily on automated systems combined with careful oversight to ensure nothing was overlooked.

THE OUTCOME

Despite everything, the results were beyond our expectations:

- **2.4 million** people reached on Facebook
- **7,600 interactions** and **37,000 link clicks**
- **2.189 million** reached on Instagram
- **8,850 visitors** clicked the registration link
- **934 students** and **373 supervisors**
- **481 projects** showcased
- **91,143 visitors** accessed our Expo website

These numbers showed us that going virtual did not mean reaching fewer people, it actually meant reaching more.

LESSONS THAT LAST

At first our team was full of concern and we feared the expo would lose many participants. We did not anticipate how this online edition of the Expo would open the door for many people, and, surprisingly, the number of the registered projects increased compared to the previous edition.

The virtual format of the Expo removed borders, reduced costs, and gave students from all over Asia an equal opportunity to shine. It also gave MILSET Asia something equally valuable: a stronger network, a growing contact database, and new collaboration opportunities with academic partners across the region.

The most important lesson we learned from this experience is captured in the saying, *where there's a will, there's a way*, provided there is outstanding leadership and an experienced and qualified team. We shared a lot of excitement and joy along with many congratulations from friends and partners. Yet, dramatically a few days after the closure of the Expo, we received with tears and sadness the passing away of our father and leader En Adnan Almeer. What had been a celebration of youth, science, and achievement became a moment of reflection and mourning for the man who had quietly stood behind so many of these successes. And so the whole youth of Asia said farewell to whom had devoted all his life to keep them excited and happy while they entertained themselves through science and technology.

We look forward to welcoming you to the next edition, whether online, in-person, or somewhere in between.

RESEARCH ACTIVITIES OF STUDENTS IN THE NEW NORMALITY: REAL, VIRTUAL, REMOTE. A RUSSIAN EXPERIENCE

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Abstract

This article analyzes the experience of transforming and modernizing the formats of educational programs and projects aimed at organizing students' research activities during the period triggered by the COVID-19 pandemic. It notes how traditional offline formats abruptly (and necessarily) transitioned to online formats, and how after the pandemic they most often began to be implemented in hybrid formats. Special attention is given to recommendations for the most successful implementation of online clubs that engage students in exploratory research.

Keywords: *new normality, students' research activities, competitions and conferences, international research school, online format, digital tools*

INTRODUCTION

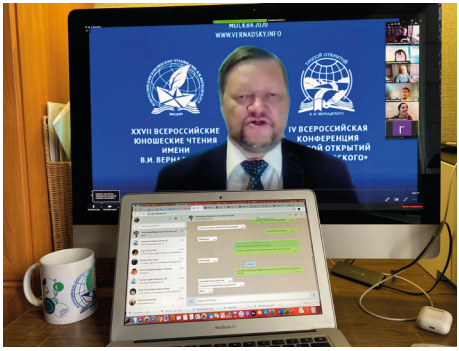
The period from 2020 to 2022, characterized by the global COVID-19 pandemic, significantly changed our practices in various areas of life. Transformations were particularly pronounced in the field of education, both primary and supplementary. The abrupt transition from offline to online learning then back to offline was not easy. For various reasons, even more complex formats of educational practice began to spread: hybrid formats. Education after the pandemic has become different, it has increasingly used various digital communication means and organizational services.

ORGANIZING EVENTS

The journal Researcher was one of the first in Russia to present a large-scale project for engaging students in research activities in online formats (the Online Park project) (Obukhov et al., 2020). It also provided an overview of digital tools for organizing and supporting research and project activities for high school students (Minzhulina & Obukhov, 2022).

Since 2020, numerous studies and analytical materials have been published in Russia, as well as in other countries, regarding various digital tools that allow effective educational practices in online formats (Abankina et al. 2020; Bekova et al. 2021; Bessilina et al. 2020; Karlov et al. 2020; Kozlov et al. 2020; Kosaretsky et al. 2020; Sivak et al. 2022). Special issues of various journals on this topic have been published (Obukhov, 2022). For instance, one of the leading competitions for school research in Russia, the All-Russian Research Competition V.I. Vernadsky was first held online in the spring of 2020 and again in 2021. Since 2022, it has been conducted in both offline and online formats. This allowed the maximum number of participants to take part in the competition, including those who faced difficulties attending in person (considering the vast distances between regions of our country, from the Far East to the Kaliningrad region). In the offline format, we returned to the broadest implementation of the educational program of the competition, which is not always possible in the online format.

The All-Russian Competition of



The All-Russian Research Competition named after V.I. Vernadsky — the first major event we successfully conducted online in 2020.

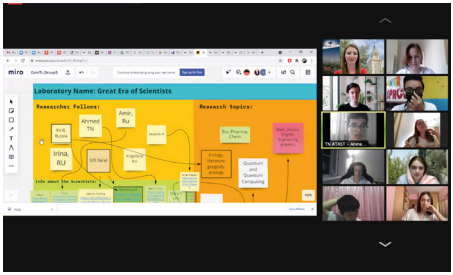
Research Works and Creative Projects for Preschoolers and Young School children *I am a Researcher* was canceled in 2020. In 2021, 2022, and 2023, it was held online, and the online experience was transformed into methodological recommendations (Trifonova, 2021). This time it allowed the competition to be initiated among students of hospital schools under the *We Teach We Know* project. Furthermore, this competition will continue in a hybrid format: offline for children in "normal"

The All-Russian Competition of Research Works and Creative Projects for Preschoolers and Young Schoolchildren "I Am a Researcher," held in an online format.

educational conditions and online for children undergoing long-term treatment. In several regions (for example, Yakutia and the Krasnoyarsk Region), where distances between settlements are measured in hundreds of kilometers, students now have equal opportunities to present the results of their research and projects, regardless of transportation accessibility issues.

The festival of local history associations Regional Festival has been implemented in online, offline, and hybrid formats at various stages, which allowed for large-scale engagement not only from teams from different regions but also from trackers from various cities (Glazunova, 2022). We conducted the International Research School online in 2021 and in hybrid format in 2022 (Obukhov, Salnikova, & Fisher, 2023). This experience showed us that while the online format is quite realistic, the hybrid format is problematic. Despite significant difficulties with time zones, it is possible to organize research teams work in such a way that by distributing tasks among participants the work can be conducted almost around the clock. All participants are in equal conditions but in different territories. The diversity of countries and regions can also be used as a resource for comparative studies. However, the hybrid format showed that children are not in equal conditions (those who participate in person and those who participate remotely) and cannot participate equally in most activities of the International Research School's program. This led to the decision in 2023 for the International Research School to return to the offline format.

In the spring of 2022, we formulated



Communication training during the 2021 International Research School, conducted in an online format.

(through preliminary voting in our community) the key theme for the XII International Conference *Students' Research Activities in the Modern Educational Space* (http://issl-konf.ru), which took place in November, 2022, in Moscow: *Students' Research Activities in the New Normality: Real, Virtual, Remote*. The conference widely presented the results of an experimental study conducted by the Center for General and Additional Education A.A. Pinsky at the Higher School of Economics, in collaboration with the "GlobalLab" platform, supported by the Russian Foundation for Basic Research (scientific project No. 19-29-14190, Development of Motivation and Self-Efficacy of Schoolchildren in the Study of Natural Sciences through Participation in Online Clubs [according to supplementary education programs in natural sciences]) (Kersha & Obukhov 2023).

The experiment on the "GlobalLab" platform helped 1023 students from grades 7-9 in the Khangalassky Ulus of the Sakha Republic participate in natural science clubs with a research component. Moreover, the implementation of a series of clubs conducted in the methodology of "action research" on other platforms plus the experiment allowed us to formulate justified recommendations for the optimal model of organizing online clubs for school children to engage them in research and project activities. The clubs mentioned above were organized as follows:

- 2020. *Online Park* club for 150 sixth-graders from Moscow schools in the Google Classroom platform.
- 2021. *Online Research* club for 180 sixth-graders from Moscow schools in the Google Classroom platform.
- 2022. *Opening the World* marathon club for 1397 students from grades 1-11 from 28 regions of Russia in the "Reactor" platform.
- 2023 and 2024. *Online Research* club for 220 sixth-graders from Moscow schools in the Google Classroom platform.

A GATHERING MODEL

After all the previous experience, a model to better balance the different factors involved in school research programs should have the following characteristics:

1. Development of a Club

1.1. Prioritization of hybrid formats or of online clubs on a platform with regular online meetings with students in "flipped classroom" formats for set and implemented tasks, which supports cognitive and social motivation and enhances self-efficacy.

1.2. Combination of text and visual instructions for research and project tasks, specification of formats for data recording and presentation, along with a short video tutorial for the task, which has a motivating and demonstrative significance (visual forms of task presentation are more engaging for modern students, enhancing their

Communication training during the 2022 International Research School, conducted in a hybrid format.

motivational involvement).

1.3. Special attention at the initial stage of student inclusion in online clubs should be paid to leveling participants' digital literacy regarding the basic tools of the digital platform where the club is implemented, (included during the first online meetings); the possibility of obtaining prompt consultative support (tutoring) during task implementation, and technical problems (mastering new activities and tools requires initial support to prevent a decrease in self-efficacy and demotivation during the implementation of substantive tasks).

2. Consideration of Students Age Issues

2.1. Taking into account the return opportunities for students regarding independence. For younger students (possibly with adult participation, including parents, and starting from grades 5-6), independent participation of students with organizational support from adults is a technical aspect. The complexity of tasks should be measured, from high to low-difficulty tasks or age-related tasks. It is essential to keep motivation and self-efficacy, ensuring that students are always in a situation of successfully-solving tasks within their individual and age "Zone of Proximal Development", through requests for help and support from adults or more experienced peers.

2.2. The schedule and intensity of activities in clubs should vary according to age and implementation period (the younger the students, the shorter the clubs can be; the older the students, the longer they can be). During intensive learning periods, do not overload with tasks, and, during vacation time, intensify practical assignments. The club can include tasks for plan developing

and self-organization skills, enhancing the experience of self-efficacy. When students are older, it is more important to maintain productivity in the club through pragmatic and social reinforcement, possibly through systems of crediting/re-crediting results in the club in general education courses, or through gaining access to significant new educational and social resources.

2.3. Accessibility of tools for task implementation should be available to every student or involve the use of publicly available digital tools considering the abilities of students of different ages (with sufficient novelty of methods for students), which will support a high level of cognitive motivation.

3. Productive Activities

3.1. Proliferation of productive tasks to initiate students' research and projects requires mastery of specific methods and ways of execution for experimentation, data collection and systematization, measurements, etc. It's essential to do independent searches to answer various questions over local material (rather than searching for ready-made solutions and answers on the internet). This will provide a significant resource for the development of cognitive motivation.

3.2. Informational materials, links, texts, and videos on the platform should be selected and placed as additional reference materials needed to implement set tasks. This allows a more meaningful and motivated assimilation of theoretical material, significant for the development of scientific literacy.

3.3. The possibility of implementing research and projects in both individual and group formats, as well as formats where individually completed tasks, when combined in a group, can reach a new level of generalization. Here, everyone sees the value of their contribution to the common cause, which also enhances students' social motivation.

4. Freedom of choice and Self-Determination of Students

4.1. The creation of opportunities for students to choose subject lines of study, as well as specific research or project tasks for implementation (both in content and in format) positively influences motivation and self-determination of activities.

4.2. A variety in implementation formats and ways of presenting research and project results in the club's activity program to maintain students' motivation. It does not only help mastering new content, but also new forms of activities and presentation of its results. The course should include a range of tasks regarding the place of implementation (for research and design methods in localities, where linking to their locality is the students' task to solve, as well as at-home or at-school tasks.

4.3. The presence of tasks of varying levels of complexity (in terms of time and cost), which are pre-marked for students who choose to implement the tasks (levels of "touch," "action," and "depth" with different coefficients in scoring, x1, x2, x3), allows better development of planning skills and level of aspirations for students.

5. Formative Assessment and Feedback

5.1. The principle of cumulative assessment for implemented tasks

with visualization of "growth" in achievements as productive actions, where each participant can "compete" with themselves, clearly seeing their progress, enhances motivation for self-development and reduces the distress of failure risk .

5.2. A simple and understandable criteria-based assessment system for task completion results, distinct from school assessments, motivates self-development and improvement of skills. Here is a sample of what could be used as an assessment system:

- 0. The task is not as it should be.
- 1. This assessment requires feedback on what and how to improve.
- 2. The task is fully completed.
- 3. The task is completed above the set requirements.

5.3. In addition to criteria-based assessment for task completion results in points, there is a requirement for prompt and constructive, supportive and motivating feedback. Recommending specific actions for improvement, development, and refinement (if necessary) regarding the research core provides a combination of growth in self-efficacy and development of specific skills and abilities.

Additionally, during the implementation of online formats involving students from different regions of Russia in research activities (both within the framework of the Opening the World marathon and at the Regional Festival marathon), it became clear that it is essential to consider the climatic and sociocultural characteristics of various regions; flexibility and a broad range of research assignments relevant to the climate, flora, and fauna of different territories are necessary.

CONCLUSIONS

These recommendations, along with the analysis of diverse experiences in implementing students' research activities during the challenging pandemic period from 2020 to 2022 and the subsequent years 2023-2024 indicate that our opportunities for formats and tools for engaging children and teenagers in research have expanded. We do not reject and understand the value of offline formats; at the same time, we retain proven online formats and, if necessary, implement the most complex hybrid formats. We have begun to live actively in the new normal, inventing new ways of interaction and forms of activity implementation. We will not "roll back" to the state before 2020. We will build our future perspectives with expanded experience and increased diversity in formats for organizing students' research activities.

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EDUCATION FOR INCLUSION

ENERYS DEL CARMEN OLAGUÍBEL GUEMÁREZ
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Abstract

The COVID-19 pandemic revolutionized the way we do things, including the educational learning practices. This article summarizes the changes experienced in Puerto Rico, especially the challenges faced by our non-profit organization Jovenes Científicos por Puerto Rico. Those challenges led to an integration of technology to the learning experience. However, integrating offline, virtual, and remote learning modalities in education offer diverse benefits for inclusive practices, particularly for students with diverse learning needs and circumstances.

Keywords: *inclusive education, distance learning, best learning practices, educational flexibility and accessibility, personalized learning, hands-on learning*

Mr. Francis Mulenga from Zambia participating via Skype.

Mr. José Martínez from Mexico participating via Skype as part of FICEP.

The COVID-19 pandemic revolutionized the way we see the world. All our paradigms suddenly were shaken. But we had to continue living under the new circumstances, especially when the education of our children could not be stopped.

Puerto Rico was not an exemption within this new reality. And we had to use creativity to face it. In the face of science education, how could we teach STEM concepts, which are often hard to understand, far from students and without having laboratory equipment? For example, how could we teach robotics in a remote environment?

By learning from others, we started using all the technological tools available. Online learning was the first option explored. At the beginning, there was some resistance from all the parts involved, but we started perceiving the benefits of this kind of learning. The world suddenly became smaller. There is no excuse now for not having a great speaker from another country teaching our students and we can participate in international panels as well. The international collaborations started to flourish. One of the great examples of this type of collaboration occurred during the International Science Forum (Foro Internacional Ciencia en Puerto Rico in Spanish). One of our speakers was from Mexico and he offered a very interactive conference with the students participating in the Forum, in Puerto Rico.

But doing science during those times was very difficult, especially when most of the students were restricted from a laboratory at home, even without basic pieces of glassware to work with their investigations. And here is where

imagination and creativity entered in the equation again. At that time, we started a collaboration with a great scientific communicator from Zambia, Francis Mulenga, who taught us how to construct laboratory equipment from materials that were easy to find.

Our next challenge was to motivate students to participate in a scientific forum under those hard conditions. But our enthusiasm and motivation never decreased, and in 2021 we conducted our Forum completely online. The participation of international students and judges increased, raising the quality of the event.

This new reality presented another great opportunity to use online learning (where there are no time limits). If a student, or a teacher could not be available at a specific time, they still could continue with their learning process at any other given time.

And suddenly, with the work of many scientists, conditions started to "normalize". But what was considered normal had changed forever. The learning conditions had significantly changed. The things that we had to implement clearly enriched the learning process. There was no doubt about the benefits of offline learning. The human touch is essential and learning by doing is also very important, especially in the scientific fields. However, by adding the elements of distance and online learning, the experience can increase exponentially. In addition, science must be inclusive. Students of all backgrounds should have the opportunity to learn science. And to do that, science has to be fun and accessible.

In 2022, I personally had the opportunity to travel to Washington D.C. to take the workshop Zero Barriers in Science Education with our allies of Ciencia Puerto Rico[1] . This trip helped me understand that technology can be a great ally for students with different disabilities. Sign language can be included in workshops, making them reachable for deaf students. Captions can also be included in online training, facilitating the student's comprehension of difficult topics.

Moss Myllena Cristyna Braz da Silva (National Geographic's Science Fair movie) speaking via Skype with students from Puerto Rico.

Jóvenes Científicos Por Puerto Rico is a non-profit organization dedicated to students' scientific divulgation from all around the island. For this reason, one of our primary objectives was to promote science with the help of communication tools like Skype, and include it in our workshops for a diversity of students. The lessons learned helped us develop strategies that were adapted to those backgrounds. In our current workshops we include offline, remote and online learning depending on

1 1 Ciencia Puerto Rico (CienciaPR) is a non-profit organization that aims to advance science education, communication, and careers within Puerto Rico and among Puerto Rican and Hispanic communities. They connect a large network of scientists, students, educators, and allies, leveraging their collective knowledge and voices to democratize science and transform science education.

the necessity of the students being served. We adapt the workshops to the necessities of our different students.

For example, in robotics workshops, depending on the time available, we start by providing a brief introduction of the topic. Robots that are well known by movies are introduced to them including short videos of famous scenes with captions included. The concept of programming and robot mobility are then introduced. A brief exercise is performed where one student acts as the robot and the other acts as the programmer. The robot student has a band in the eyes and has to follow the instructions that the programmer indicates. Depending on the quantity of computers available, students can perform a small program. However, if only one computer is available, the program is performed by the facilitator using the instructions given by the students. Then, depending on the materials available, a small robot is constructed. In the case that no robotic kit is available, the mechanical concepts are taught using available materials such as cardboard. Finally, when possible, students have the opportunity to drive the robots and perform small challenges with them.

For more advanced students the robotic education is enriched by personal instruction that is typically performed by a distant instructor that can answer specific questions that students have while constructing their robots. During the design process the use of programs found online, such as AutoCAD, is stimulated. Students also participate in robotic competitions, both online and offline.

As mentioned before, current best learning practices include the use of offline, remote and online experiences depending on the available resources and the necessity of the students. Offline learning experiences offer real-time feedback, personal interaction, and hands-on learning opportunities. They also foster social involvement, networking, and can be more engaging for some learners who thrive in a structured environment with fewer distractions. Online and remote learning offers flexibility, accessibility, personalized learning, and affordability. The combination of activities that involve the three learning processes can increase the inclusion of all the students in STEM activities.

Enerys Pgan Olaguibel, President Jovenes Cientificos por Puerto Rico at SER Foundation

EMPOWERING YOUTH IN ERONGO FOR A SUSTAINABLE FUTURE: A DETAILED ACCOUNT OF THE YOUNG CITIZENS GREEN ECONOMY CONFERENCE IN WALVIS BAY, NAMIBIA

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Abstract
This article presents a comprehensive scientific report on the Young Citizens Green Economy Conference, held on September 13-14, 2024 in Walvis Bay, Namibia. Based on the MILSET Young Citizens Conferences (YCC) concept, the event empowered over 150 youth from Namibia and South Africa (aged 15–25). The conference aimed to promote environmental literacy, sustainable development awareness, and active youth engagement within the green economy sector. Hosted by the Leos of Walvis Bay and supported by the Youth Climate Action Fund and local partners, the conference served as a platform for science engagement, grassroots activism, and cross-border collaboration. Structured around interactive sessions, creative workshops, eco-challenges, and green innovation showcases, the conference served as a participatory model for youth-led sustainable development. The article provides in-depth analysis of the program, educational methodologies, key themes, participant outcomes, and recommendations for replicability in Southern Africa.

Keywords: *green Economy, youth Empowerment, science & community engagement, climate education & action, MILSET Young Citizens Conference, environmental innovation, project-based learning*

INTRODUCTION

Namibia's Erongo Region, home to diverse ecological zones and industrial hubs, faces acute environmental and developmental challenges, including desertification, coastal erosion, and youth unemployment. Recognizing the urgency of these intertwined crises, the Young Citizens Green Economy Conference was convened to empower youth with tools to engage in green entrepreneurship, environmental advocacy, and sustainable development informed by science.

The rationale was simple yet profound: enable young people to shape their environmental future through scientific knowledge, civic participation, and innovation. With its diverse representation and action-oriented agenda, the conference stood as a milestone for regional science engagement.

In response to the global climate emergency, the Young Citizens Green Economy Conference was developed to amplify youth voices in science, innovation, and environmental governance. Inspired by Lions International Environment Pillar and the MILSET Young Citizens Conferences (YCC) framework, the event provided a unique opportunity for science-based civic engagement.

OBJECTIVES

Lions International and MILSET YCC Frameworks encourage young people to discuss global challenges, propose innovative solutions, and engage with civic actors through science. Aligned with this approach, the Conference objectives were:

- To raise environmental awareness

Question-and-answer session facilitated by Obedine Tsuses.

Participants engaged in illustrating their vision of a sustainable community.

and promote green economy education among youth.
- To connect Namibian and South African youth through collaborative science engagement.
- To foster project-based learning and grassroots climate action.
- To promote interdisciplinary understanding of sustainability.
- To develop leadership and communication skills through hands-on learning.
- To inspire actionable community projects based on environmental science.

METHODOLOGY AND DESIGN

The program employed interdisciplinary, inquiry-based learning, integrating climate science, project-based pedagogy, and reflective discussion. Participants were grouped into diverse teams to encourage cooperative learning and peer mentorship. Each activity was grounded in a scientific or civic theme relevant to the green economy transition.

CORE SCIENTIFIC THEMES

- Climate Change and Global Warming
- Renewable Energy (solar, wind, biomass)
- Waste Management and Circular Economy
- Ecology and Coastal Ecosystems
- Science Communication

Participants engaged with these themes through expert talks, interactive experiments, and peer-led exploration. All content was adapted for youth-friendly formats.

Participants discussing the impact of climate change on communities

YOUTH REFLECTIONS AND MEASURED IMPACT

Post-conference evaluation showed:
- 91% improved their understanding of green economy concepts.
- 82% reported improved teamwork and problem-solving skills.
- 77% intended to launch environmental projects in their communities.
- 68% expressed interest in science careers related to sustainability.

Selected feedback included:

"I never knew science could be this practical and fun."

"Now I believe youth can lead the green transition."

DISCUSSION: LESSONS AND FUTURE DIRECTIONS

The conference demonstrated that science engagement catalyzes sustainable behavior change. Blending formal knowledge with community relevance

fostered deeper commitment.

Key takeaways include:

- Youth respond positively to participatory science experiences inspired by the MILSET YCC framework.
- Local ecological contexts make climate science tangible and personal.
- Interdisciplinary formats enhance retention, innovation, and civic confidence.

Future recommendations:

- Institutionalize annual YCC-style conferences in all Namibian regions.
- Integrate green economy education into formal curricula with strong emphasis on scientific literacy.
- Fund and scale youth-led environmental projects through innovation labs and municipal partnerships.

A CASE STUDY FROM INNOVATION CHALLENGE,

Plastic-to-Brick Upcycling Program Community waste collection and compression to create building materials.

This proposal combined engineering, environmental science, and entrepreneurship.

RELEVANCE TO MILSET'S YCC AGENDA

This event embodies MILSET YCC's commitment to science for global

Participants showcasing the eco-friendly products they created during the session

citizenship. It localized global problems into action-based education and fostered a culture of youth-led sustainability. In Africa we can use this model to scale similar conferences across the continent.

CONCLUSION AND RECOMMENDATIONS

The Young Citizens Green Economy Conference provides a replicable template for inclusive youth science engagement. It demonstrated the power of peer learning, community science, and civic creativity. Organizers recommend:

- Institutionalizing YCC-based conferences in regional science calendars.
- Establishing a national youth green innovation fund.
- Creating a YCC Africa alumni platform.

The Young Citizens Green Economy Conference exemplifies how MILSET's Young Citizens Conference model can be adapted to African contexts to create meaningful youth engagement in science, policy, and environmental innovation. As the climate crisis deepens, platforms like this empower youth to become architects of a just, green transition. As the climate crisis intensifies, empowering youth with scientific agency is both a necessity and an opportunity for transformative change. The event's outcomes confirm that science engagement, when made inclusive and action-oriented, has transformative power for youth and their communities.

ACKNOWLEDGMENTS

Special thanks to Youth Climate Action Fund, Bloomberg Philanthropies, the Municipality of Walvis Bay, Lions International, MILSET Africa, all facilitators, speakers, and the over 150 inspiring youth who made this vision a reality.

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OPENING UP NEW HORIZONS –NOVEL APPROACHES TAKEN BY TISF IN POST-PANDEMIC ERA

Abstract

Taiwan International Science Fair has been organized annually for over 20 years. After COVID-19 pandemic, new measures have been taken to attract more participants. More interesting events are held to increase the mutual understanding and culture exchange between domestic and international participants.

Key Words: *Science Fair, Post-Pandemic Era, culture exchange*

HISTORY OF TISF

The history of the Taiwan International Science Fair (TISF) dates back to 1982 when two students were selected from the National Primary and High School Science Fair to participate in the International Science and Engineering Fair (ISEF). Since 1991, the chosen students for international science fairs have represented the National Primary and High School Science Fair. In 2002, this science fair was renamed as the Taiwan International Science Fair (TISF).

The organizer of TISF is the National Taiwan Science Education Center, which is a science center under the Ministry of Education (MOE) of Taiwan, Republic of China. The TISF guidelines are formulated by the Science Fair Consult Committee. The judging procedure includes a D&S review, a three-stage interview, and the award categories Young Scientist Award, the First to Fourth award and the Special Awards, which reference to the ISEF.

The TISF is a science research competition for high school students from grades 9 through 12. The mission of organizing the science fair is to foster talented young scientists. In addition to selecting good science projects in Taiwan, the exchange of research ideas and culture experience is equally important. Therefore, we invite students from different countries to participate in the fair. Domestic winners, besides winning grant awards, are selected to represent Taiwan at various fairs around the world.

NEW GOALS

Facing the rapid change of global society and technology, new goals are set for the TISF:

1. Scaling the science fair up by increasing domestic and international participation. During the pandemic, the TISF also experienced a challenging condition, but we did not stop holding the science fair. The participation of international students was forced to be held online because of the border control in 2021 and 2022. From 2023, the TISF was back to the in-person version. We learned the importance and preciousness of face-to-face experience from the online fair. Therefore, we would like to expand the scale of the science fair by increasing the number of participants, both domestic and international ones.
2. Deepening experience and exchange between domestic and international participants. The TISF schedule was designed to be tight and busy. In this way, domestic students focused more on the competition than the culture exchange with the international students. Therefore, more activities or events are organized in order to provide more opportunities for the Taiwanese and international students to get to know each other and make friends.

NEW APPROACHES

1. New venue for exhibition. The TISF is organized by the National Taiwan Science Education Center, which is a science center housing hundreds of hands-on exhibits in a 12-floored building. The TISF used to be held

in the library, located on the 9th floor. However, there are several renovation works taking place these years. Classrooms and meeting rooms for science class (and many other activities) are located on the B1 floor. Considering the venue for the TISF, the B1 floor has been remodeled as a multi-purpose space which can be used as the exhibition venue during science fair. The renovation work finished at the end of 2023. Thus, the B1 was used as the exhibition venue for the 2024 TISF. The new space can accommodate up to 250 projects instead of 180 projects in the old venue. The issue of air conditioning and lighting are also improved in the new space.

2. New affiliated international partners. The number of countries participating in the TISF keeps growing since its establishment in 2002. The number has been around 10 to 20 countries in the first 10 years, from 2002 to 2012. However, there are now more than 20 countries since 2013, and the number has reached 29 countries in 2025.

The main goal of TISF is to select Taiwanese students to participate in science fairs abroad. Before 2019, 23 TISF finalists were selected to participate in 7 international science fairs, International Science and Engineering Fair (ISEF) in the USA, I Giovani e le Scienze in Italy, International Festival of Engineering, Sciences and Technology in Tunisia

29 representatives from participating countries are on stage in the opening ceremony of 2025 TISF

(I-FEST2), Karademir Science Energy Engineering Fair (OKSEF) in Turkey, Expo Science International (ESI) in Abu Dhabi, MOSTRATEC in Brazil, and all-Russian Science Festival (SoF) in Russia. From 2020 to 2021, we did not participate in any international science fairs because of the COVID-19 pandemic. In 2022, we started sending students abroad again but participated in only 2 offline fairs and 2 online. In 2023, we tried to select more projects, and participated in more fairs. In 2025, 50 TISF finalists were selected to participate in 10 international science fairs. There may be 2 more fairs we are planning to participate in 2026. The number of finalists and international science fairs we participate in are growing. By taking part in the science fairs, we believe students can broaden their horizons by making friends with students from various countries.

3. Encouraging the participation of domestic students. The Taiwanese students participating in the TISF are mostly from the famous schools in the metropolitan area. Currently, we are trying to encourage the participation from more rural areas by organizing workshops for teachers in the remote areas of Taiwan. So the number of participating schools and students have grown in the past few years.
4. Extending from 5 to 7 days at the science fairs. The program for international participants was reviewed in 2023, and one decision that was taken has to do with increasing the participation two days. The first day of the program is the culture tour. This event helps providing an opportunity to relax after a long journey of flight. We hope they can recover from the exhaustion when the activities begin.
5. Increasing workshops and tours. We organized more workshops and tours for international participants to experience Taiwanese culture. The highly applauded workshop is the Taiwan Special Tea Workshop, which provides the knowledge of Taiwanese tea and the opportunity to taste different kinds of tea. Pineapple cake is one of the most popular desserts in Taiwan. Pineapple cake DIY workshop provides the students and supervisors the chance to make the cake by themselves.

Group photo before departure for the culture of 2025 TISF

Students try the traditional toy-diabolo, known as the Chinese Yo-yo during culture tour

Culture tour to Pingxi to set off sky lanterns is one of the most favorite activities among international participants.

Science Tour – visit the lab and research facilities in National Tsinghua University

Taiwan Special Tea Workshop for supervisors

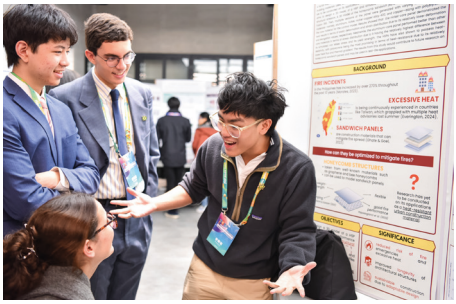
Taiwan Special Tea Workshop for supervisors

In addition, tours to visit renowned universities such as the National Taiwan University and the National Tsinghua University in Taiwan were also organized to provide chances for students to know about the science research in Taiwanese universities. Visiting Microsoft Office in Taipei was also included to let the students learn about how engineers work.

6. Providing more opportunities for culture exchange. In order to ensure the international participants are well taken care of, we work with the Student Ambassadors in high schools. These students open their houses to host the international students participating in the TISF. They used to stay in the student ambassadors' house during the TISF. However, the international participants opted to stay in a hotel instead because of a change in the living conditions in Taipei. Student ambassadors keep working with us to host the international participants in spite of this situation. They accompany international participants during their stay during the TISF program. In their free time, usually in the evening, they volunteer to take them to the night market or any popular places. They also assist if there is any need for help. They also help organize workshops or ice breaking events for students to get to know each other.

Country Booths in the Culture Night provide opportunities for participants to showcase and experience different cultures from other countries.

7. New Judging Procedure. There are three stages for domestic students but only one for international students. However, the procedure is revised so that all the students participate in the first and second stages in order to provide a second chance for participants to present their research to the jury. The purpose of the third stage judging is to select the representatives (only domestic students) to participate in the science fair abroad and the Young Scientist Award (the biggest award of the TISF). From 2025, two candidates for the Young Scientist Award were selected and they were asked to give a presentation to all the judges of the TISF. Then after the discussion of the jury, the winner of the Young Scientist Award is selected.



Young scientists from different countries share each other's research.

The Culture Night event is one of the favorite events of the TISF

LOOK FORWARD

Despite the long history of the TISF, we keep taking new approaches in order to achieve our core value of fostering young scientists by providing a good platform for them to showcase their work, exchange ideas and experience different cultures. Therefore, the organizer of the TISF, the National Taiwan Science Education Center, keeps moving forward by providing more interesting activities and events for the participants. We will still continue establishing partnerships with national organizers abroad.

INNOVATION IN STEAM IN THE NEW NORMAL ERA: THE ROLE OF THE INDONESIAN YOUNG SCIENTIST ASSOCIATION (IYSA) IN DEVELOPING OFFLINE, ONLINE, AND REMOTE INTERNATIONAL EVENTS

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Abstract

This essay outlines the Indonesian Young Scientist Association's (IYSA) pivotal role in adapting and advancing STEAM education during the new normal era. By seamlessly integrating offline, online, and remote approaches, the IYSA has broadened access to scientific opportunities for young learners globally. The organization's initiatives, including online competitions and workshops, remote collaborations, hybrid events, and digital resource development, demonstrate a commitment to inclusivity and innovation. Furthermore, the IYSA's collaborations with universities and research institutions underscore its dedication to providing high-quality, relevant STEAM education, ultimately serving as a model for global scientific outreach in the digital age.

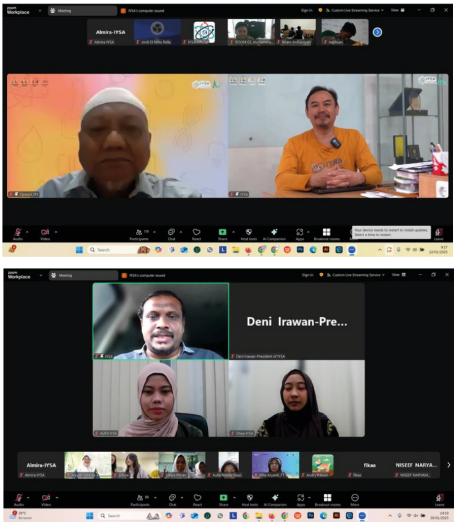
Keywords: IYSA, STEAM, Online Events, Online Education, Remote Collaboration, Hybrid Events, Innovation, Youth Science

IYSA Offline Competition

The Indonesian Young Scientist Association (IYSA) is a non-profit organization dedicated to promoting science among young generations, particularly in Indonesia. With a mission to develop the scientific potential and talent of young students and university students, the IYSA organizes various activities, including scientific competitions, exhibitions, workshops, and seminars. In response to the challenges of the new normal, the IYSA has played a crucial role in adapting and developing Science, Technology, Engineering, Arts, and Mathematics (STEAM) events both nationally and internationally. With a strong focus on developing the potential of the younger generation, the IYSA has successfully developed STEAM events that are relevant to contemporary needs.

The new normal era has brought fundamental changes in how we interact, learn, and collaborate, especially in the field of STEAM. The increase in virtual learning has become one of the most prominent changes, where digital platforms now serve as the backbone for delivering learning materials, conducting workshops, and facilitating cross-border collaboration. However, adaptation is not limited to the virtual realm. Real-world activities have also undergone significant adjustments, with strict health protocols such as participant number limitations and social distancing becoming the new norm. Additionally, the development of remote learning models, both asynchronous and synchronous, is crucial to reach participants from various geographical locations, ensuring accessibility of STEAM education for all. Finally, the integration of advanced technologies such as virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) is increasingly permeating STEAM activities, opening new opportunities for immersive and interactive learning experiences.

In response to travel restrictions and direct interaction limitations, the IYSA has successfully organized online scientific competitions and exhibitions, such as the



IYSA Online Competition

International Science and Invention Fair (ISIF), the Innovative Science Environmental and Entrepreneur Fair (AISEEF), the World Society of Environmental and Ecological Chemistry (WSEEC), and the Global Youth Invention and Innovation Fair (GYIIF), among others. These initiatives enable global participation without geographical barriers, where participants from various countries can present their projects through digital platforms. Jury evaluations and question-and-answer sessions are conducted online, creating an inclusive competitive and collaborative environment. Thousands of participants have benefited from these events, promoting international collaboration and providing a platform for young generations to showcase their scientific talents on the world stage.

Furthermore, the IYSA proactively conducts online workshops and webinars featuring experts from various STEAM disciplines. These sessions cover a wide range of topics, from robotics and programming to biotechnology and product design, as well as crucial subjects such as Plagiarism Prevention and Detection Strategies, research methodologies, and others. The online format eliminates geographical limitations, allowing participants to learn directly from experts without the need to travel. This significantly enhances access to high-quality STEAM education, reaching a broader and more diverse audience.

The IYSA also facilitates remote collaboration projects, creating opportunities for students from various countries to work together on scientific projects. Through online collaboration platforms, participants can share data, discuss, and develop joint solutions. These initiatives not only promote cross-cultural collaboration skills but also provide valuable experience in working in international teams. Participants learn to appreciate diverse perspectives and build innovative solutions through cooperation.

Adapting to the current situation, the IYSA also organizes hybrid STEAM events, combining real-world and virtual elements. This model provides flexibility for participants to choose between offline or online participation, depending on their conditions and preferences. Hybrid events allow for direct interaction between participants and judges, while still utilizing digital platforms to reach a wider audience. This approach ensures that events remain

Rumah Riset

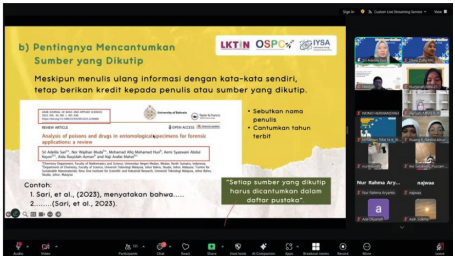
Logo of Rumah Riset Application, developed by IYSA

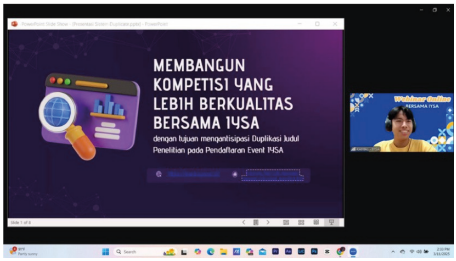
inclusive and accessible to all, regardless of their location or circumstances.

Additionally, the IYSA has developed various digital educational resources, including learning modules, video tutorials, and interactive simulations in the form of Rumah Riset applications. These resources are available online, enabling students to learn independently and develop their STEAM skills. This development demonstrates IYSA's commitment to providing sustainable and flexible educational access. Students can access materials anytime and anywhere, allowing them to learn at their own pace and according to their individual needs.

The IYSA also collaborates actively with various state universities both in Indonesia and internationally, as well as research organizations worldwide. This collaboration includes knowledge exchange, joint program development, and participation in research projects. These partnerships strengthen IYSA's capacity to provide high-quality STEAM education that is relevant to the development of science and technology.

In conclusion, the IYSA has proven itself as an adaptive and innovative organization in facing the challenges of the new normal. Through the integration





Webinar with the IYSA

of offline, online, and remote approaches, the IYSA has successfully expanded the reach of STEAM education and provided equal opportunities for young generations to develop their scientific potential. By continuously innovating and leveraging technology, as well as collaborating with various parties, the IYSA not only contributes to the advancement of science education in Indonesia, but also serves as an inspiration to the global education community in promoting STEAM in this digital era.

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CITIZEN SCIENCE IN SCHOOL ENVIRONMENTAL STUDIES

Abstract

This article examines the conduction of a school environmental research within the framework of the "Environmental Patrol" project in the format of scientific volunteering (citizen science) as an initiative for the Decade of Science and Technology. The article discusses the stages of project development, its current status, and project development prospects. The emphasis in this article is on the benefits of student participation in citizen science programs.

Keywords: *citizen science, environmental patrol, environmental monitoring, Decade of Science and Technology, scientific volunteering*

In Russia the 2022 – 2031 decade has been declared the Decade of Science and Technology (Decree of the President of the Russian Federation dated April 25, 2022 No. 231 [1]), one of the initiatives which was related to scientific volunteering (citizen science). In April 2023, the All-Russian Public-State Community of Children and Youth "Union of the First" launched a new direction: Citizen science [2]. What it is and why students should participate in citizen science projects, and what projects they can take part in is what follows.

Citizen science is the concept of conducting scientific research with the involvement of a wide range of volunteers, many of whom may be amateurs. For example, they have no preliminary scientific education or specialty training. It is clear that all schoolchildren fall into this category. According to IBM Corporation experts, the development of citizen science is among the top five global trends for the next five years [3]. In the Russian-speaking environment, the term "scientific volunteering" is more commonly used and has become one of the top-level initiatives of the Decade of Science and Technology. The Decade of Science and Technology allows us to solve the problem associated with attracting talented youth into the field of research, as well as increasing the awareness of Russian citizens about the achievements and prospects of national science [1].

Students of School No. 630, members of The Russian Community of Children and Youth "Union of the First", take part in measuring the concentration of fine particles in the air (RM 2.5, RM 10) together with employees of the Moscow Environmental Monitoring (April 6, 2023).

Despite the fact that significant interest in the phenomenon of citizen science has arisen only in recent years, this phenomenon itself has a history of more than a century and was first used for bird observation at the very beginning of the twentieth century [4]. There is a large number of projects in the world in which volunteers are recruited to conduct research. And very often, these projects have to do with environmental issues. These include observing whales and other marine mammals from tourist ships in the Arctic and Antarctic [5], studying coral reefs [6], studying the plants species composition, including invasive species, and mapping their populations [7].

One of the first school projects in the field of ecology was monitoring the state of the atmosphere in Great Britain [8]. The project was implemented in the second half

The participant of the Ecological Patrol project carries out measurement of key parameters of the atmosphere.

Foresight session of the Ecological Patrol project, where participants discuss the directions of the project development.

of the twentieth century and it involved 15,000 students who studied the state of air and air pollution using the bioindication method with lichens. Lichens are organisms sensitive to air pollution by sulfur dioxide, which leads to their almost complete disappearance in cities. The entire territory of Great Britain was divided into sections each of which was studied by one or another school. Then, a general map of air pollution in Great Britain was formed.

In 2019, the "Environmental Patrol" project was launched in Russia, the goal of which was to develop an environmental school-monitoring network [9]. Unlike the British project, which was based on the bioindication method, the Russian project was based on the method of instrumental environmental monitoring. This is due to the fact that the project initially included the inclusion of as many regions of Russia as possible, which belong to different natural areas, and have very different species composition of lichens. In such cases bioindication approaches are not always effective and do not allow comparison of the results obtained by different teams. Therefore, it was decided that project teams that will carry out research in the regions should be equipped with a unified equipment set for school environmental research. With the support of the Innovation Promotion Fund, a competition was held among Russian equipment manufacturers, as a result of which more than five hundred sets were prepared, including digital sensors for measuring dust concentration, pH and electrical conductivity. The proposed set of sensors allows you to measure a wide range of parameters of both air, water, precipitation, and soil. The fundamentally important feature was the ability to connect the sensors to the teacher's (student's) smartphone or computer ("bring your own device" technology), which made it possible to significantly reduce the cost of equipment and equip more schools.

In 2020, the Methodological Council of the Environmental Patrol Project was formed, which included representatives of the M. V. Lomonosov Moscow State University, a non-governmental environmental foundation called V.I. Vernadskiy, the Innovation Promotion Foundation, the Educational Technologies Navigator Fund for Technological Support of Education, the Innopraktika company, and the Federal Center for Additional Education and Organization of Children's Recreation and Health. As a result of a competitive selection, 21 regional operators were selected. Four hundred eighty educational organizations presented 678 projects in the field of ecology. Four hundred eight organizations reached the finals, and a total of 482 equipped teams participated in the competition, which made it possible to provide 3,400 school children with the equipment necessary to conduct research.

The following were conducted: training for project participants working with

research equipment, as well as advanced training courses for teachers. Before the start of the 2020-2021 academic year, the collection of data from participants from pilot regions on the state of the atmosphere, soil, and water was launched. To date, 6722 measurements have been received. Most participants were involved in atmospheric monitoring (5,700 analyses, 1,498 results in the "Water" track, and only 154 results in the "Soil" track, which is explained by the difficulty of conducting soil research for school work).

In 2021, the all-Russian Environmental Patrol Competition was held for the first time. At the same time it was included in the List of Olympiads and other intellectual and (or) creative competitions, events aimed at developing intellectual and creative abilities: ability to study, physical culture and sports, interest in scientific research, engineering, technology, physical education and sports activities. These events also help promote scientific knowledge, and sports achievements annually, all approved by the Ministry of Education of the Russian Federation [10].

In 2022, two thousand thirty-four projects from 5330 participants living in 80 constituent entities of the Russian Federation, as well as a number of works from Kazakhstan, Mongolia, and Moldova have already been submitted to the competition. The largest number of works related to the "Young Researchers" track, supported by numerous requests of participants in the "Environmental patrol" project, was specially introduced for primary school students. Following, the tracks "Air", "Water", "Comprehensive monitoring" and "Soil" corresponded to a general trend in the number of studies in the school environmental monitoring system. The results of the project are taken into account when entering data into the state information resource over gifted children "Talents of Russia". Since 2022, the project has been presented in the platform of scientific volunteers [11], and participation in the project allows students to receive hours in the "Personal Volunteer Electronic Book".

In the future, the Environmental Patrol project may become the basis for creating an all-Russian network of school environmental monitoring in the format of citizen science. Moreover, it will allow not only entering new data and analyzing large data already accumulated in the system. The

The participant of the Ecological Patrol project conducts monitoring studies of natural waters.

The participants of the Ecological Patrol project get acquainted with the developments of the Smart Home, which can reduce the negative impact on the environment.

first steps in this direction were taken in 2022 at the International Exhibition "EXPO-SCIENCES ASIA 2022". This exhibition took place from February 20th to 26th in Dubai, and as a result they were awarded a medal [12].

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THE WORLD WILL BE A BETTER PLACE WHEN THE STUDENTS EXCEED THEIR TEACHERS

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Abstract

Increasing interest in the study of physics is stimulated by students' participation in competitions and scientific exhibitions. The teacher's role is to guide and support young people in carrying out projects that represent applications in nature, technology, and research. Identifying the phenomena studied in class in real-life situations is an important step for both the student and the teacher. MILSET ESI represents, for young people and others, a perfect opportunity to build confidence in the minds and hearts of the participants, as well as a chance to interact with wonderful people.

Key words: *students motivation, students encouragement, trust and empathy between teacher and students, youth science contests and conferences*

Being a teacher means to enrich the minds and souls of students with knowledge, to develop their thinking and their sensitivity in perceiving the information around them, and last but not least, to earn their trust and encourage them to identify their passions.

As a physics teacher, I have tried to explain phenomena to them, to support them in identifying these in nature and technology. By stimulating thinking and creativity, there is great satisfaction when you come to know them and identify their interests.

I have studied the Theory of Multiple Intelligences, and found that studying physics stimulates the development of some types of intelligence identified by H. Gardner. I understand that this theory, together with the Theory of Emotional Intelligence written by Daniel Goleman, is important for achieving successful teaching activities.

For seven years, I organized Science in the Park, an activity involving students aged between twelve and fifteen to present experiments, models, and posters in the City Hall Park. There was an atmosphere of trust and joy when they were listened to by the "jury" (older students) as well as by park visitors. We didn't give out prizes, only participation certificates, but all the children were excited, and at the end (especially the younger ones) they had an hour of play in the park followed by ice cream.

Theater group performing at the "Stefan Procopiu" Creativity Contest.

In the year 2000, I discovered the Ștefan Procopiu Physics and Technology Creativity Contest, organized by a group of teachers from Iași, led by Professor Iulian Leahu (a group I joined with great enthusiasm). The contest was designed in alignment with Howard Gardner's Theory of Multiple Intelligences and the concept of creativity, considering that creativity is the peak of intelligence and a condition for authentic learning, meaning the ability to process content through one's own thinking.

The sections of the contest were the following: Written Papers, Laboratory Techniques, Cooperative Groups, Scientific Topic Presentations, Computer-Based Physics, Scientific-Themed Compositions, and Applied Physics. The topics given in the Written Papers section were designed to stimulate the participants' imagination and creativity. There were not problems that could be solved using standard algorithms, but rather theoretical situations with multiple possible solutions.

In the Laboratory Techniques section, groups of three students participated and were assigned tasks related to conducting experiments on natural phenomena. They were asked to study the phenomenon, identify measurement errors, and assess its applicability from their own point of view.

In the Cooperative Groups section, teams of five students created a short film based on a given topic, which was related

to what they had studied in class. The participants used videos and photographs they had taken themselves, showing natural phenomena, from which they selected material relevant to the assigned topic.

In the Scientific Topic Presentations section, participants, either individually or in small teams, presented a topic of their choice related to the applications of physics theory in technology or research.

In the Computer-Based Physics section, participants, either individually or in teams, presented programs for solving problems and virtual experiments.

In the Scientific-Themed Compositions section, students presented literary works, graphics, paintings, or musical pieces they had created, all related to physical phenomena or physicists. I participated in this section with a class of students for three consecutive years, presenting plays they had written, with characters such as physical quantities, phenomena, and famous physicists like Galileo Galilei and Isaac Newton.

In the Applied Physics section, models and mechanisms created by the students were presented.

While I could easily coordinate students in this contest, for the Rosneft competition, I was a supporting teacher. I had a student, Nedea Andrew, who had been passionate about robotics from a very young age. He was in a class where I taught physics, and at one point, when he was about twelve years old, he confided in me that he wanted to create a robotic fly for spying. That's when I learned about his passion, and even though robotics is not my field, I encouraged him to talk to me about robotics and show me what he was working on. He was a self-taught individual.

MILSET Romania delegation at the at the MILSET ESE in Sarajevo

For several years, I participated with him in the Rosneft Competition, organized in Suceava by 'Ștefan Cel Mare' University, 'Petru Rareș' High School, and Signus Society. I was very happy when Nedea Andrew was selected to participate in the ESE in Toulouse. It was my first encounter with the MILSET family, and there, together with Professor Dan Milici, we decided to take the necessary steps to establish MILSET Romania. This is how I managed to participate in ESI Fortaleza with Dima Razvan and Roman Andrei, who built a drone and asked me to support them as their coordinating teacher. I want to emphasize that it's important to understand and support students who know more than you, to trust them, and to offer them opportunities that will stimulate them. The students I participated with in ESI Puebla, Mexico, and ESE Sarajevo were very excited about the exhibition. They exchanged ideas, made friends with whom they still correspond, and had wonderful moments.

I am grateful for having participated in ESE and ESI, for meeting wonderful people, and for learning many new things from the

MILSET Romania delegation at MILSET ESI 2023 in Puebla, Mexico.

young participants. There has always been a festive atmosphere, one of openness, information exchange, and brotherhood. I appreciate the participants in the Olympics and the competitions with prizes. Over the years, I have had students who participated in the National Physics Olympiad, but their successes were mostly due to their own hard work, rather than mine. I have always been a teacher to all my students, regardless of their level or interests, and I have always tried to help them push beyond their limits.

I conclude with gratitude and admiration for the MILSET Family.

BEE MUSEUM-MOROCCO: INSPIRING ECOLOGICAL AWARENESS THROUGH EDUCATION

Abstract

This paper explores the educational and emotional power of immersive museum experiences, with a focus on the Bee Museum in Morocco. Drawing inspiration from naturalists like Réaumur and scientists such as Pierre-Gilles de Gennes, the museum promotes a hands-on, inquiry-based approach rooted in socioconstructivism. From observing bees in transparent hives to engaging in archaeology workshops or exploring reconstructed 19th-century naturalist cabinets, visitors, children and adults alike, connect with science through curiosity and active discovery. These scenes, whether of students fascinated by bees or absorbed in replicating Lascaux cave art, reflect a lasting cognitive horizon shaped by doing, seeing, and remembering.

Keywords: *naturalists, socioconstructivism, hands-on learning, inquiry-based learning, science education, childhood discovery, archaeology workshop, museum pedagogy, emotional learning, cognitive horizon*

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Bee pollinating almond flowers©iStock.

BEE MUSEUM, A BEACON FOR ENVIRONMENTAL AWAKENING

The Bee Museum is a pioneering initiative designed to reconnect people, especially young generations, with nature. Through immersive exhibits, interactive learning, and science-based storytelling, the museum serves as a vital tool in raising awareness about biodiversity, sustainability, and the critical role of pollinators in our ecosystems.

A hundred million years ago, flowering plants, bees, and dinosaurs shared the Earth. Today, the bees are still here, unlike the dinosaurs, which were a billion times bigger. © www.elsabugot.fr/

The Bee Museum in Morocco is more than a building. It is a third place, a hybrid space between home and school, where shamanic tradition meets scientific rigor. Here, learning is storytelling. Action is ritual. Observation becomes meditation. We aim to be a modest yet transformative museum, one that encourages wonder and responsibility.

THE BEE AND THE FLOWER: A 100-MILLION-YEAR CO-EVOLUTION

The interaction between pollinating

insects and flowering plants is one of the most extraordinary examples of co-evolution in Earth's history. Originating during the Cretaceous period around 100 million years ago, bees and angiosperms have developed intricate mutualistic relationships: specialized morphologies and behaviors in bees enable efficient pollination, while flowers evolved colors, scents, and nectar to attract them.

Even when dinosaurs roamed the Earth, bees were already shaping terrestrial life. Today, while dinosaurs are extinct, bees, billions of times smaller, still persist.

ECOLOGICAL AND ECONOMIC IMPORTANCE OF BEES

Bees contribute to the reproduction of over 75% of flowering plants and about 75% of the world's food crops. Their impact on agriculture is immense. In California, for instance, the billion-dollar almond industry is entirely dependent on bee pollination.

In the foreground, a protective hand shelters the bee, a powerful symbol. In the background, a group of kindergarten children exploring the fascinating world of bees.©D. Louaradi-Bee Museum Morocco.

Beyond agriculture, bees also provide valuable natural products—honey, wax, propolis, and royal jelly, used for nutrition, medicine, and even spiritual practices across many cultures.

ANTHROPOGENIC THREATS IN THE ANTHROPOCENE

In recent decades, human activity has deeply disrupted this ecological balance:

- Habitat loss and fragmentation
- Intensive monoculture and land-use change
- Pesticide use, especially neonicotinoids
- Climate change and pollution

These pressures are contributing to dramatic declines in pollinator populations worldwide and threatening the stability of entire ecosystems. Scientists warn we are living through the sixth mass extinction, distinct from previous ones because it is human-driven.

THE ROLE OF ENVIRONMENTAL EDUCATION

Faced with ecological breakdown, education becomes a strategic response. The Bee Museum believes that environmental education should:

- Foster scientific literacy and systems thinking
- Cultivate an emotional and ethical connection to living beings
- Encourage experiential learning through observation, experimentation, and inquiry

Learning about pollinators is not just biology, it is a gateway to understanding the interdependence of life on Earth.

EMOTION AS A PATHWAY TO UNDERSTANDING

I deeply believe that emotion plays a key role in scientific curiosity and ecological responsibility. The Bee Museum's museographic design is based on noble materials such as wood and jute canvas, offering a warm and inviting atmosphere. It seeks to awaken pathos, which in turn can lead to logos: reason and understanding.

Great scientific minds like Pierre-Gilles de Gennes spoke of early emotional encounters in science museums that shaped their careers. Our museum draws from this same principle. When his grandfather took him to the Palais de la Découverte, a spark was lit, a memory that stayed with him, a sense of wonder fully preserved from childhood into adulthood.

A group of kindergarten children exploring the fascinating world of bees."©D. Louaradi-Bee Museum Morocco.

A student is reproducing the drawings from the Lascaux cave, illustrating the principle of learning by doing, during the archaeology workshop at the Bee Museum. © D. Louaradi-Bee Museum Morocco.

Today, behind the glass of the Bee Museum's transparent hives, we hope to enchant visitors in the same way, when they observe the pollen-gathering foragers, the dancing bees mapping floral resources or the hive cleaners removing their dead.

Whether it's a child counting bee legs or a scientist reflecting on the co-evolution of bees and flowers, each visitor departs with a new perspective, shaped by their own cognitive horizon.

LEARNING BY DOING: FROM CURIOSITY TO CONSCIOUSNESS

The Bee Museum aligns with thinkers like Dewey, Piaget, Vygotsky, and Montessori, advocating for "learning by doing", learning grounded in action, reflection, and lived experience. Bachelard highlighted the pivotal role of error in the process of knowledge acquisition. Inspired by the well-known quote often attributed to Confucius , "I hear and I forget. I see and I remember. I do and I understand", the museum promotes a socioconstructivist approach, encouraging learning through hands-on exploration and questioning. This kind of scientific leisure, grounded in curiosity and play, lays the foundation for long-term ecological responsibility.

A PHILOSOPHICAL MOMENT IN BEE MUSEUM'S TRANSPARENT HIVES

For three years, I observed bees daily in transparent hives, just like René-Antoine Ferchault de Réaumur did in the 18th century. Réaumur was a pioneering French naturalist who devoted significant effort to

studying bees and their behavior. He was among the first to document the intricate social structure of bee colonies, their communication, and their division of labor. His detailed observations and drawings laid the foundation for modern entomology and deepened our understanding of these fascinating insects.

Inspired by his work, I witnessed a society driven by instinct, structure, and survival. I saw how deformed drones or worker bees, those with vestigial wings or even a rare "unicorn" bee with only one antenna, were systematically expelled from the hive, sent to what could be called the colony's cemetery. These careful observations reveal the strict natural selection mechanisms that maintain the health and efficiency of the hive.

Do bees know what they're doing? Yes and no. They "know" in evolutionary terms that inefficiency threatens the colony's survival. Yet they possess no human-like consciousness: no empathy, guilt, or memory. Bees are not moral. They are engineered by nature to persist. But will they survive the synthetic poisons, such as neonicotinoids, developed to maximize profits? And if they don't, will Homo sapiens, the sorcerer's apprentice, survive the collapse of the systems bees sustain?

REDISCOVERING HOLISTIC SCIENCE: THE SPIRIT OF THE 19TH CENTURY

In the 19th century, scientists were not specialists, they were philosophical doctors, blending physics, biology, geology, and art. This multidisciplinary mindset fueled major breakthroughs. Today, over-specialization risks fragmenting our understanding

A curious young student peers into one of the museum's transparent hives, closely watching the bees at work. © D. Louaradi-Bee Museum Morocco.

A fascinating journey through time. In 2019, students explored the Bee Museum's reimagined 19th-century cabinet de curiosités. Echoing the holistic spirit of early scientists, the space is filled with diverse specimens: mounted insects, mineral samples, vintage educational posters, antique books, and historical scientific instruments.© D. Louaradi – Bee Museum, Morocco.

of nature. To confront complex global challenges (climate change, biodiversity loss, technological ethics) we must return to systemic, cross-disciplinary thinking.

Rediscovering this spirit is not nostalgic, it is necessary. And this is what we do in the Bee Museum.

THE FUTURE IS IN OUR HANDS

Bees have been survivors for over 100 million years, emerging long before many other species on Earth. Their longevity is a testament to their extraordinary collective intelligence and social organization. Living as superorganisms, bees exhibit remarkable altruism and an advanced division of labor, specializing in tasks such as foraging, nursing, defending, and hive maintenance, long before the principles of scientific management proposed by Frederick Taylor.

Their ability to communicate through dances and pheromones, coordinate complex behaviors, and adapt dynamically to environmental changes demonstrates one of nature's most sophisticated examples of teamwork and self-organization. Yet, despite this ancient wisdom and resilience, their future, and ours, is not guaranteed. The answer lies in our hands: in education, in museums, in shared knowledge, emotional connection, and ethical responsibility.

Let us teach our children not only facts but the deeper wisdom to live harmoniously within nature's limits. Let us build spaces, like this museum, that inspire not just knowledge, but true awareness and consciousness.

Artwork-Motto by D. Louaradi – Bee Museum © Photo Abdelkrim Mokhtari

BRINGING THE COSMOS CLOSER: CREATIVE APPROACHES TO TEACHING ASTRONOMY

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Abstract

In this article I share practical and creative strategies for teaching astronomy in an engaging and accessible way for everyone. Based on real experiences both in the classroom and outdoors. The article explores interactive demonstrations, storytelling, and the use of technology to spread curiosity about our universe. The goal is to make astronomy inspiring, turning it into a journey of discovery for students of all ages.

Keywords: *astronomy education, STEAM, astronomy outreach, hands-on learning, science communication, storytelling in science, remote education, interactive Learning*

CONNECTING WITH THE STARS

Astronomy has this unique ability to awaken curiosity and spark wonder. Since the dawn of civilization, people have looked up at the night sky and asked timeless questions: What are stars made of? Are we alone in the universe? How do galaxies evolve? These questions continue to inspire scientific inquiry today, especially among young minds eager to explore what is unknown. But in a world oversaturated with technology, short attention spans, and the complexities of online learning, engaging students in astronomy requires more than just data: it requires creativity, empathy, and consistency.

Here I share practical tasks I have done to bring astronomy closer to students, drawing from real classroom experiences, outreach presentations, and even remote learning sessions during the COVID-19 pandemic.

MAKING ASTRONOMY TANGIBLE

As we can imagine, astronomy faces a challenge not shared by many other sciences: we are incapable of touching, digging up, or directly interacting with our subject. Celestial objects are unimaginably far away. But with a little creativity, even the most abstract astronomical concepts can become accessible and meaningful. Here I share some ideas I have developed to inspire young students.

A young student explores the phases of the Moon using a flashlight and a foam ball, illustrating how light and perspective affect lunar observations: an interesting introduction to scientific research.

- Simulating Lunar Phases. Here, students can use a lamp or flashlight to simulate the Sun, and a pair of balls of different sizes made of any material to simulate the Moon and the Earth. Or they can even be the Earth themselves and thus have the same perspective, viewing the representation of the Moon as they would from Earth during a specific phase. This helps students understand why our Moon changes phases every 28 days.
- Building a Solar System Model. One of the great challenges for students is to have a clear understanding of the tremendous distances that exist not only throughout the universe, but also here in our solar system. To achieve this, we can bring great distances down to a scale of a few millimeters and centimeters, with celestial objects scaled proportionally, and thus recreate the vast distances that exist in our solar system, thus, helping them understand the concept of astronomical units.
- Visualizing Gravity. A simple activity using a stretched blanket, a large object in the center being the Sun, and small marbles being the planets, rotating and “falling” toward the center, simulating gravitational attraction. This gives them an idea of how gravity is based on the principle of the deformation of space-time

and not a simple "attractive force" that pulls objects in space together in a similar way.

Another approach that can give us excellent results is designing and playing games, like board games or strategy card games. These are not just fun, but also they're powerful learning tools. For example, a card game based on constellations, planets, or famous astronomers can turn a lesson into a playful challenge, where students absorb knowledge almost without noticing. A board game simulating a mission through the Solar System, where players solve real space problems to move forward, builds both teamwork and scientific thinking. The excitement and laughter that come with these games often lead to meaningful conversations and deeper engagement. Through play, students connect with the universe in a way that is enjoyable, memorable, and truly fun!

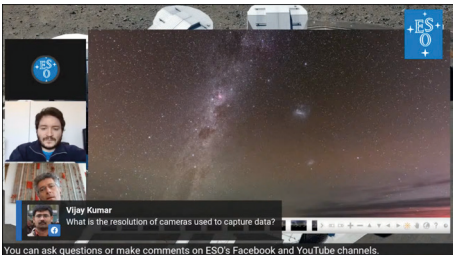
Attempts have the power to humanize science, transforming abstract concepts into relatable experiences that connect with students on a deeper level. For instance, when we tell students about Galileo's first observation with a telescope, we are not just teaching science, we are conveying the human adventure of discovery. Another powerful story I always use is the experiment Eratosthenes made over 2,000 years ago. Without computers or satellites, he measured the size of the Earth with remarkable accuracy, simply by thinking critically about shadows and mathematics. This story not only teaches geometry and scientific reasoning but also shows that anyone can make significant discoveries.

Besides, we can complement these stories by adding real images of celestial objects from observatories like Hubble or the James Webb Observatory. They remind students that the universe is real, beautiful, and waiting to be uncovered, not just through numbers, but with wonder.

The wonder of watching real images from telescopes is only comparable to the wonder of seeing them with our own eyes. Organizing public astronomical observations with telescopes or taking students outdoors to see some celestial events like sunspots, solar eclipses or planetary alignments can truly be transformative experiences. There is something unforgettable about seeing Saturn's rings or the surface of the Moon with your own eyes: suddenly, astronomy becomes real, immediate, and deeply personal. These shared moments of wonder often spread a curiosity that lasts long beyond the event itself. They also create powerful stories that students take home, tell their families, and remember for years. In these moments, science is no longer just a subject to learn; it becomes something to feel, a wonderful experience beneath the stars.

Showing a custom-designed astronomy board game at a science fair to make astronomy an easy learning experience for general people.

Performing observations of the Sun with a solar telescope during a school science outreach event.



Screenshot from a 360° virtual tour of a professional observatory, offering students and general audience remote access to the facilities where modern astronomy happens.

TEACHING ASTRONOMY IN THE VIRTUAL ERA

During the COVID-19 pandemic, there were many challenges in getting together to carry out educational activities, new creative approaches had to emerge through online classes, which were driven via videoconference or in a hybrid format. So, teaching astronomy under these circumstances can be intimidating at first. But it also opens opportunities to connect with students in different ways. One of them, for example, was organizing virtual tours to different observatories in Chile that already had free 360-degree images, like the ESO observatories. This gave a nice opportunity for students to "visit" these facilities at their homes and ask questions in a very interactive way.

In the case of young students, you can complement this virtual experience with some astronomical software such as Stellarium, Starry Night, or Celestia, which simulate the night sky in real time, allowing students to explore constellations, planetary movements, and deep-sky objects as if they were outside under the stars. Within these virtual experiences, we allow people to share spaces for questions, comments, and thoughts, creating a safe space even through a screen. Flexibility, patience, and shared wonder go a long way in turning screens into windows to the universe.

A JOURNEY WORTH TAKING

Astronomy is more than science, it is a connection to something greater. By making it approachable and engaging, we invite students to see themselves as explorers of the cosmos, capable of asking big questions and seeking big answers. Whether it is through storytelling, creative experiments, or digital tools, our job as educators and scientists is not only to teach what we know, but to inspire the next generation to discover what we do not yet understand.

IRS 2023 CHEMISTRY PROJECT.

CHEMISTRY IN SILICO: DESIGN AND PREDICTION OF PHARMACOLOGICAL AND PHARMACOKINETIC PROPERTIES OF NEW COMPOUNDS

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Abstract
The International Research School (IRS) is an interactive summer program that brings together high school students from around the world to conduct fast-paced research projects in science and technology within a stimulating, multicultural environment. The aim of the IRS 2023 chemistry project, titled "Chemistry in silico: design and prediction of pharmacological and pharmacokinetic properties of new compounds", was to computationally design new pharmacologically potential active compounds and to introduce the students to the basic medicinal chemistry concepts and computational chemistry tools. In this project, standard computational chemistry tools, including in silico screening, molecular modeling, and docking, were used to design and evaluate novel ligands targeting the 5-HT2A receptor. Starting from serotonin and the antidepressant trazodone, students generated 52 derivative structures, which were assessed for binding affinity, ADMET properties, and blood-brain barrier (BBB) permeability. Three top candidates (compounds 1–3) exhibited strong binding affinities (IC_{50} = 0.023–3.71 μM), stable interactions with key 5-HT2A active site residues, and favorable ADMET profiles, adhering to Lipinski's rule of five. All three compounds also demonstrated positive BBB permeability and moderate toxicity (class 3 of 6). These findings suggest that compounds 1–3 may serve as promising leads for further development of CNS-targeted therapeutics.

Keywords: molecular docking, 5-HT2A receptor, ADMET prediction, blood-brain barrier (BBB) permeability, drug design

INTRODUCTION

Medicinal chemistry is a chemistry field devoted to finding new drugs with improved pharmacological profile, regarding efficacy and safety. Main stages in the drug development include finding new lead compounds for the desired targets (*in silico* search, molecular modeling, and synthesis), pharmacological evaluation both *in vitro* and *in vivo*, pharmacokinetic studies, and clinical studies. Computational chemistry is an important tool for the early stages of drug development.

The aim of the IRS 2023 chemistry project, titled *Chemistry* in silico: *design and prediction of pharmacological and pharmacokinetic properties of new compounds*, was to computationally design new pharmacologically potential active compounds and to introduce the students to the basic medicinal chemistry concepts and computational chemistry tools. As the target for the drug design, 5-HT_{2A} receptors were chosen, due to their well-known interactions with neurotransmitter serotonin and commercially available antidepressants. 5-HT_{2A} receptors belong to a class of G-protein coupled receptors (GPCRs) and are normally located at the surface of a cell, serving to accept messages from other cells, via neurotransmitters such as serotonin, dopamine, adrenaline etc. The recent breakthrough by Vargas *et al.*[1] showed us that 5-HT_{2A} receptors can reside inside the cell and that drugs interacting with intraneuronal 5-HT_{2A} receptors can improve neuronal networking, thus acting as psychoplastogens (neuroplastogens). Neuroplasticity or neural-plasticity is an important feature to be exploited since it can have various neurophysiological and psychological beneficial effects[2].

Chemistry project test at the International Research School 2023

Given the limited time and the students' different backgrounds in chemistry, the drug design was performed on the basis of structural modification of known 5-HT_{2A} active compounds such as serotonin or antidepressant trazodone, without emphasizing the complex nature of ligand-based and structure-based drug design. Since serotonin is a polar molecule produced in the brain, it does not have to cross the BBB; however, it cannot have the neuroplasticity effect because it can only bind to the 5-HT2A receptors on the surface of the cell. Taking it all into account, it was expected from the students to design chemically correct structures that have acceptable physico-chemical properties to be able to cross the BBB and enter the cell. Pharmacokinetic ADMET profiles (absorption, distribution, metabolism, excretion and toxicity) were calculated for the newly designed structures, as important features in the drug design.

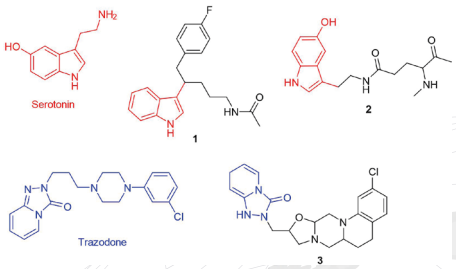
METHODS

All drawings and calculations were done using freeware software, free versions of programs for academic purposes and free

web-based tools. Structures were drawn in Biovia Draw Academic, and molecule editor Avogadro (v. 1.2.0) was used for optimizing energies of the structures and generating the 3D molecular structures of the designed compounds. Polar hydrogens and gasteiger charges were added by AutoDock Tools (v.1.5.7). The crystal structure of 5-HT$_{2A}$ was retrieved from the Protein Data Bank (PDB) (www.pdb.org, PDB ID:6A93). Protein structure was prepared for the docking analysis using ChimeraX (v. 1.6.1). This procedure included deletion of solvents and ligands from the PDB files. The addition of hydrogens and Kollman charges to the structure and a process of energy minimization were performed in AutoDock tools (v.1.5.7). Molecular docking was performed using the Autodock VINA algorithm, and nine distinct poses were generated for each molecule as previously described in literature. The most stable complexes' conformations were selected as the most favorable, and their interactions were analyzed and visualized using Discovery Studio software (v.20.1.0.19295). ADME properties were calculated on the SwissADME web-based platform. Toxicity of the designed compounds was predicted with Pro-Tox II web-based prediction tool. BBB permeability was calculated by CBLigand-BBB prediction server.

RESULTS AND DISCUSSION

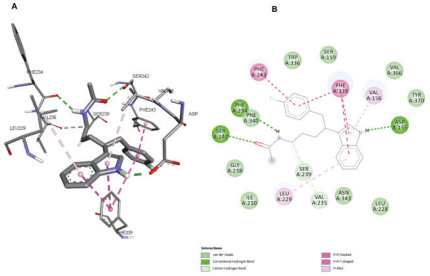
The standard computational chemistry tools such as database search *(in silico)* and molecular docking were used to design new structures and to calculate their binding affinities towards 5-HT$_{2A}$. The main tasks during this project were: *in silico* search, molecular modeling i.e. structure design, molecular docking, ADME prediction, data analysis, and presentation. As starting structures that aimed to be improved during this project, serotonin and commercial antidepressant trazodone were used. Students designed new structures based on the structures of these compounds by changing the molecular scaffold according to the desired interactions with the target protein. A total of 52 structures designed by the students were evaluated for their binding affinity with 5-HT$_{2A}$ by molecular docking tools. Three of the most successful candidates regarding the binding affinity and ADMET properties are presented in Figure 1. Compounds **1** and **2** are serotonin derivatives, while of the trazodone derivatives, compound **3**, showed highest 5-HT$_{2A}$ binding affinity (Table 1).



Structures of serotonin and trazodone, and the most potent newly designed compounds

The docking analysis revealed high calculated binding affinities of **1-3** (IC_{50}=0.023, 3.71, 0.488 μM, respectively) binding interactions with 5-HT$_{2A}$ comparable to serotonin. In general, compounds **1-3** produced stable complexes with 5-HT$_{2A}$, most of which were supported by hydrogen bonds with active site residues. Ser242, Phe234, Asp155 (**1**); Ser131, Leu229 (**2**); and Asn110, Asn384 (**3**) were the active site residues that interacted

with **1-3** ligands in this manner. All ligands were further stabilized in their complexes with 5-HT$_{2A}$ via numerous hydrophobic interactions such as π-π, π-alkyl, π-anion, attractive charges and halogen interactions. The superior affinity of compound 1 can be attributed to additional hydrogen bonds and two π-π stacked interactions with Phe243 and Phe339, which were not observed in **2** or **3**. Interactions of the compound **1** that showed submicromolar affinity toward 5-HT2A are depicted in Figure 2.



A) 3D and B) 2D illustrations of interactions of 1 with the target enzyme (PDB: 6A93)

ADMET properties were calculated for all of the designed compounds and it was found that most of the compounds possess favorable pharmacokinetic properties, especially concerning Lipinski's rule of five, as an empiric rule for determining the druglikeness. For potential new orally active drug, this rule suggests molecular weight (MW) less than 500 Da, a number of hydrogen bond acceptors (HBA) less than 10, a number of hydrogen bond donors (HBD) less than 5, a water/octanol partition coefficient (Log*P*) less than 5. As it can be seen, compounds **1-3** obey Lipinski's rule of five with favorable pharmacokinetic properties (Table 1).

The permeability of the BBB is crucial for drugs designed to specifically impact the central nervous system (CNS). To address this concern, we utilized the CBLigand-BBB prediction server to calculate the BBB permeability of the most active derivatives. As indicated in Table 1, all computations for the compounds **1-3** resulted in a positive BBB permeability, which is essential for compounds aiming to target 5-HT$_{2A}$ receptors, particularly within neurons.

TABLE 1. CALCULATED 5-HT2A BINDING ENERGY AND AFFINITY (IC50) AND ADME PROPERTIES 1-3

Cmpd	Binding energy (kcal/mol)	IC$_{50}$ (μM)	MW	HBA	HBD	Gla absorption	BBB permeability	CLogP[b]	Predicted LD$_{50}$: (mg/kg)
1	-10.4	0.023	338.41	3	1	High	Yes	3.48	200
2	-7.4	3.707	452.38	3	4	High	Yes	2.41	200
3	-8.6	0.488	411.88	4	0	High	Yes	4.57	290

[a]gastrointestinal absorption
[b]Calculated Log*P*

The toxicity of newly designed compounds was predicted using ProTox II web-based prediction tool. According to ProTox II, compounds **1-3** were positioned in toxicity class 3 of 6, where class 6 is considered non-toxic (Table 1). This average toxicity is not unusual in synthetic drugs, however some improvements in the drug design of **1-3** compounds could be made. Overall BBB permeability and ADMET results together with the high calculated affinities of newly designed compounds during this project make them potential lead compounds for further drug development.

CONCLUSION

Several methods of computational chemistry have been studied. New potentially active compounds have been designed and interactions with 5-HT_{2A} were analyzed. The ADMET properties of newly designed compounds have been calculated. Three of the 52 designed compounds showed high 5-HT_{2A} binding affinities, favorable ADMET properties and BBB permeability, which designate them as potential new lead compounds for the drug development. Students became more familiar with medicinal and computational chemistry tools and terminology.

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USING STEAM PROJECTS AND ROBBO-CLASS CAPABILITIES AS A MEANS OF DEVELOPING STUDENTS' RESEARCH SKILLS IN BIOLOGY CLASSES

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Abstract

The article discusses the use of STEM projects and ROBBO-class capabilities as a means of developing functional literacy in biology classes. The use of a ROBBO class enhances the interdisciplinary nature of students' activities and the practice-oriented nature of tasks. Based on the prototyping of the ROBBO class, models of biological objects are made for practical testing of hypotheses, which develops students' skills to apply interdisciplinary knowledge in real conditions, to communicate constructively.

Keywords: *STEM project, ROBBO class, functional literacy, interdisciplinary communication, practice orientation*

If students are unable to apply their knowledge in a real situation, undoubtedly, the whole educational process loses its meaning. The application of knowledge only according to the algorithm learned within the framework of studying one academic subject is not enough. According to the UNESCO's World Report, "cognitive sciences are multidisciplinary, their contribution ... is not limited only to algorithmic aspects of information processing" [6].

The ability to solve diverse interdisciplinary tasks makes it the basis of competence and professional competitiveness of a person: the ability to study throughout a lifespan.

Focusing only on changing the contents of education will not create conditions for the development of skills that are components of functional literacy, which is recognized as a strategic task in the field of education [1]. The national strategy for sustainable socio-economic development of the Republic of Belarus (until 2030) defines the need to transition from education: when the acquired knowledge and skills meet the rapidly changing requirements of society and economy, techniques and technologies ensure the development of personal initiative and adaptability of a person.

From 2019 to 2022, gymnasium No. 50 in Minsk was included in the republican innovative project over the implementation of the STEAM education model. My pedagogical observations have shown that research activities in pedagogically organized problem situations help students overcome the isolation of thinking within the boundaries of the logic of one academic subject.

In the STEAM project *Bridge*, students learned to select the necessary tools themselves, and decided why death occurs at the slightest scratch by an arrow smeared with curare poison.

Preparation for the STEM project Bridge

The creation of subjectively new knowledge for students required more time, since a lot of mistakes were made. The effectiveness of the teacher's explanation of the mechanism of conducting a nerve impulse through neurons and the features of the synapse would undoubtedly be higher in terms of time and effort. But working on a problematic issue, students overcame the narrowness of subject-centered thinking, realized the interdependence of natural phenomena, and developed subject and meta-subject skills. Sergey Rubinstein's remark is very accurate, that a person assimilating already acquired knowledge should still discover them for himself, since "a person really owns only what he obtains by his own labour."

Critically comprehending and interpreting information based on modeling, students considered the possibilities of restoring the synapse. During the implementation of STEAM projects, students realized the need for cooperation at various levels. The organized research

activity of students involves teaching them the ability to communicate constructively not only in the *student-student* and *student-group* variants, but also at the *teacher-student* level, since this is required by the interdisciplinary practice-oriented nature of the activity.

Since biological objects are hierarchically complex subordinate systems, visualization facilitates their understanding. The use of modern digital technologies contributed to the development of students' information competence. But the possibilities of information technologies are not limited to this. Thus, the electronic digital laboratory, which is a part of the ROBBO class, allows you to use the measurement results as a proof of the hypothesis put forward. The processing of measurement results is facilitated by the built-in software, while the results are displayed on the screen in the form of graphs or statistical analysis. This optimization of the processing of the received measurements allows students to get away from the routine complexity of processing the results, which takes a lot of time. The process of research activity is optimized, students have the opportunity to make adjustments to hypotheses promptly, and change the conditions of the experiment.

The presence of a ROBBO 3D printer makes it possible to produce models based on prototyping for practical testing of hypotheses. The production of prototype models using 3D printing increases the motivation of students, expands the

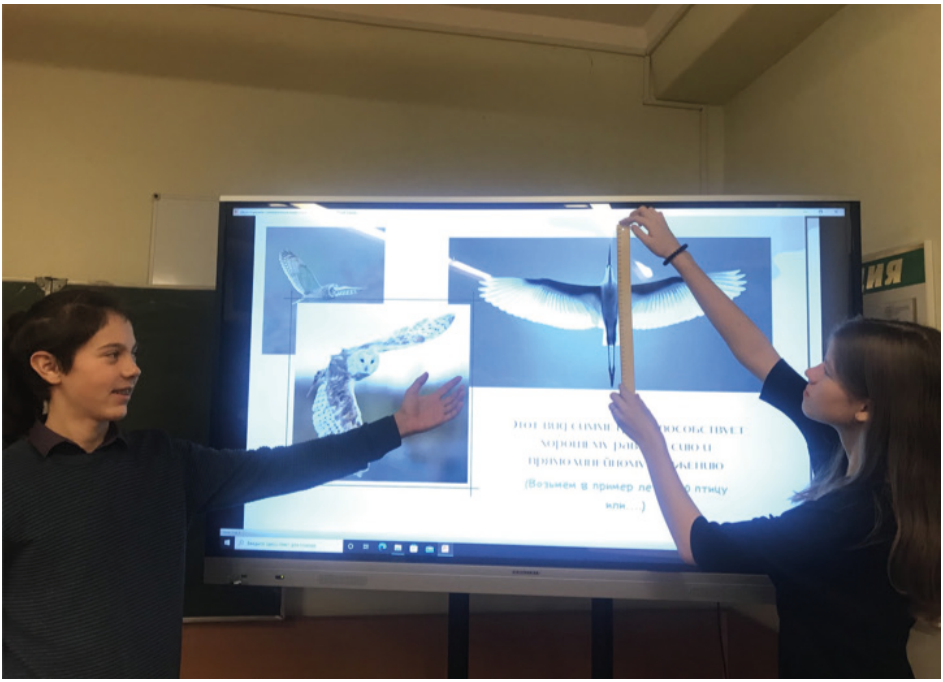

Figure 2. Presentation of the STEM project Snowflake

interdisciplinary nature of activities, and strengthens the practice orientation of tasks.

An integrated approach is a prerequisite for the success of the project. The didactic basis of STEAM education is problem-based learning, which provides a purposeful sequence of cognitive actions of students to solve a problem. [2, pp. 22-31]. The entertaining formulation of a problematic question, which contains a contradiction, and its level of complexity accessible to students increases the motivation of students [5, pp. 50-52].

Project training is a technological basis of STEAM projects. It is characterized by interdisciplinary and integrative nature and therefore helps overcome the limitation on the formation of a holistic worldview, which is imposed by the division of knowledge into subject areas. [3, pp.50-57].

The use of capabilities of the ROBBO class enhances the practical orientation of tasks, their situational nature. By highlighting the essential features of an object that can be monitored, students, in fact, master the basics of modeling. The capabilities of 3D prototyping and 3D printing inherent in the ROBBO class make it possible to put models into practice, and the use of a set of sensors of the ROBBO class electronic laboratory allows measurements to be carried out using the created model.

Students in the 9th grade, working on the STEAM project *Ball*, considered the shape of bird nests from the standpoint of the efficiency of heat preservation, reflecting on the ratio of surface area and volume. Discarding insignificant details, which is modeling, students solved the problem based on the integration of knowledge in biology, physics, and mathematics. This allowed the students to see not a fragmentary, but a unified picture of the world. Using the capabilities of the ROBBO class allows you to move from thought-experiment theoretical calculations to a practical measurement of heat loss in nests of various shapes, and confirm the conclusions in practice.

The ability to quickly process the obtained results, embedded in the ROBBO class thanks to its software, helps students to evaluate the results fast. After reflecting on the achievement, if necessary, the hypothesis and the conditions of the study are adjusted. The development of research culture is impossible if students are only evaluated through reproducing the educational material in the textbook, or during the teacher's monologue.

Figure 3. Group consultation of the STEAM project Ball

The use of STEAM projects and ROBBO class capabilities in the classroom or in extracurricular activities involves students in research activities, developing the ability to put forward hypotheses, analyze information, give arguments, make conclusions, determine the boundaries of the application of experiments. Independent mental activity of a searched

character also causes personal experiences of students, forms a personal, caring attitude to the educational material and the learning process [4, pp.21-29].

In this case, the life experience of students becomes a source of new knowledge, the basis for the implementation of learned ways to solve problematic issues in research activities.

The creation of real models taking into account the morphological and anatomical features of biological objects makes the process of teaching biology more dynamic, helps conduct experiments based on them, and allows them to realize the "completion" of educational content has to do with an integral system of knowledge and skills.

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TEACH WHAT YOU ARE

INTERVIEW WITH JEAN-CLAUDE GUIRADON

Abstract:

This article features an exclusive interview with a living legend in the field of youth science engagement: Jean-Claude Guiraudon — former President and current Honorary President of MILSET, and most importantly, one of the organization's founding members. As a key witness to the birth of a global movement, he reflects on the origins and evolution of MILSET and the emergence of a new culture centered on scientific and technical activities for young people. In this conversation, Jean-Claude shares how he first discovered youth science initiatives, what inspired him to champion their promotion, how MILSET was founded, and who the influential figures were in shaping its path. His insights offer a unique perspective on the power of international cooperation and non-competitive scientific expression among youth. The interview was recorded in October 2023 in Puebla, Mexico, during the MILSET Expo-Sciences International 2023.

Keywords: *youth science activities, science clubs, project based learning, non-competitive exhibitions, Expo-Sciences, international cooperation, MILSET*

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Jean-Claude Guiraudon at the ESI 2023 Cultural Evening. Puebla, Mexico.

Jean-Claude Guiraudon and Gerard Gautier at the MILSET ESI 2023. Puebla, Mexico

WHEN, WHERE AND HOW DID YOU FIRST DISCOVER THE SCIENTIFIC AND TECHNICAL ACTIVITIES OF YOUNG PEOPLE? AND DID YOU WANT TO TAKE PART IN IT? WHO INVITED YOU?

My first contact was when I was teaching students at the *Ecole Centrale d'Electronique* (ECE) from 1961 on, on my return from seven years' service in the French Navy. With a group of students, we formed the rocket club GETS (*Groupe d'Etudes de Télécommunications Spatiales*), which led us to join the *Association Nationale des Clubs Scientifiques* (ANCS), chaired by Inspector General [of National Education ministry] Louis Couffignal.

This new organization, created in 1962, was supported by the French *Centre National d'Etudes Spatiales* (National Space Center) and the Ministry of Youth and Sports. It was a member of the organization CIC (*Comité Intérimaire de Coordination, Interim Coordinating Committee*), an association under Belgian law, whose Secretary General was Francis Wattier, and which was accredited by UNESCO.

In November 1964, the Youth Commission of the *Council of Europe*, where France was represented by Colonel Maurice Troyes, decided to hold a meeting of Science and Technology organizations in Strasbourg, its headquarters, under the coordination of the CIC. The aim of this meeting was to examine how it was possible to support the activities of youth in the field of science, environment and culture.

As the General Secretary of the *Association Nationale des Clubs Scientifiques* (ANCS), Roger Blauwart, was unable to attend (it was the November vacations), I stepped in as an emergency replacement, thus entering the international footbath. Despite my poor English, I managed to fit in.

There were more than fifty associations from Belgium, Czechoslovakia, France, Poland, Portugal, Rumania, Spain, Yougoslavia… It was mainly European at this

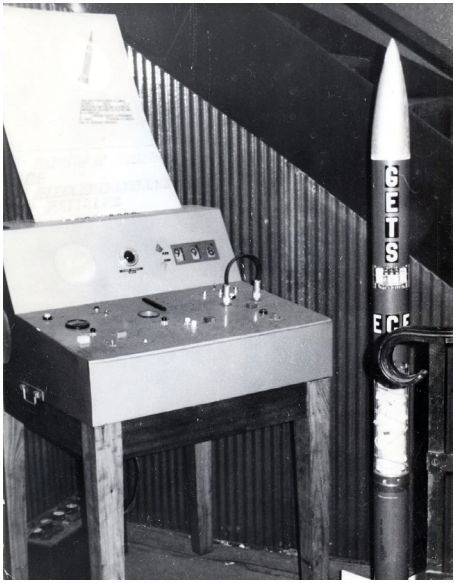
time, but there were also Algeria, Morocco, Tunisia, Argentina, USA and Canada. The majority of countries involved in the Committee were French-speaking.

Discoveries, acquaintances and emotional bonds were made, and in particular I fell in love with the Tunisian team, led by Abdel Hamid Fekhi, on behalf of the *Association des Ingénieurs et Techniciens Tunisiens*.

The following three events, all cardinal moments for me, would lead me to throw myself into the swimming pool's adult bath.

First, in 1965, André Thirion and I went together to Tunisia to visit their laboratory club, with the support of the French Ministry of Foreign Affairs. The Tunis laboratory club program was under the responsibility of Beji Sansa and was coordinated by Thirion, président of the French *Club Jeunes Sciences*. The French Ministry paid for our mission and also gave some funding to the club.

Then, in 1967, during the *Montréal International and Universal Exposition*, the Young Canadian Scientists organized the *Congress for Extracurricular Scientific Activities*, where I led a French delegation of 70 young students and tutors. This Congress was the moment when the CIC transformed itself from an *"Interim"* into an *"International" Coordinating Committee*, thus considerably broadening its geographical coverage. This second event also brought national benefits for us, with the creation of the *Fédération Nationale des Clubs Scientifiques* (FNCS), which was to be headquartered inside the *Palais de la Découverte* ("Palace of Discovery"), in the framework of a new "Youth Section". The president of the FNCS was the Director of the Palace, Mr. Jean Rose. In the day-to-day operations, the FNCS and the Palace's Youth Section were actually indistinguishable.



A rocket : First rocket of the GETS Rocket Club, launched in July 1967.

Youth and Space Conférence, Marly-le-Roi (France), 1972. Foremost left is the Sovietic cosmonaut Yuri Khrunov, in discussion with (from left to right), Jean-Pierre Quétard, the ANCS Président, Jean-Claude Guiraudon, Michel Bigner, and Marcel Lebaron.

The third event was the *Youth and Space Conference* (Conférence "Les Jeunes et l'Espace") of 1972, co-organized by the CIC and the ANCS, *Association Nationale des Clubs aéro-Spatiaux*, whose first President was Mr. Pierre Quétard, a high-level executive of *Matra* Space Division, who

was to get fast drawn into the youth space activity and would keep the function for years.

This was the first initiative specialized in rocket clubs, an immediate consequence of the space race between the United States and the USSR. The work of this meeting was very fruitful, since it is on this occasion that fifteen associations came together in a new international association under French law with Mr. Diegmann, president of the German organization DGLR, as president. The vice-president was Mr. Lips, from the NERO club (Netherlands), and the general secretary, Michel Hallet (Belgian aerospace club). Hervé Moulin, pioneer of the French clubs, achieved the feat of bringing the Komsomol from the USSR with cosmonaut Yuri Krounov, the first man to change Sputnik, as its top star. Henri Têtu, treasurer of the French ANCS, also became very active in this initiative.

WHAT WAS YOUR PERSONAL CONTRIBUTION INTO MILSET DEVELOPMENT?

My personal contribution was when, around the 60s, I started to work with the youth and science associations in the framework that I have just described, with the CIC and my presence in the 1964 Strasbourg meeting.

After the General Secretary of the CIC suggested that I participated in these activities, we prepared our participation for the *International and Universal Exposition* in Montréal (Canada) in 1967, which I have already mentioned. Specifically, in the framework of this *Universal Exposition*, we decided to prepare an *International Congress about Science and Technology for Youth*. We went to Montréal with the French delegation, which was mainly comprised of my students. At that time I was a teacher of mathematics, physics and chemistry in the *École Centrale d'Électronique* (ECE) (an electronic engineering school in Paris). We started new cooperation with Canada mainly. I developed bilateral cooperation with other countries. I pushed the French association to enter the international field.

In 1978 the General Secretary of CIC died and the organization faced some problems, international cooperation went down. It became clear that it would not be possible to restart this organization.

The year 1985 was proclaimed by the United Nations as an *International Youth Year* (IYY), and in my mind came the idea to organize a big youth event in France in 1985, and took the opportunity

Jean-Claude Guiraudon at the Youth Congress "Assises de la Jeunesse". Toulouse, 1985

of this proclamation that was supported by UNESCO, too. At the beginning of the 1980s, we started a new structure with an international vocation, with the aim of preparing this event. It was the CIRAST, for "Collectif International pour la Réalisation d'Activités Scientifiques et Techniques", in English *International Collective for Realizing Science and Technology Activities*.

Under this framework, we prepared and organized an event, which we called *Youth Congress*, in French "Assises de la Jeunesse", to be held in Toulouse, a very high-tech city in Southern France. We projected the event as *a non-competitive youth projects exhibition* and in fact it became a prototype of the future MILSET *Expo-Sciences International*.

Some of the organizations that came to Toulouse were older contacts, but mainly the organizing committee established new relations with youth organizations from all over the world to invite them to this expo. It did not have several African countries participating, such as Cameroun, Gabon, Sénégal.

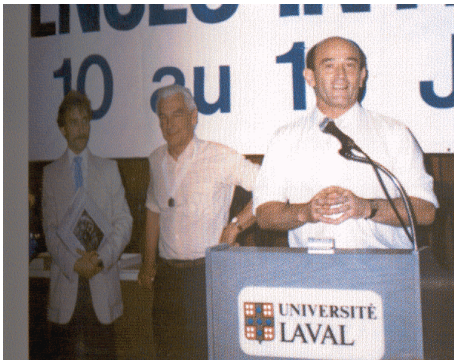
The preparation was done in very close cooperation with Québec, with its "Conseil de développement du loisir scientifique" (CDLS), and we got the support of the bilateral organization OFQJ (*Office Franco-Québecquois pour la Jeunesse*, French-Québec Youth Bureau). Another important partner for preparing Toulouse congress was the *Arab Union for Science Clubs*, then chaired by Mr. Hassen Akrout (Tunisia), and whose General Secretary, Mr. Beji Sansa, was also from Tunisia.

We obtained strong support from French national and local authorities, from Ministries of Youth, Culture, and Research, to the Toulouse municipality. One sign of this support is that the President of the recently created *Cité des Sciences* in Paris–La Villette, Mr. Roger Lesgards, was President of the Toulouse Congress, as well as becoming Honorary President of CIRASTI (at one point, CIRAST changed name to become CIRASTI).

What was very important is that the event operated a complete change of paradigm, switching from the Congress format (where participants, mainly educators or teachers, were just talking on different topics) to the Expo format, in which youth science projects were shown. With it, educators were still present, but they became "accompagnateurs" (escorts, companions), and the focus shifted on to the young people themselves. Another change from previous "Olympiads"-type events was the *non-competitive* orientation. So this change of paradigm could be considered as my personal contribution, I think.

During this big congress with thirty participating countries, it was decided to create within two years a new international association. For this reason, some kind of committee was set up in the framework of CIRAST to prepare the creation of this association. And it was planned to hold a big congress two years later, in 1987 in Québec, Canada. Again, the preparation of this Congress was done in close cooperation with Québec CDLS, with its Director, Michel Bois, being very active.

It is in this congress that MILSET was formally created. The decision to create MILSET was made in Toulouse in 1985. What is interesting is that in this kind of committee which prepared the creation of MILSET you



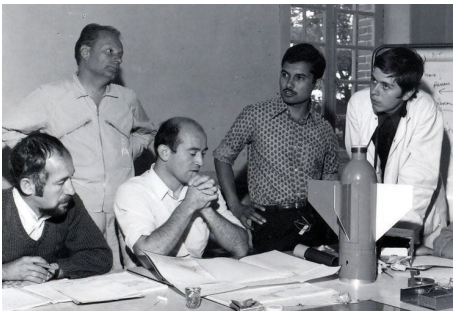
MILSET Creation. .ESI '87. Quebec, Canada

find Canada, you also find Tunisia and you find France with Jean-Claude.

The CDLS and the Congress benefitted from an important support, including a financial one, from Québec hydro-electric company, *Hydro-Québec*, and it was actually Maurice Huppé, Director of *Hydro-Québec* Research Center, who was elected the first President of MILSET during the association's founding General Assembly. As President of the *Kuwait Science Club*, Adnan Al-Meer, who had participated in its creation, entered the Board of the new association. It must also be noted that it was Michel Bois, General Secretary of CDLS, who suggested the name MILSET for the new structure and had it adopted during the founding General Assembly.

WHY DID THE IDEA OF PROMOTING SCIENCE AND TECHNOLOGY ACTIVITIES AMONG YOUTH IN DIFFERENT COUNTRIES BECOME SO IMPORTANT FOR YOU?

I was a teacher in ECE for eight years and I had created a Rocket Club in the school. What I think is that, when you are a teacher, you do not teach students the contents only, you actually teach them what you are; that is, if you have a good relationship with your students. You just *show* them what you are, you teach them motivation, personality, you teach them how to manage, you give them your example. You teach not only the questions. You should not bore or bother the people when you teach them. This is a specific relationship to students, not just teaching formally, but being *with them* and motivating them to develop themselves. I wanted to expand this model to extra-curricular activities; the format of the Expo-Sciences motivated people to do things by themselves, not just to repeat as robots things after the teacher.



Discussion about à rocket project, probably in La Courtine summer rocket camp end of the 60s. From left to right : M. Lebaron, Head of CNES Youth Section, his supériorité in CNES, Colonel Laty, J-C Guiraudon, the technician of the SEP and a youth from the project team.

What happened is that I was actually just answering requests from students. As I had good contact with them, I started to do other activities with them. For instance I played football with my students, and at one point the students came to me and asked me, "why don't we do something technical together?" And then the first school "rocket club" in France came true. This is the way to listen to what the people you are teaching want, not just to tell them to keep quiet because there is a programme to follow.

What I witnessed. I spoke before about this paradigm shift in education that happened with the CIC, when the Congress changed its format to become the *Expo-Sciences*. When you compare the formal teaching with the club activities, where the students have their own projects, they want to lunch a rocket, they want to build a telescope, they want to make a study that is interesting for them, then you can see that the club activities are ten times more efficient for learning, because learning is the self-personal process. This is how I came to

Tents :Launching campaign during the 60s or 70s in the military camp of La Courtine. M. Lebaron and JC Guiraudon can be seen with the participants.

this idea, how I should make this a better model. I got the students to do projects that they liked, and I saw that when they were really engaged in their research, they learned a lot better than when they were doing class work, exams or whateve.

That was the reason why I promoted this model. I saw that during the traditional classroom education the teacher is the only source of knowledge, the only reference for the students, but during club activities the students themselves and their projects become the source of knowledge and the reference. Moreover the life of school children is not limited to the walls of the school, they have their own personal life outside of school, there are parents, and there is also the society.

And one of the key features of the project activity is also that at the end of the project students have to report and to show to society what they have done. The students of the rocket club get out of the walls of their club to show what they have accomplished, which means that the school itself is opening. So the Expo-Sciences model becomes a model for open education.

Beyond this educational aspect of the project method in the disciplinary field, there is also, I believe, another benefit: the development of a more general interest, an awareness of problems. For instance, nature activities certainly teach things on how the environment works, but they also help develop an interest for the protection of the environment.

PLEASE TELL US ABOUT THE MOST IMPORTANT PEOPLE FOR YOU IN THE HISTORY OF MILSET. WHICH OF THE FOUNDERS HAS BECOME A SIGNIFICANT PERSON OR ROLE MODEL FOR YOU AND WHY?

You know, there are a lot of people, everyone who has been involved. That is why this question is difficult to answer. I must answer: “Everyone, because I learned from everyone”.

The first important person for me in France was Mr. Maurice Troyes, who was responsible for education in our French ministry of Youth and Sports. Actually this person has not been in direct relation to MILSET, but he has remained a reference for me, he has been important for me, not because of what he was doing, what he knew, what he was in charge of, but because what he was and how he was behaving (it is exactly what I mentioned before when I spoke about being a teacher…)

I have already mentioned Mr. Roger Lesgards. He was the director of the National Space Center, and totally devoted to youth science activities. He was the boss of Marcel Lebaron, who was pushing things to help rocket clubs. When the present National Science Museum was created, the *Cité des Sciences* (City of Science) of La Villette, Mr. Lesgards became its first President.

Roger Lesgards was working with

me for the national rocket activities, the science clubs. I already mentioned his role in supporting the 1985 Toulouse Congress, so he lent his shoulder in a very important moment, but I should add he has been a very important actor in the field of education in France, and also did a lot to bring funds to MILSET.

Another of the firsts was Mr. Pierre Quétard. He was a French industrialist, the General Director of *Matra Space*, a very important French Space company, and he chaired our French association of rocketry science, *Aerospace Clubs Association* (in French *Association Nationale des Clubs aéroSpatiaux*, ANCS), which was a part of the French *Fédération Nationale des Clubs Scientifiques*, FNCS, *National Federation of Science Clubs*), although on the field they were working much together and became integrated. However, Mr. Quétard was a very good example of someone who took responsibilities in education and devoted much time to it, and he did a lot as a volunteer, while being a high level and a very busy person.

Mr. Jean Rose helped me, from his position as Director of the *Palais de la Découverte* (Palace of Discovery) in Paris, the first National Science Museum in France (at the time, the present National Science Museum of La Villette did not yet exist). Mr. Rose was also the president of the *National Federation of Science Clubs* I just mentioned.

I should also mention several people in the French National Space *Center*, *the Centre national d'Etudes Spatiales* (CNES). At one point, there was a big problem in France with several young people trying to build rocket propellers, and blowing themselves up. CNES could have limited itself to forbid any such activity, but what was decided instead was to have also an educative action, by giving a framework to youth rocket activities, develop a new line of propellers that could be given to young people, and ensure the security of the launching campaigns. The Director General of CNES, Michel Bigner, appointed Ms. Élise Blosset to establish a *Youth Section inside* CNES, and she did it very well. Jacques Delaunay was the first head of this *Youth Section*, afterwards succeeded by Marcel Lebaron. Marcel to me has been a friend and a very important person. I'm speaking about people in France, because first I'm thinking about my country, from where I started activities. From France I should also mention Jean-Pierre Trillet.

Image 8. Welcoming the South African Delegation at ESI 1995: Jean-Claude Guiraudon with Derek Gray and Carole Charlebois.

If we go on over Canada, I should mention Michel Bois and Carole Charlebois. Roberto Hidalgo in Mexico. Then Adan Al-Meer and Dawood Al-Ahmad in Kuwait, they have always been together. Enrique Padilla from Argentina. I should also mention Derek Gray from South Africa. At the time, the country was still under *apartheid*. But when Derek and his wife Rosemary came for the first time to a MILSET *Expo-Sciences*, they managed to put together a mixed delegation, gathering black and white people together. In *apartheid* time, it was really a crazy idea, it was very dangerous.

When the South African delegation entered the stage the first day, all the youth of the other countries spontaneously applauded. Derek Gray became a very good example for me.

I should also mention Stanislav Medričky, from Czechoslovakia, who was present at Québec for the founding GA, and from France, Albert Varier, for the *Centres d'Entraînement aux Méthodes d'Éducation Active* (CEMEA, Training Centres for the Promotion of Progressive Education), and Hubert Gourichon, for the *Francs et Franches Camarades* movement.

Then we have a lot of people from other countries as well, but it is difficult to put them in any kind of order.

Jean Claude is asking Ksenia to ask Adnan Almeer the same question.

MILSET Executive Committee meeting held in Jordan during ESA Asia 2014.

ADNAN AL-MEER: Many of the founders are no longer involved in the development of the organization, they were there and then they vanished, they are not with us anymore. Only Jean-Claude and I are still here. And of course, Carole Charlebois. This is the real MILSET now *(looks at Carole)*. You don't have this organization, you don't have these rules, you don't have these meetings, you don't have an exciting family. Before, meetings took place once every six months or even less frequently. Now they are held regularly. You see the quality of *Expo-Sciences*, you see the regional activities. You see people that are working, working, working. And they enjoy it. That's it.

JEAN CLAUDE: How many people has he mentioned?

ADNAN ALMEER: Only two. You *(looks at Jean-Claude)* and Carole. They are the most important.

KSENIA: And you, Adnan

ADNAN: I can't say about myself. Jean-Claude is at an age now. But he managed to build MILSET. You know, he took everything in a very personal way and with so much enthusiasm. He hosted everybody from North Africa in his house, he invited us there in his house. He organized the MILSET office in the *City of Science* in Paris, and he made the whole thing work.

And Carole. She is retired, but she is still working very hard. When people retire, they are usually enjoying life, but she works every day.

And more people that I should mention: Roberto as a president, and you, Ksenia, and Antoine from Belgium and also Dawood who is organizing everything in Kuwait.

Image 10. MILSET Honorary President Mr. Jean-Claude Guiraudon and MILSET General Secretary and Treasurer Mrs. Carole Charlebois received the MILSET grand prize medal during the "Youth Successes" forum opening ceremony for their great efforts, unlimited generosity and sincere dedication to the organisation. Kuwait. April 2018

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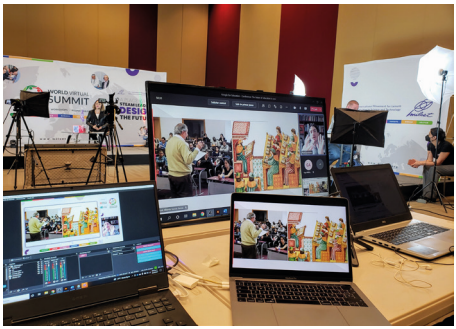
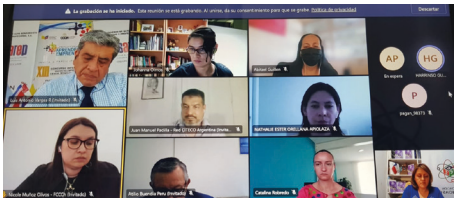
STRATEGIC VISION: CHARTING MILSET'S COURSE TO 2029

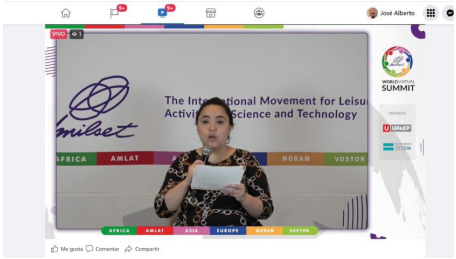
Abstract:

This article introduces the MILSET Strategic Plan for 2024-2029, developed through a collaborative, two-year process involving regional offices, member organisations, and the Executive Committee. The plan was shaped by a global SWOT analysis and discussions at the 2021 MILSET World Virtual Summit, then refined by a Strategic Planning Committee into six focused priorities. Presented at the 2023 General Assembly in Puebla, Mexico, the plan outlines MILSET's vision, mission, and strategic goals, each supported by operational objectives. It sets a clear path for strengthening global impact in STEAM education by 2029.

Keywords: *Strategic Plan, STEAM Education, SWOT Analysis, SMART Goals, Key Performance Indicators (KPIs), Youth Engagement, Global Collaboration*







MILSET World Virtual Summit 2021.

The International Movement for Leisure Activities in Science and Technology (MILSET) embarked on the development of its 2024–2029 strategic plan in September 2021. This process began with a comprehensive SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis undertaken by its regional offices to identify key issues requiring strategic attention.

A pivotal moment in this process came with the MILSET World Virtual Summit, held from 25 to 29 October 2021. The summit featured a series of thematic round tables that explored the future of MILSET, beginning with a reflection on the founding vision of Jean-Claude Guiraudon. These discussions delved into the motivations of young participants, mechanisms for enhanced collaboration among members, the promotion and reach of MILSET's activities, current challenges faced by STEAM-focused organisations, and an overview of global STEAM methodologies. The summit concluded with a final session synthesising the insights and aspirations gathered throughout the week.

The outcomes of the summit were

consolidated into a report entitled "MILSET Future Drawn by the Regions". This document included an integrated SWOT analysis and put forward 14 strategic goals and 49 associated actions spread across ten pages.

However, effective strategic planning demands focus. Ideally, a strategic plan centres on three to five priorities, each supported by SMART goals — Specific, Measurable, Achievable, Relevant, and Time-bound — along with clear Key Performance Indicators (KPIs) to track progress.

To translate vision into measurable progress, a Strategic Planning Committee was established, comprising representatives from each MILSET region. Their mandate was to refine and consolidate the many proposals into a focused set of strategic priorities — a task they accomplished through a series of virtual meetings and collaborative discussions.

Over the subsequent two years, extensive collaboration across MILSET's network led to the development of a pragmatic and impactful strategic plan. The final version was presented at the MILSET General Assembly during the 2023 MILSET Expo-Sciences International (ESI), hosted in Puebla, Mexico. At this assembly, the Executive Committee introduced the six strategic priorities guiding the movement through 2029 and encouraged all regional offices and member organisations to align their own planning with this unified direction.

Since then, MILSET's staff, Executive Committee, and regional offices have collaborated annually to define a set of strategic imperatives — the highest-priority actions for each year — supported by operational goals that are further developed by staff into SMART goals and KPIs. This approach ensures consistent, measurable progress toward the organisation's long-term objectives.

We are pleased to present the MILSET Strategic Plan for 2024–2029, which includes the organisation's vision and mission statements, a definition of its beneficiaries, and a "practical vision" — a clear picture of what MILSET aims to have achieved by 2029. The plan is anchored by six strategic priorities, each with operational goals that guide the organisation's collective efforts.

This plan is the product of a broad, inclusive, and forward-looking process. With the continued engagement and commitment of our member organisations, regional offices, Executive Committee and staff, MILSET is well-positioned to meet its goals. Together, we aim to strengthen the movement's global impact and foster growth, innovation, and excellence in STEAM education and youth engagement over the next four years and beyond.

MILSET STRATEGIC PLAN 2024-2029

VISION

Inspiring youth through STEAM activities

MISSION

MILSET supports its member organisations to engage youth in STEAM through motivation, cooperation, and networking by:

- Helping member organisations create an environment in their country that enables youth to be involved in STEAM.
- Connecting, supporting, and representing member organisations around the world.
- Stimulating and supporting international youth networking and cooperation through STEAM.
- Providing member organisations with global opportunities to engage youth in STEAM.

BENEFICIARIES

1. MILSETs primary beneficiaries are its members – affiliated youth STEAM organisations – and those working with their youth, including teachers.
2. Youth are MILSET's secondary beneficiaries.
3. MILSET focuses on supporting its members to develop an environment for youth to do STEAM.
4. MILSET programs and events serve youth.

PRACTICAL VISION STATEMENT

By the end of 2029, MILSET will:

1. Promote the role of youth STEAM and MILSET in global and sustainable development, prosperity, and peace.
2. Establish a global online community of regional offices, members, and youth STEAM leaders.
3. Deliver excellent global and regional programs and events.
4. Grow MILSET's membership of national youth STEAM organisations.
5. Achieve long-term sustainability and systematic renewal of governance leadership.
6. Provide expertise, content and training valued by members and recognized internationally.

STRATEGIC PRIORITIES

GOAL 1. Promote the role of youth STEAM and MILSET in global and sustainable development, prosperity, and peace.

1. Include opportunities and incentives to encourage positive interaction, collaboration, and sociocultural exchange in all MILSET and member organisations' events and programs.
2. Promote the concept of MILSET as an international family united by a passion for STEAM, STEAM projects, and global collaboration and networking.

GOAL 2. Establish a global online community of regional offices, members, and youth STEAM leaders.

1. Work with regional offices and members to identify specific communication, collaboration, and resource sharing needs, and audiences.
2. Identify reliable sources of regularly updated content and resources.
3. Identify potential platforms/ solutions based on region/member needs and expected content.
4. Explore the potential value of sharing youth STEAM projects online.
5. Offer regular MILSET global online community-building activities.

GOAL 3. Deliver excellent global and regional programmes and events.

1. Deliver standards-based events and programs, including Expo-Sciences International (ESI), Leader Congress, STEAM Photo Contest and Young Citizens Conferences.
2. Support the delivery of Regional programmes.
3. Enable regional offices and members to be creative and innovative in developing programs to serve youth and those who support them.
4. Offer resources and regular training for adult leaders and supervisors that support the development, delivery, and sharing of youth programs by regional offices and members.

GOAL 4. Grow MILSET's membership of national youth STEAM organisations.

1. Identify unrepresented countries and potential member organisations in collaboration with regional offices.
2. Present clear and compelling membership benefits.
3. Ensure that membership fees are not a barrier to new members.
4. Implement a simple, rapid membership application and renewal/update process.
5. Welcome each new member and provide onboarding support through the first two years of membership.

GOAL 5. Achieve long-term financial stability and systematic renewal of governance leadership.

1. Secure global program sponsors that contribute sufficient funds annually to support the salaries of at least four full-time staff.
2. Establish sufficient long-term reserve funds to support MILSET global office operations for 12 months.
3. Develop a 5-year rolling budget that includes existing activities and new initiatives.
4. Establish a regular succession of MILSET leadership with recruitment based on skill requirements, engagement, as well as representation of youth and regions.

GOAL 6. Provide expertise and training valued by members and recognized internationally.

1. Consolidate and classify existing MILSET resources to identify what is available and how they could best be shared with members and others.
2. Develop content related to the promotion and engagement of youth in STEAM.
3. Ensure high quality content for Leader Congress events and ensure a global audience.
4. Improve MILSET's online visibility and search engine optimization (SEO).
5. Identify potential international opportunities to showcase MILSET's expertise and experience in youth STEAM engagement.
6. Explore research partnership opportunities with universities related to STEAM education, outreach, and promotion, as well as MILSET's impact.

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A VISIONARY LEADER WHOSE LEGACY SHAPED GENERATIONS

HONORING ENG. ADNAN ALMEER

"Great leaders may leave this world, but their vision and legacy continue to shine as a beacon of inspiration for generations to come." This saying perfectly illustrates the life and impact of Eng. Adnan Almeer. His legacy is not only something we remember, but it also continues to guide, inspire, and shape the future of MILSET as well as the youth STEAM community across the world. In this article, I am honored to share with you some bright moments of the journey of one of the most beloved figures in the MILSET family.

At an early age Eng. Adnan joined the Kuwaiti Scout movement, where he

Eng. Adnan Al-Meer with his fellow Scouts during one of the camping trips in the 1960s. The photo captures the spirit of camaraderie, adventure, and discipline that defined the scouting experience of that era

acquired discipline and self-confidence, which nurtured his innate ability to be a future leader with a determined mind and inspired soul. Taking part in several national and international camps offered him a wide range of possibilities to discover new places and meet new people from different backgrounds, empowering him with an open mind and global vision. Along with the openness of areas and spaces, an extreme curiosity and love for science drove him to explore more and knock on more doors.

CONTRIBUTIONS TO MILSET

Meeting of the Supervisory Committee for the Construction of the Al-Ojairi Observatory, chaired by Eng. Adnan Al-Meer. To his left is astronomer Dr. Saleh Al-Ojairi, accompanied by the supervising engineers of the project – 1980, at the Kuwait Scientific Center

After several meetings with peers having the same passion for science, the idea of establishing an international organization aiming at promoting STEAM culture among youth arose and was realized in Quebec in 1987. Adnan was a driving force throughout every stage of MILSET's development, from its foundation in Quebec to its expansion in France, culminating in the success of the final era in Mexico. Eng. Adnan expressed in one of his interviews that, "In science, unlike politics, customs, or faith, there are no differences. These differences only exist in equipment; some countries possess potential, others don't." From that belief, the establishment of MILSET as a non-governmental organization sprang out. From this perspective, he devoted his life within MILSET to break those differences by empowering youth in underprivileged areas of the world by providing them with expertise and expanding the organization of Expo-Sciences across the world.

(Left to right): seated — Abdul Hamid Al Faqueh (elected), Michel Bois (re-elected), Jean-Claude Guiraudon (re-elected), Maurice Huppé (re-elected), Cheik Dem (elected), Alain Bernard (elected); standing — Albert Vanier (re-elected); Sébastien Abgodon (elected); Augustin Gampene (elected), Alain Thirael (elected), Adnan Al Meer (re-elected) Abderrazzaze El Aliq (elected), Angela Miele (elected), Said El Kharrazi (re-elected), Vladimir Lelek (elected), Ibrahim Saleh Al Naimi (elected) and Enrique Padilla (elected). Michel Hallet (re-elected) and Joao Palmeiro (re-elected) are not shown. Names of associations representing executive committee members are listed on page 3.

Eng. Adnan Almeer with the MILSET Executive Committee at the MILSET ESI' 89 in Brest, France

The establishment of the first MILSET regional office in Asia, with its headquarter in Kuwait, was one of the bridges through which Eng. Adnan implemented his philosophy in real action that would positively affect Kuwait and the entire continent.

Eng. Adnan Almeer with the MILSET Executive Committee Gathered at the Paris Headquarters in 1997

ENG. ADNAN ALMEER: A MAN OF ACHIEVEMENT

Numerous achievements of Eng. Adnan are both internationally and nationally recognized. Among the achievements he himself mentioned with pride and joy in many interviews were the following:

- The Kuwaiti Science Club. It was established on August 14, 1974 with more than 20,000 active members.
- The contribution in the foundation of many Science Clubs in the Arab World, notably in Qatar, KSA, and many other countries.
- The Arab Union of Scientific Clubs. This organization was a union for the previously founded science clubs.
- Al Ojeiri Center. Eng. Adnan played a vital role in the foundation of this center under the umbrella of the Kuwaiti Science Club. It was founded on April 15, 1986.
- Kuwait Robotics Center. This center was the first specialized robotics center in the Gulf region to be established in 2002.
- The Environmental Center for Students in 2009.
- The Kuwaiti Cooperative Center for Camps and Student Programs. It is currently under construction and is set to be opened soon. It will be the first of its kind in the Middle East.

A GLIMPSE OF THE FUTURE

As we commemorate the memory of our beloved mentor, the late Adnan Almeer, we find comfort in knowing that his spirit will forever remain with us. Since "The torch was passed to a worthy hand," MILSET Asia will continue to shine brightly as it always has.

Celebrating 20 Years of MILSET: 2007, Durban. Eng. Adnan Almeer with the MILSET Executive Committee

Eng. Adnan Almeer with Jean-Claude Guiraudon: A Longstanding Friendship Across Borders, 2013

Eng. Adnan Almeer Honoring MILSET President Roberto Hidalgo during the ESI 2019 Gala Dinner.

ENG. ADNAN ALMEER: A LIFE OF SERVICE, A LEGACY OF INSPIRATION

ON BEHALF OF MILSET COMMUNITY

It is with profound sorrow and heavy hearts that we mourn the passing of our beloved friend, Eng. Adnan Almeer, MILSET Director, President of MILSET Asia, and one of the founding members of our beloved organization.

Adnan's legacy is immense, and his life is an enduring example of love, kindness and devotion to youth and science. He was more than a leader, he was a father figure, a beacon of inspiration, and a protector to many of us. Through his calm demeanor and quiet wisdom, he motivated young minds. With his charismatic presence, relentless volunteerism, and deep passion for science he nurtured hundreds of thousands of talents, paving the way for future generations.

His generosity, humility, and diplomacy turned challenges into opportunities, making the difficult easy and the impossible achievable. Adnan's fingerprints are etched in the fabric of MILSET and in the hearts of all who were blessed to know him.

For over 35 years, Adnan has been the steadfast soul of MILSET, never once wavering in his commitment. It is hard to imagine MILSET without him, but his spirit will forever live on within our family. The true essence of love, brotherhood, and unity he embodied will continue to inspire us all.

Eng. Adnan Almeer at the MILSET General Assemly. ESI 2023. Puebla (Mexico).

The International Movement for Leisure Activities in Science and Technology

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