Catalyzing STEM Education and Public Engagement through the IANAS Science Education Program

Presented by
The National Academy of Sciences of Argentina
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Index

Preface

The Inter-American Network of Academies of Sciences (IANAS) is a regional network of Academies of Sciences created in 2004 to support cooperation towards the strengthening of science and technology as a tool for advancing research and development, prosperity and equity in the Americas.

In 2020, the National Academy of Sciences of Argentina (ANC) proposed to IANAS the re-launching of its Science Education Program (IANAS-SEP), which had been inactive since 2017. With approval from the executive committee of IANAS, ANC convened a panel to reignite a focus on science, technology, engineering and mathematics (STEM) education and public engagement by member countries, and catalyze collaborations to share effective practice.

The COVID-19 global pandemic has underscored the critical importance of STEM skills, which includes scientific literacy, and the role that scientists, social scientists, health scientists, mathematicians and engineers can play supporting outreach and education for youth, educators, policy makers and the public.

The panel met several times virtually and collaboratively developed this statement to inspire action at the regional and local levels through the IANAS Science Education Program Focal Points. The goal of the statement, itself, is to inspire members of IANAS Academies to support and enhance early years, primary, secondary and post-secondary STEM education and public engagement activities in order to develop a scientifically literate and engaged citizenship.

In this statement, "STEM" stands for science (life, health and physical sciences), technology, engineering and mathematics, representing specific disciplines. However, the committee also used the term "STEM" in the broader context of multi/inter-disciplinary approaches in education that bring the disciplines together in relevant ways. The phrase "scientific literacy" (defined as the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity[1]) is also used in the broad context of supporting literacy and skills across all STEM fields.

It is our hope that this statement will motivate and support members of IANAS Academies and SEP Focal Points to: engage in STEM education and outreach with schools, communities, and local governments and policy-makers; support organizations that are dedicated to these pursuits; and continue the collaborative approach that resulted in this statement.

1 https://www.google.com/url?q=https://www.nap.edu/read/4962/chapter/4%2322&sa=D&source=editors&ust=1614980375589000&usg=AOvVaw1DUo76gB9hN_-6sdX-Ao_D *(retrieved March 5, 2021)*

Executive Summary

Science and technology are impacting and reshaping nearly every aspect of life, from leisure, schooling and work to understanding and solving pressing global problems such as pandemics and other health crises, climate change, sustainable energy, agriculture, access to clean water and more.

Scientific literacy and the skills developed through engagement with science, technology, engineering and mathematics (STEM) have never been more important. These skills include, but are not limited to, problem-solving, critical thinking, numeracy and mathematical thinking, digital skills, and communication. Exposure to STEM fields, starting young, also develops confidence and builds knowledge, both of which are required to ask questions and participate in meaningful ways in emerging social, ethical and economic debates about complex issues, such as sustainable development, artificial intelligence and genomics in our rapidly changing world.

There is also growing concern about the continued lack of diversity across the STEM research enterprise itself, public trust in STEM, and the public's ability to decipher a growing amount of misinformation and disinformation. STEM skills are associated with higher-paying jobs in general, yet there continues to be a wage gap between men and women. These factors underscore the critical importance of educating youth in ways that help all students see STEM as accessible to them. Technological advances are rapidly changing the nature of work, underscoring the importance of ensuring students graduate with needed skills. It also points to the importance of engaging the public, including leaders and decision-makers, in meaningful ways on STEM-based issues to tackle emerging challenges and embrace opportunities with transparency. Otherwise, the risks are very high of ever-expanding social divides, escalating issues of injustice, equality, equity and diversity.

Members of IANAS Academies have a responsibility to support education and public engagement to develop STEM literacy, skills and trust. There are significant differences across the IANAS member countries with respect to spending on education, youth performance on international tests, teacher training, government investment in STEM and innovation, and economic prosperity. However, there are many similarities and much to learn from each other.

The time is right for IANAS to re-launch its Science Education Program (IANAS-SEP) and catalyze a concerted STEM education and outreach effort to achieve the following goals:

1- Strengthen scientific literacy, building critical thinking skills, fostering curiosity and catalyzing lifelong interest in STEM

2- Build capacity across all levels of the formal education system (early childhood, primary, secondary, and post-secondary education) by promoting inquiry-based STEM education

3- Foster equality by improving equity, diversity, inclusion and accessibility across STEM fields

4- Build career awareness and workforce development to support a changing global economy

5- Enhance STEM education for Sustainable Development

This statement sets out key recommendations to achieve these goals, thereby contributing to achieving the following vision: ***Members of IANAS Academies contribute to the development of informed citizens who use and engage with science, technology, engineering and mathematics (STEM) in meaningful ways and can participate in a new global economy and STEM workforce.***

The following recommendations were developed by the panel for use by members of IANAS Academies to accomplish the five goals listed above. They are further detailed in the following sections.

Recommendations to Support Learning In and Outside School

A.1 Support educator training and professional learning to build confidence in teaching STEM content knowledge and effective pedagogy.

A.2 Support access to effective learning resources that improve STEM education.

A.3 Build digital literacy, including computational thinking, amongst students and teachers.

A.4 Involve scientists and engineers, including post-secondary students, industry professionals, early career academics and Young Academy members, in STEM education.

A.5 Engage school administrators and community organizations in understanding the value of STEM education and building a culture of inquiry in their school and community, contributing to the development of a vibrant STEM education ecosystem.

Recommendations for Engaging Civil Society

B.1 Engage proactively with media (social media and traditional) to popularize STEM disciplines and share academic work in accessible, relevant and engaging ways.

B.2 Engage the public through popularization events (e.g. festivals, cafés, public lectures), consultations, and community-based research activities that involve the co-creation of knowledge.

B.3 Engage with government representatives to inform relevant policy initiatives.

B.4 Engage with industry to understand and support their needs (e.g. research, talent development), and engage them in communication and education activities.

Finally, it should be noted that members of the STEM community, including IANAS[2], have *always* engaged with youth, educators, policy-makers and the public. However, due to existing systemic institutional barriers the importance of these outreach efforts is not always recognized. This statement underscores the critical role that IANAS's Science Education Program must play in addressing these barriers and explicitly acknowledge the inherent importance of supporting education and community engagement. The future of STEM relies on public trust, engaged citizens and the development of diverse talent.

2 Inquiry-Based Science Education: Promoting changes in science teaching in the Americas. IANAS-IAP 2017. ISBN 978-607-8379-26-2

The History and Definition of STEM

The acronym 'STEM' refers to four distinct areas of knowledge: science, technology, engineering and mathematics. In the field of education, 'STEM education' also refers to different teaching and learning strategies that make it easier for students to connect these areas of knowledge together, supporting the development of critical thinking and creative problem-solving.

Interest in building a science culture and strengthening STEM education is not new. Indeed, during much of the 20th Century this interest usually focused on improving science education with a connection to technology, often promoting the importance of scientific and technological development. For example, looking at the USA, in 1917, the *Vocational Education Act* strengthened apprenticeships at the secondary school level. Later, in 1983, the American document *Nation at Risk*[3] was published. This report resulted from concerns about poor performance of students in science and mathematics. Then in 1990 the National Science Foundation increased funding for science education and emphasized the relevance and the synergy of science, mathematics, engineering and technology for the development of society (the first acronym, SMET, was soon changed to STEM[4]).

Several reasons exist for the growing global interest in STEM education. In multiple policy documents from different countries, three problems are regularly identified:
1- the growing impact of STEM on future work and the economy (vocations);
2- the importance of improving equity, diversity, inclusion and accessibility in STEM professions, often focused on achieving gender equality, and
3- the need to equip all citizens with skills in STEM areas so they can participate in society as responsible citizens with critical thinking skills and as agents of wealth generation in an increasingly technological world (STEM literacy).

Although much attention is paid to STEM education, generally a crucial but often overlooked underlying factor is mathematics, which is required for success in the other disciplines. Considerable research[5] about mathematics education has identified the importance of quality instruction and the learner's self-image or identity (i.e. sense of self-efficacy in math). Increasingly, policy documents state the importance of mathematics. Furthermore, one of the factors that seems to affect girls' decisions to pursue STEM studies is their perceptions about their own math ability. Therefore, as STEM education and outreach initiatives are considered, the importance of mathematics education should not be overlooked.

As described in several of the following recommendations, many instructional strategies designed to improve STEM education have been in use for decades (e.g. inquiry, project-based or problem-based learning). Research into human learning in disciplines such as neuroscience, artificial intelligence, and the use of big data provide increasing understanding with respect to the selection of appropriate evidence-based strategies.

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3 *The national Commission on Excellence in education. (1983). A Nation at Risk: The Imperative for Educational Reform: United States Secretary of Education. Retrieved February 14, 2021: https://edreform.com/wp-content/uploads/2013/02/A_Nation_At_Risk_1983.pdf*

4 *https://www.google.com/url?q=https://www.britannica.com/topic/STEM-education&sa=D&source=editors&ust=1614980375592000&usg=AOvVaw1uU7KQJeLjnXw8WYArfhuD*

5 *UNESCO. (2017). Cracking the code: Girls' and women's education in science, technology, engineering and mathematics (STEM). Paris. Retrieved February 14, 2021: https://unesdoc.unesco.org/ark:/48223/pf0000253479*

It is essential to allow students to connect and delve into the learning of the four areas and explore connections between them and with other areas to achieve understanding and skills to face complex problems such as sustainable development and climate change.

In summary, STEM education refers to improving education in science, technology, engineering, and mathematics to solve three major issues (vocations, diversity and STEM literacy for all); and, quality mathematics education underpins success in all STEM areas. There are various educational strategies available to develop pupils' understanding, skills, and motivation; however, none of them alone respond to all needs in STEM education. The recommendations in Part A focus on how members of IANAS Academies can support STEM Education in and outside schools.

Despite the increasingly common use of the term "STEM" across education, this term is rarely used in connection with the media, culture research, and government legislation and policy. With respect to media and research related to outreach and communications, the reference is usually related to 'popular perceptions of science' or issues of 'science and society'. Across governments, 'scientific evidence' is actively sought and integrated into policy and regulations in departments such as Health, Environment, Natural Resources, Agriculture, Industry, Economic Development and more. Over time, this restrictive language has resulted in disproportionate attention on specific aspects (e.g. stereotypes about scientists, often interpreted as laboratory chemists), while seemingly excluding fields such as mathematics and engineering. It is especially important for members of IANAS Academies to be explicit and vocal about the cross-cutting or underpinning role that STEM plays in all aspects of our lives, from popular culture to policy and the regulatory environment. The recommendations in Part B focus on how members of IANAS Academies can engage with civil society to advance STEM literacy and public policy.

Recommendations to Support Learning In and Outside School

A.1 Support educator training and professional learning to build confidence in teaching STEM content knowledge and effective pedagogy.

Educators have many challenges to manage in their day-to-day practice on top of teaching STEM. Few primary or secondary school educators have graduate level STEM training and may, themselves, have misconceptions about the nature and processes of STEM disciplines. For example, many educators mistakenly think a linear 'scientific method' underpins all STEM fields! Furthermore, since STEM knowledge advances rapidly, it is unrealistic to think educators can stay current on issues and identify meaningful ways to incorporate advancements in their classroom practice, without support from researchers from STEM disciplines and faculties of education.

The extent of training required to become a certified classroom teacher varies across IANAS member countries. In some regions specialized education training follows a general undergraduate degree. In other places one year of post-graduate training is provided, during which, exposure to STEM teaching is minimal.

Educators who are interested and have good working knowledge of STEM are more likely to be confident and willing to engage students in hands-on, inquiry-based learning experiences. Members of IANAS Academies can play an important role in helping educators build confidence and knowledge by supporting their professional learning using various formats such as training workshops and conferences, online learning webinars and courses, ongoing professional learning communities and fellowships for teachers to join their labs for a week.

It can be especially powerful to bring teachers together and provide a safe, respectful space to engage in discussion, lesson planning, and hands-on learning with STEM researchers and faculty of education professors. When educators have the opportunity to engage in hands-on experiences themselves, they are more likely to provide similar experiences for their students. In such sessions, in addition to addressing STEM concepts and their relevance, it is also valuable to showcase common misconceptions about the topic and facilitate discussions about how to address the misconceptions. Also valuable are opportunities to discuss how unconscious bias can affect learners. For example, teachers can telegraph discomfort in STEM without realizing it. On the other hand, modeling curiosity and a desire to explore can be powerful motivators for students. Raising awareness about key barriers to youth STEM engagement can help educators find ways to mitigate them (some barriers are a lack of role models, lack of awareness of topic relevance, post-secondary pathways and related careers).

While discreet professional learning opportunities (i.e. single workshop or conference) are valuable, ongoing and regular opportunities are most impactful for sustained change. In these circumstances, teachers can share their classroom experiences teaching STEM with members of IANAS Academies and learn from each other. Working with the same group over time builds trust and confidence. Such professional learning communities benefit from both online and in person opportunities to collaborate.

Collaborations with primary and secondary educators also offer significant value to STEM researchers who are required to teach post-secondary students but often have little or no pedagogical training themselves.

A.2 Support access to effective learning resources that improve STEM education.

Much is expected of primary and secondary school teachers. They are expected to keep students safe and help them develop into informed and engaged citizens. They are required to interpret curriculum (education policy documents) in meaningful and relevant ways so that students acquire the intended skills and knowledge for successful progression in their education. They are also expected to inspire students to become life-long learners who aspire to contribute to society and embark on meaningful work in the future.

On top of the day-to-day pressures of managing a classroom, primary teachers are often expected to teach several subjects, including mathematics, science, language(s), art, physical education, history, geography, social studies, and more. Furthermore, a lack of funding often results in teachers purchasing classroom supplies, including materials for hands-on activities, using their own money – or not teaching some topics.

Secondary school teachers have fewer subjects to teach but they are usually pressured to prepare students for post-secondary studies over supporting the development of STEM literacy of all students at a more general level. In many places, they also face pressure to prepare students for standardized exams. They are expected to engage students in learning about STEM processes but often lack access to appropriate equipment. Few secondary teachers have graduate level research experience and typically studied in environments that favoured the memorization of facts over inquiry-driven activities.

During the COVID-19 pandemic, teachers at all levels were also expected to pivot overnight from teaching face to face in classrooms to teaching online, often lacking access to appropriate technology themselves, and/or having minimal experience with remote education.

With a clear understanding of the needs and challenges that educators face, members of IANAS Academies can provide tools and resources that could transform the STEM learning experience for both students and educators. At the most basic level, teachers need easy access to trusted, valid educational resources and equipment.

The members of IANAS Academies are encouraged to collaborate with teachers to develop relevant and meaningful learning resources for classroom use, thereby reducing reliance on outdated textbooks. Examples include donating equipment and supplies, volunteering in the classroom to train students on the use of equipment, and providing new opportunities for students to engage in real scientific inquiries, fostering their scientific identity. Members of IANAS Academies can collaborate with teachers and curriculum developers on the development of STEM lessons and curriculum for the classroom. This type of collaboration can be particularly helpful with complex, confusing or abstract topics and in fields that are changing rapidly. It is also important for STEM professionals who represent traditionally marginalized audiences to offer their "STEM story" to curriculum developers or teachers so that students can "see themselves" in the STEM profession.

Finally, simply informing educators about valid and trusted programs and resources that already exist would be very helpful since teachers often have very limited time to search and validate new resources.

A.3 Build digital literacy, including computational thinking, amongst students and teachers.

The digital era has revolutionized nearly all aspects of our lives and many aspects of work. It has transformed many fields by enabling the gathering and manipulation of tremendous amounts of data and information. Furthermore, public access to data and applications is becoming easier every year thanks to the Internet. Despite the rapid and continued expansion of Internet users, however, access is not equitable and many people around the world continue to have no or very limited access[6]. The lack of access is particularly acute in developing countries, resulting in the denial of socio-economic opportunities for large segments of the global population and rising inequalities.

The growing digital divide became overt during the COVID-19 pandemic, especially for school-aged children (for instance, in Mexico only 45% of households had a computer[7]). It was caused by a lack of equipment and/or Internet access for youth outside school and demands significant attention and investment from governments. While access to technology is crucial, at the same time, research into its use in education and impact on learning must accelerate. The role of teachers remains critical to ensuring technology is used appropriately to support knowledge and skill development. However, if teachers lack comfort or skills, themselves, the use and value of these tools will be restricted even when they are available.

Digital literacy includes more than technical or programming skills. It also encompasses the cognitive, social and emotional aspects of working and living in a digital environment[8]. Students need adequate skills for the adoption, use, and the creative development of new technologies; computational thinking skills are paramount. When used appropriately, digital technologies can offer powerful educational experiences. For example, using the many sensors that exist on smart phones and accessing real data sources can bring new relevance to STEM learning for students, also contributing to the development of informed citizens. Using technology to solve real-world problems can be especially powerful for girls who may be more inclined to see technology as tools for service. The rapid rise of online information demands that digital literacy also encompasses critical thinking skills to decipher and interpret. Finally, the ethical issues related to data manipulation and data handling must also be addressed.

Members of IANAS Academies with expertise in the use, development and analysis of digital technologies can contribute to the digital literacy of both students and teachers through the following actions:

6 *https://www.broadbandcommission.org/Documents/working-groups/SchoolConnectivity_report.pdf*

7 *Using data of the Instituto Nacional de Estadística y Geografía, https://www.inegi.org.mx/temas/ticshogares/*

8 *"Building digital competencies to benefit from existing and emerging technologies, with a special focus on gender and youth dimensions", UNCTAD Commission on Science and Technology for Development, E/CN.16/2018/3*

- Advocate for equitable access to affordable internet for all learners.
- Provide opportunities for teachers to gain confidence and skills with digital technologies.
- Organize collaborative projects among students of different schools that require the use of digital technologies to gather and exchange information and the presentation of results.
- Address the growing challenges that come from online content that promotes misconceptions, discrimination, polarization and conspiracy theories over the understanding of the natural and made world.

A.4 Involve scientists and engineers, including post-secondary students, industry professionals, early career academics and Young Academy members, in STEM education.

STEM researchers and professionals at all career stages can contribute to STEM education in diverse and important ways. These include, supporting curriculum development; visiting schools and community settings to engage youth in hands-on learning and career discovery; inviting students and educators to labs, businesses and post-secondary campuses; popularizing STEM; writing books; supporting educator professional learning; providing equipment and supplies; explaining STEM models and ways of thinking, and more.

Members of IANAS Academies, STEM researchers, post-secondary students, industry professionals and Young Academy members can be inspiring role models who share their experience and passion for STEM, building knowledge, skills and confidence of students and educators. Even a single visit to a classroom can address negative stereotypes and misconceptions, foster curiosity and open doors for young people who may have never met a STEM professional.

In many countries, students rarely interact with scientists and engineers, and therefore have few opportunities to understand and enjoy how the disciplines are conducted. They usually have very limited ideas about STEM disciplines, their breadth, diversity, relevance and impact on everyday life. The engagement of positive and diverse role models can help young people 'see themselves' having a future in STEM.

Appropriate training and preparation are critical for the STEM community to maximize the benefits of their engagement in primary and secondary education. In supporting educators, it is important to adopt a partnership stance and seek to understand the challenges that educators face in the classroom, which can include a lack of equipment and supplies; the need for subject matter experts; limitations in their own STEM training, and other pressures that could include large class size, mixed grade classrooms and diverse student levels.

STEM professionals can have a particularly positive impact supporting the professional learning of secondary school teachers. Typically, these educators have completed some post-secondary STEM education themselves but have considerable difficulty keeping up with scientific and technical advances, including how to incorporate them into their classrooms. Universities, school administrators, Ministries of Education and Science and Technology Councils could collaborate to establish programs that convene, support and prepare STEM professionals to train teachers. In return, participating STEM professionals can learn about effective pedagogy and learning theories that underpin the science of education, thereby supporting improvements in their own post-secondary teaching activities.

Despite the value and importance of supporting education, in many countries the active involvement of STEM professionals and researchers continues to be limited by the reward structure of the post-secondary enterprise. Members of IANAS Academies are encouraged to publicly endorse and support participation in STEM education and actively seek to remove barriers.

A.5 Engage school administrators and community organizations in understanding the value of STEM education and building a culture of inquiry in their school and community, contributing to the development of a vibrant STEM education ecosystem.

The development of a scientifically literate population that embraces a STEM culture and the importance of inquiry will not happen solely through individual teachers working in their classrooms. The importance of engaging and supporting members of the broader ecosystem must also be addressed since both formal and informal education systems shape the learning of youth and adults. Within the formal education system, school administrators (i.e. principals) play a significant and often overlooked role in setting the school culture. The informal education community, comprised of outreach organizations, museums, STEM centres and many others, are also key partners that engage learners in and outside school.

In primary and secondary education, school administrators are responsible for the success of students and teachers in their school. As the leader, they set the school tone and culture through their decisions and actions. The majority of such leaders have little STEM experience or formal STEM training and often are not aware of the opportunities and benefits of STEM-based learning for students and educators. They might be uncomfortable with STEM themselves, and model their discomfort, foster stereotypes or even prevent inclusion efforts (e.g. perpetuating 'girls don't belong in STEM'). However, when school administrators become champions of STEM-based learning, and embrace collaboration with the STEM community (e.g., outreach organizations, museums, local industry partners, university professors), the results can be transformative. They support school-community projects; invest in professional development opportunities for teachers; celebrate the involvement of students in STEM competitions and fairs; develop school-wide STEM programming and more.

When working with schools and community organizations, members of IANAS Academies should reinforce the connection between STEM, inquiry and community science[9]. By fostering curiosity, questioning and problem-solving using real-world problems, a life-long learning mindset can be developed amongst participants along with showcasing the relevant applications of STEM areas. Children are naturally curious and show great interest in activities in which they are challenged to formulate questions and seek solutions. Similarly, adolescents are attracted to challenging problem-finding and problem-solving activities, where they can be proactive. Members of IANAS Academies could share their expertise to support hands-on learning that offers individual and team opportunities to explore real world problems that provoke participants to identify, formulate, investigate and develop solutions for questions and problems that are relevant to learners.

STEM education ecosystems promote inquiry learning opportunities in schools, but they can be constrained by a lack of adequate infrastructure (laboratories, computer rooms etc) or because teachers do not feel prepared to adopt them in their practices. Additionally, school leaders may not be familiar with inquiry learning and question its

9 https://www.sciencedirect.com/science/article/pii/S1462901119300942

validity. In many countries, this approach is not practiced or trained during studies in colleges or universities, and often, educators have little or no opportunity to experience problem-solving, the scientific method or project-based activities, themselves. Therefore, it is especially important for scientists to engage in local STEM education ecosystems and model and support inquiry approaches, which can offer powerful opportunities for students to experience the thrill of discovery and understand the beauty and power of STEM.

Recommendations for Engaging Civil Society

B.1 Engage proactively with media (social media and traditional) to popularize STEM disciplines and share academic work in accessible, relevant and engaging ways.

Scientific discoveries and the development of new technologies directly affect our everyday lives. Neuroscience, big data, artificial intelligence, genetic manipulation, energy and the environment are just a few areas of active research with significant and direct impact on societies, education and individuals. They also raise ethical concerns and pose complex challenges both for policy makers and for the population at large. People need access to reliable and understandable explanations about these issues and greater transparency into STEM research processes to make informed decisions. Fostering scientific literacy and critical thinking are especially urgent now with the rapid growth of fake news, pseudo and anti-science messages, misinformation and disinformation. The rise of social media and online communities has resulted in the escalation of opinion sharing, without valid supporting evidence, leading to a decline in public trust in science. Active and informed discussions about STEM can build public confidence and trust in STEM, increase scientific literacy and also attract more people to STEM careers.

Engagement of members of IANAS Academies with social media and traditional media can also challenge pervasive, negative stereotypes about STEM. It is especially powerful for STEM professionals who represent traditionally marginalized audiences to engage in public communication, addressing the so-called stereotype threat[10]. This includes women, Indigenous peoples, people of colour, people with disabilities and others who continue to be under-represented in STEM fields. Visibility to positive role models who shatter stereotypes is especially important for young people and their parents supporting the concept of 'if you can see it, you can be it'.

There are many ways to engage with the public using various media formats, including:

- Being accessible to journalists
- Podcasts and Webcasts
- TV and radio shows
- Social Networks
- Articles in newsletters and on websites devoted to STEM popularization
- Articles in magazines and newspapers
- Outreach talks associated with major STEM conferences
- Scientific training of science journalists
- Books for the general public

10 Steele CM, Aronson J. "Stereotype threat and the intellectual test performance of African Americans." J Pers Soc Psychol. 1995 Nov;69(5):797-811.

Communications and media training are strongly encouraged as the STEM community engages in public outreach. This is important because each platform requires specific skills and approaches, and each audience needs different things (i.e. presenting at a STEM conference to peers requires a different approach from communicating with the public). Engaging early career scientists and postsecondary STEM students in outreach activities, especially through social networks and online platforms, is key to challenging stereotypes and reaching out to young generations. Traditional mediums are more likely to reach older audiences. Members of IANAS Academies are encouraged to support and engage proactively with social media and/or traditional media outlets to help popularize STEM and share their work so that it is accessible to the public.

B.2 Engage the public through popularization events (e.g. festivals, cafés, public lectures), consultations, and community-based research activities that involve the co-creation of knowledge.

STEM influences and permeates all aspects of our lives. It offers a lens to understand the world, fostering curiosity and inspiring wonder. Given that people spend most of their time/lives outside school, it is important for the STEM community to engage the public in informal ways (informal here means 'outside school'). When scientists and engineers engage the public in meaningful ways that also increases transparency into the STEM enterprise, it can build trust, understanding and support in addition to scientific literacy.

Many informal settings exist to build STEM engagement, such as botanical gardens, museums, aquariums, zoos, science and technological centers, field experiences, social media and more. The valuable role of informal STEM education has been well documented[11].

Increasing access to technology, mobile devices and the Internet eliminates previous geographic restrictions and offers exciting new ways to engage the public in STEM programming. In person visits to museums and science centres continue to offer powerful engagement opportunities and, increasingly, these centres are also providing online access to their collections for teachers, students and the general public, thereby extending their reach and influence.

STEM festivals, Olympiads, and fairs, mathematics competitions, cafés and other programs offer additional approaches that stimulate curiosity and interest in STEM. They encourage students to pursue STEM studies, improve scientific literacy and support the development of STEM skills among young people and the general public. They also serve to showcase the relevance of STEM in everyday life. Days and weeks of celebration (e.g. DNA Day, World Engineering Day, Science Literacy Week, Pi Day) provide themes that can be leveraged to rally and coordinate outreach activities across communities. On a larger scale, the United Nations has declared 2021-2030 to be the Decade of Ocean Science for Sustainable Development, offering an international organizing framework that could be used to coordinate local, national and international learning opportunities.

In recent years, Citizen Science Projects have gained momentum and importance worldwide, building positive working relationships and reducing the divide between society and STEM researchers. In these projects, citizens and researchers work together on real research projects.

Members of IANAS Academies are encouraged to support and engage in these diverse informal STEM learning opportunities, which would also benefit from coordination, promotion and financing to broaden participation.

11 P. Bell, B. Lowenstein, A.W Shouse, M.A. Feder, "Learning Science in Informal Environments: People, Places and Pursuits, National Research Council, 2009

B.3 Engage with government representatives to inform relevant policy initiatives.

Addressing key challenges currently faced by humanity requires a strong and positive STEM – policy interface. Climate change, threats to biodiversity, the spread of infectious diseases, access to healthy food and drinking water, and sustainable resource development are just a few complex challenges that require concerted action from governments, industry, the social sector, inter-governmental institutions, non-governmental organizations and the STEM community. In addition to ongoing research and innovation efforts, IANAS STEM professionals have many opportunities to share their expertise to benefit society.

Effective participation in policy-related activities requires an understanding of where and how policy is developed, who develops it, and subsequently how it is implemented. Increasingly, governments and agencies around the world are showcasing their efforts to develop 'evidence-informed policy' and/or 'science-informed policy', thereby underscoring the importance of STEM advice and evidence in shaping policy. However, many other factors are also involved. Diverse opportunities to engage in policy-related discussions and activities exist at international, national, regional and local levels.

STEM, by nature, is an international endeavour characterized by collaborative networks that span country borders – as epitomized by IANAS itself! International organizations such as InterAcademy Partnership (IAP) and the International Science Council (ISC) promote science as a global public good and offer natural platforms to foster dialogue between the STEM community and policy makers. ISC acts as a Lead Coordinator of the United Nations Major Group for Science and Technology and through its work with the World Federation of Engineering Organizations (WFEO), seeks to integrate STEM into major global policy processes. Involvement with the governance of international unions offers STEM professionals with opportunities to influence international practice in their field and to participate in discussions that can lead to policies of global impact.

Most policies and regulations are developed and implemented by complex ecosystems of national, regional and local governments. Most countries in the Americas have different bodies that focus on the scientific enterprise versus areas that are influenced by STEM such as economic development, energy, natural resources and health at both national and regional levels. Some aspects of responsibility focus on providing funding and others are directly involved in defining and managing regulations. The direct participation of the STEM community in all facets is often possible and should be endorsed and supported by IANAS. In addition, IANAS should address systemic barriers that can negatively impact the career progression of STEM researchers and professionals who do participate in policy-related work.

Other levels of officials governments, including elected and non-elected ones, also benefit from engaging with the STEM community, which could be organized through intermediary organizations such as scientific or engineering societies. The dialogue between policy makers and the STEM community at all levels requires considerable effort from all parties but contributes to informed policy development.

In summary, it is important that members of IANAS Academies:

- Actively participate in national and international STEM societies
- Be willing to invest time on the governance of national bodies overseeing STEM and innovation in their countries
- Develop a shared language that allows a useful dialogue with politicians and policy makers
- Invite politicians and policy makers to take part in the activities of the STEM community

B.4 Engage with industry to understand and support their needs (e.g. research, talent development) and engage them in communication and education activities.

A broad landscape exists for members of IANAS Academies to engage with industry for mutually beneficial purposes, such as education and training, research, development and commercialization.

A primary goal of policymaking activities for IANAS should be to improve alignment between education and workforce needs. Connecting with industry and staying abreast of shifting demands is a critical part of this process. When there is a strong point of connection between education and employers, valuable information can be shared about the skills employers need and the services education provides. Information gained from employers can inform education practices and help ensure graduating students are ready for work. Furthermore, work placement opportunities for trainees can improve their skills and likelihood of employment. Given the strong employer preference for experience, such real-world learning opportunities need to be a central component of educational experiences at all levels, especially post-secondary.

On the contrary, when education and industry are disconnected, there is a serious risk of students entering the workforce with outdated or mismatched skills. This could become even greater during the Fourth Industrial Revolution, now underway. Marked by rapid advances in automation, artificial intelligence, and the fusion of technology with almost every aspect of work and life, employers are calling for people with strong digital skills, problem solving and critical thinking skills, initiative, project management, and interpersonal skills in addition to technical STEM skills and knowledge.

Beyond supporting talent development, researchers can engage with industry to solve their problems and develop innovative products and services through consulting, applied research, patent development and academic entrepreneurship[12]. Academics bridge the worlds in entrepreneurial ways by commercializing technologies that emerge from their own research and by supporting industry with research or business opportunities. For many companies, this offers a valuable way to deepen their research capacity and launch valuable collaborations.

Universities, granting councils and other organizations that help connect industry with researchers can support the collaborations and ensure critical services are in place, such as legal, intellectual property management, financing and more. It is especially important for researchers to understand industry needs and potential constraints before embarking on industry partnerships. For example, to protect intellectual property and commercialization activities, publishing research findings may not be encouraged or allowed by industry partners. By supporting academics who engage with industry and technology development, universities can demonstrate ambidexterity in their ability to support the production of both scientific knowledge and technological outputs[13] and

12 *Perkmann M. and Walsh K.,2007, Int J. of Management Reviews 9, 259-280.*
13 *Ambos, T.C. et al 2008 J. of Management Studies, 45, 1424-1447*

provide appropriate protection and support.

Members of IANAS Academies are encouraged to engage with industry to understand their needs, strengthen education and trainee development, lead applied research projects and develop innovative products and services.

Appendix

Examples of initiatives that align with recommendations.

A.1 Support educator training and professional learning to build confidence in teaching STEM content knowledge and effective pedagogy.

Smithsonian Science Education Academies for Teachers

The Smithsonian Science Education Center (SSEC) offers opportunities for educators, administrators, and other stakeholders aspiring to transform science and STEM education. In addition to curriculum and digital media resources, the SSEC offers professional development that supports educators to implement STEM within the classroom. Through its Smithsonian Science Education Academies for Teachers (SSEATs), teachers learn behind the scenes at museums and science facilities, learn directly from scientists in the field, and engage in authentic STEM experiences that teachers then bring back to their classrooms. Professional development resources are available both digitally and in person and cover a variety of topics from delving into student understanding to increasing science content knowledge in educators. See: https://ssec.si.edu/professional-development

Let's Talk Science Professional Learning for Educators

Let's Talk Science offers educators blended (in person and online), ongoing and connected professional learning experiences in both English and French. These opportunities are flexible to meet the various needs of educators working towards improvements in their practice. By participating in this program, educators will confidently be able to support the learning and engagement of their students through STEM, inspiring them to become engaged citizens in a rapidly changing world. Opportunities include live and on-demand webinars, co-learning broadcasts that involve students too, self-paced modules and various formats of in-person training. See: https://letstalkscience.ca/professional-learning

Doing Science at School Program, National Academy of Exact, Physical and Natural Sciences of Argentina

In 2006, the National Academy of Exact, Physical and Natural Sciences of Argentina implemented the "HaCE" Program ("Doing Science at School") which offers nearly 50 workshops/year to train teachers in Inquiry-Based Science Education (IBSE) pedagogy. The Academy also developed pedagogical resources for STEM education, published the book "IBSE: an innovative pedagogy for primary and secondary level" (2012), which is freely distributed. See: https://www.ancefn.org.ar/categoria.asp?id=689

Stem-Academy Program, Colombian Academy of Science

The Colombian Academy of Exact, Physical and Natural Sciences, through its STEM-Academia program (www.stem-academia.org) provides courses and workshops for in-service teachers related to the teaching-learning process of different STEM areas. In association with local governments and private companies, courses are periodically offered both in face-to-face and virtual modality on topics such as: teaching mathematics in the early years, STEM education and sustainability, teaching engineering at school, teaching computational thinking or girls in STEM.

Science at your School, Mexican Academy of Sciences

In 2002 the Mexican Academy of Sciences launched the program "La Ciencia en tu Escuela" (Science at your School) for Kindergarten up to Grade 9 teachers. The goals were to change attitudes towards STEM, bring together teachers and scientists to find new ways to teach and engage youth in Inquiry-Based Science Education (IBSE) pedagogy. In order to scale up the program throughout Mexico and other Latin American countries, an online program evolved to include a variety of learning modules. Different methods, techniques, strategies, and as much multimedia as possible were used, always with the guidance of an expert or a consultant in the discipline. Individualized instruction is available with an educator for a small group of students (25). Currently there are about forty different courses on-line plus several videos on specific topics. See: https://lacienciaentuescuela.edu.mx/

A.2 Support access to effective learning resources that improve STEM education.

Smithsonian Science Education Center

In 2016, in collaboration with scientists from the InterAcademy Partnership (IAP), the Smithsonian Science Education Center began developing free community research guides based on the UN Sustainable Development Goals. Each "Smithsonian Science for Global Goals" guide empowers youth ages 8-17 and their teachers to discover socio-scientific issues in their community, understand the underlying science of the issue, and use what they learn to act – to build a more sustainable planet. Topics range from mosquito-borne diseases, food/nutrition, COVID-19, biodiversity, vaccines, and sustainable communities. Students focus on sustainable actions that are student-defined and implemented and develop scientific inquiry and sustainability mindsets See: https://ssec.si.edu/global-goals

Let's Talk Science

Let's Talk Science offers a diverse suite of free digital resources in English and French for Early Years, elementary and secondary school educators. Aligned with Canadian curricula, resources are searchable by topic and grade level, and include lesson plans, hands-on activities, backgrounders, career profiles, videos, high quality images and more on many different STEM topics. Access to free classroom projects and various professional learning opportunities is also available. Online professional learning communities allow educators to share and learn from each other. See: https://letstalkscience.ca/

The "HaCE" Program, National Academy of Exact, Physical and Natural Sciences of Argentina

The Argentine National Academy of Exact, Physical and Natural Sciences within its "HaCE" program, developed several experimental modules for teaching STEM in schools at the initial, primary, secondary and technical levels. For the sake of sustainability, one of the premises of the "HaCE" Program is that modules be implemented with easily accessible materials.
Scientific literacy, workshops and courses on Green Chemistry, Climate Change, and national and Latin American outreach are briefly described in https://www.ancefn.org.

ar/categoria.asp?id=751.
A book called: *"Plastic Waste. Environmental Impact and the Challenge of Circular Economy"* (Dec 2020) can be freely downloaded from https://ancefn.org.ar/user/FILES/Residuos_plasticos-2.pdf.

The project of portable laboratories of molecular biology, National Academy of Sciences of Argentina

The National Academy of Sciences of Argentina, together with the School of Chemical Sciences of the National University of Cordoba joined the Allende-Connelly Foundation from Chile in an agreement to develop *portable laboratories of molecular biology*. The project aims to provide pre-university students with access to classical, simple experiments. In the first edition (2019), the topic was genomics and cellular and molecular biology, which allowed exploration of fundamental concepts of heredity, mutation, and evolution. Teachers first attend a short refreshment of theoretical concepts of the topic, and then with the advice of Professors, engage students in performing the experiments.

Stem education workshops, National Academy of Sciences of Argentina

The Academy organizes annual STEM education workshops for primary and secondary teachers. In these short courses, teachers learn how to teach various topics using easily accessible materials for classroom experiments. "Quimicafe" (Chemicoffee) and " Matematica en azar y juegos" (Math in chance and games) are two examples of such short courses offered as a joint program at this Academy with the National University of Cordoba and the Ministries of Science and of Education. This project establishes a link between school teachers and members of the scientific community facilitating a fluid interaction among them.

Curricular materials for teaching science, Colombian Academy of Science

To disseminate the scientific knowledge developed in Colombia, the Colombian Academy of Exact, Physical and Natural Sciences develops curricular materials for teaching science that can be downloaded free of charge on the website www.stem-academia.org. The Academy also collaborates with the PREST organization in Canada to generate free videos and resources for teaching and learning mathematics.

A.3 Build digital literacy, including computational thinking, amongst students and teachers.

Smithsonian Science for Makerspaces

Smithsonian Science for Makerspaces is a series of free engineering design and computational thinking challenges for students to engage with emerging technologies through hands-on learning. Inspired by Smithsonian Science for the Classroom (https://ssec.si.edu/smithsonian-science-for-the-classroom), these activities bridge formal science education and the makerspace movement by helping educators and teachers engage with digital and physical technologies within the context of science, technology, engineering, arts and math (STEAM) by asking them to make something new. Smithsonian Science for Makerspaces integrates computational thinking into STEM and includes 3-D models and thoughtfully designed lesson plans that will guide educators and students throughout the engineering design and computational thinking process by ob-

serving, making, designing and testing solutions to a problem. See: https://ssec.si.edu/makerspaces

Coding for Kids, Colombian Academy of Science

The Academy collaborates with other actors in the development of virtual teacher training proposals and the development of educational materials within the framework of the Coding for Kids program developed by the Ministry of National Education, the Ministry of Technologies, the British Council and the Colombian Association of Engineering Schools in order to train teachers and students in the country on issues of computational thinking. See: https://www.britishcouncil.co/instituciones/colegios/programacion-para-ninos-y-ninas

Let's Talk Science, youth workshops

Let's Talk Science offers a variety of free youth workshops, digital resources and professional learning programs for educators to build digital literacy skills, including coding and computational thinking. Resources include an introduction to computational thinking https://letstalkscience.ca/educational-resources/backgrounders/computational-thinking and introduction to artificial intelligence (https://letstalkscience.ca/educational-resources/backgrounders/introduction-artificial-intelligence)

A.4 Involve scientists and engineers, including post-secondary students, industry professionals, early career academics and Young Academy members, in STEM education.

Let's Talk Science, Outreach program

Let's Talk Science partners with over 50 universities and colleges to recruit, train and mobilize thousands of volunteers in support of STEM learning across Canada. Over the past 30 years, the Let's Talk Science Outreach program has become a sustainable, community-based, volunteer-driven program that connects the STEM community to youth and educators in schools and community settings to offer free programming in person and online. Volunteers include undergraduate and graduate students, faculty, staff and industry professionals. See: https://letstalkscience.ca/

Partners with scientists, technologists and engineers, National Academy of Exact, Physical and Natural Sciences of Argentina

The National Academy of Exact, Physical and Natural Sciences of Argentina partners with scientists, technologists and engineers of several national universities and State Ministries of Education in the country to train and mobilize volunteers to collaborate in its STEM learning program as well as in the training of local facilitators in IBSE pedagogy. Collaborations are in the form of lectures, training, short specific courses and talks with the general public and communities on STEM subjects of particular local interests, as well as in the free exchange of pedagogical resources.

The Scientist goes back to school, Colombian Academy of Science

The Colombian Academy of Exact, Physical and Natural Sciences includes scientists, engineers, medical doctors and other health specialists. This offers a wide array of options to partnering institutions and organizations. Accordingly, the Academy has developed a pilot program with a couple of private elementary and secondary schools by which members of the Academy or selected guests visit these schools and interact directly with students and faculty. These efforts have continued, the pandemic notwithstanding, with one school in the Bogotá region. "The Scientist goes back to school" program has been implemented in the city of Medellín. In it, scientists from different fields are invited to share their experience with school students and to serve as role models. The schools make the request to the academy who coordinates with the members for the visits. A similar program was carried out a few years ago in the city of Cali. The Academy has worked with local city officials (Secretaries of Education) to implement these programs, with different levels of success.

A.5 Engage school administrators and community organizations in understanding the value of STEM education and building a culture of inquiry in their school and community, contributing to the development of a vibrant STEM education ecosystem.

Smithsonian: Leadership and Assistance for Science Education Reform (LASER)

The Smithsonian Science Education Center's inquiry-based approach to science education provides students in classrooms across the country and around the world with captivating, first-hand learning experiences. The SSEC's Theory of Action -called "LASER" or "Leadership and Assistance for Science Education Reform"- advocates for scientifically-based research and best practices to inform the development of a shared vision and infrastructure for transforming science education at the school, district, state, or ministry level. LASER has been referred to as the "original STEM education ecosystem." See:https://ssec.si.edu/laser-model. The LASER Model is at the core of all of the SSEC's work and requires five elements: research-based, inquiry-driven curriculum; professional development; materials support; administrative and community support; and appropriate assessment. A five-year study demonstrated the LASER model's efficacy in systemically transforming education through science and its results have been reported internationally in Spanish by INNOVEC: http://innovec.org.mx/home/images/7-antologia_v2_digital-min.pdf

Stem initiatives, Colombian Academy of Science

The Colombian Academy of Exact, Physical and Natural Sciences organized a workshop with deans of all university schools of sciences to inform them about the Academy´s STEM initiatives. The Academy is a member of the Global Council of the IAP SEP. As such, it participated in the annual meeting of the Council held in Bangkok in 2019 and one of its Academicians presented the talk "Science Education and Literacy in Colombia" in which several initiatives in progress in the country were highlighted such as our own STEM-Academia, Empresas Públicas de Medellín, Museum of the Water, Maloka Interactive Center, Parque Explora, the Ondas program, and Nano in school.
The Academy, the Catholic University (Pontificia Universidad Javeriana), nanoCiTec Research Center and the Champagnat school have developed a program to motivate the

active participation of students and teachers, using new technologies, in the study of current challenges such as water pollution from heavy metals. High school students and faculty developed a device to detect heavy metals and were involved in the monitoring and remediation with the use of green chemistry.
In addition, workshops on creative thinking were carried out with elementary school teachers to discuss how to make creativity a strategic tool in the teaching-learning process and in scientific literacy.
A bilingual booklet "The Universe Nano" has been completed and will be distributed through the IAP-SEP network.

B.1 Engage proactively with social media and/or traditional media outlets to popularize STEM and share academic work in accessible, relevant and engaging ways.

Network of contacts, Colombian Academy of Science

Thanks to a very active program of outreach carried out through social media (Twitter, Facebook, Instagram, web page) and massive e-mail distributions, as well as by maintaining contact with traditional media outlets, the Academy has shared information and knowledge with academic and non-academic communities around the country. This involves news releases, radio programs, interviews, newspaper columns written by members of the Academy in which current events such as COVID-19, climate change, the educational crisis and many others are presented in terms easy to understand by the general public. The Academy now has a network of contacts that may be counted by the thousands of readers and followers.

B.2 Engage the public through popularization events (e.g. festivals, cafés, public lectures), consultations, and community-based research activities that involve the co-creation of knowledge.

The Academy Lecture Series, Colombian Academy of Science

The Colombian Academy of Exact, Physical and Natural Sciences has developed a very strong program of outreach through public lectures related to important events in the history of Colombia. The main point of these lectures has been to reach communities in different regions of the country where science and scientists are rarely seen. Since 2017, the Academy has also established the Academy Lecture Series (Cátedra de la Academia) in collaboration with local universities in various cities. Members of the Academy give monthly lectures about their research, about science, public policy and so on. One of the Chapters of the Academy (the Antioquia Chapter) has, in collaboration with the science museum of Medellín, Parque Explora, carried out for many years a very successful program called "Science on a Bike" ("Ciencia en Bicicleta"), aimed for the general public. Literally thousands of people benefit from these lectures, which are broadcast live through Facebook and YouTube.

"Discovering Science" talks of the National Academy of Sciences of Argentina

The National Academy of Sciences of Argentina organizes annually a set of science talks under the name "Discovering Science", given by different STEM experts who are also excellent communicators. These talks are presented twice a month and attract the interest of many people of all ages. See: https://www.anc-argentina.org.ar/es/actividades/ciclo-de-conferencias-descubriendo-la-ciencia.
Additionally, the ANC organizes an annual national contest for students at non-college level, where they must write a story on a particular subject. For instance, this year´s subject is "Cuidemos nuestro planeta" (Let´s take care of our planet) and in 2020 it was "Las plantas que nos alimentan o nos curan" (Plants that feed us or cure us). In previous years, topics included "The satellite" and "Penicillin". This contest inspires students to inquire on different subjects and, in some cases, to seek advice from researchers in science centers. See: https://www.anc-argentina.org.ar/es/publicaciones/publicaciones-de-la-comision-de-extension/.

B.3 Engage with government representatives to inform relevant policy initiatives.

Public policy in science and education, "Challenges for 2030", Colombian Academy of Science

The Colombian Academy of Exact, Physical and Natural Sciences is actively involved in discussions regarding public policy in science and education. The Academy is a consultative body to the Colombian government and, as such, takes part in long and difficult processes of construction of those policies. The Academy Working in collaboration with nine other national academies, was actively involved in the definition of a ten-year plan for education reform (Plan Nacional de Educación 2016-2026). In addition, the Academy prepared in 2018 a document called "Challenges for 2030" (Desafíos para el 2030), that was intended to call the attention of the then candidates for president of the country to the main issues the country was facing in relation to education, science and the environment. https://issuu.com/academiacolombianadecienciasexactas/docs/manifiesto_de_la_ciencia_-_desafios

Mission of Wise Men and Women, Colombian Academy of Science

Many recommendations included in the above documents were taken up by a mission convened by the Colombian government in 2019 with the proposal of drawing a road map for the country for the next thirty years. The proposals prepared by this mission (known as the "Mission of Wise Men and Women" or "Misión de Sabios") cover diverse topics ranging from education to health, the environment, bioeconomy, biotechnology, arts, equity, technology, energy, basic and space science, among others. The report was presented to the president in December 2019, and ten volumes have been published in digital form since then. From the beginning, the Academy has been working with members of the Mission and with a large group of its own members and several prominent Colombians to guarantee that the country as a whole understands, values and implements the proposals and recommendations provided by the Mission. https://accefyn.org.co/libros-mision-de-sabios/

Member of the International Network of Government Science Advice, Colombian Academy of Science

The Academy is a member of INGSA (The International Network of Government Science Advice). In this capacity, a workshop was organized in 2019, with the participation of representatives from 50 governmental and non-governmental entities from different parts of the country. One of the main objectives of the Academy is to convince the Colombian government to create a National Science Council of the highest possible level. The Academy is also working with legislators to impress on them the need to have science advisors in Congress.

Joint program of the National Academy of Sciences of Argentina with the National University of Córdoba and the Ministries of Science and Education of Córdoba

The joint program mentioned above in section A.2, between this Academy, the National University of Cordoba and the Provincial Ministries of Education and Science, which has been running during the last 20 years, facilitates the interaction of the government representatives with the academicians. Furthermore, it gives the Academy the chance to advise the political authorities on relevant policy initiatives.

Joint committee of National Science and Argentine Parliament representatives, National Academy of Exact, Physical and Natural Sciences of Argentina

This Academy believes it is important to strengthen bonds between the Academies and Government representatives as decision makers. In this sense, conversations between academicians and parliamentarians, are being held with the proposal of creating a joint committee of National Science and Argentine Parliament representatives. An Academician from this group was invited by the IPU (Inter Parlamentarian Union, (https://www.ipu.org) to deliver a talk in the meeting "Building bridges between science and parlamentarian for the good of society" that was held on March 17, 2021. https://www.ipu.org/event/building-bridges-between-science-and-parliamentarians-good-society

B.4 Engage with industry to understand and support their needs (e.g. research, talent development), and engage them in communication and education activities.

The triangle Academy-State-Industry, Colombian Academy of Science

The implementation of a triangle Academy-State-Industry, to which Civil Society is currently being added as a fourth component, is a priority for many people and organizations. However, achieving such a relationship is not an easy task. The Academy has, for a long time, advocated the importance of these interactions and small steps have been taken in this direction working with representatives of small, medium and large enterprises. Real interest has been shown by many of them. Some progress has been made with an institution known as Ruta-n (Medellín, Colombia), devoted mainly to innovation and productivity. There is a good possibility that the Academy may influence some of their activities and increase their involvement in education and science.