

STEM Education for Innovation

A Siemens Stiftung initiative in Latin America

Supported by Siemens Caring Hands e. V.

I. Motivation: STEM¹ education during times of crisis

The global community faces immense challenges caused by the climate crisis and the COVID-19 pandemic. Well-informed and sustainable action is the only way we can secure our future on Earth. For future decisionmakers to grow into roles as responsible and just local and global citizens, they must learn from an early age that they influence global coexistence through their own behavior and the practices and progress in their local surroundings.

Access to STEM education – lessons in science, technology, engineering, and math – is essential, especially during the pandemic: a firm grasp of science equips a society with the tools to meet modern challenges with innovative solutions. Science provides the foundation for developing resilience and problem-solving competencies. To learn these skills, all students and all teachers must have access to quality education – rich or poor, urban or rural, with or without access to a computer.

Never have digital learning materials, the use and availability of technology, the need for advanced training, and collaboration of all stakeholders been as important as they are now. While COVID-19 clearly demonstrated the great need for innovative teaching and learning practices, the pandemic also accelerated their implementation.

For more than a decade, Siemens Stiftung has promoted STEM education through solution-oriented, inquiry-based learning that teaches strong values. The foundation supports strong character development of socially-minded individuals by making knowledge available and promoting skills that enable active participation in shaping the future.

Faced with the COVID-19 pandemic and the need to change learning systems and methodologies, the Siemens Stiftung established a collaborative work with different institutions and educational authorities in Latin America to generate educational media and resources in STEM that respond to the educational reality imposed by the pandemic. The Foundation activated all partner projects in Latin America in a collective effort to find solutions, as well as effective measures to expand free access to education, particularly relevant during the pandemic.

In response to the COVID-19 pandemic, Siemens Stiftung has joined its Latin American partners in creating the education initiative STEM Education for Innovation.

II. Objectives: Education initiative 2020/2021

STEM Education for Innovation is an education initiative for STEM lessons created by Siemens Stiftung and its partners in Latin America. It is supported by Caring Hands e. V.

Working within regional networks, the initiative is a collaboration with local partners on conceptualizing, developing, and circulating STEM education services and materials for Latin America that are both innovative and permanent.

¹ STEM – science, technology, engineering, mathematics

The initiative combines

- openly-licensed (OER – Open Educational Resources) digital and analogue teaching materials for the entire education chain (teachers, students of all age groups),
- certification and advanced training for teachers,
- regional workshops,
- experimental teaching, and
- cooperative networks for teachers, universities, and education institutions.

Thematically, the projects focus on science, technology, sustainability, climate change, health, and digitalization.

Thanks to support from Siemens Caring Hands e.V., 14 projects in Latin America were established in less than a year as part of a Siemens Stiftung initiative. The projects create innovative education formats such as virtual seminars for teachers, digital lessons in STEM, interactive climate change maps, and videos or podcasts about health and hygiene.

Each of the initiative's individual projects is operated locally and adds value to local education systems. The local needs in each of the Latin American regions are established through close consultation with regional education experts and education authorities. Materials and concepts developed in a local pilot phase of each project can be adapted to other regions and shared in networks focusing on concepts and subject matter.

In coordinating the initiative, Siemens Stiftung is responding to specific needs and harnessing the foundation's expertise and collaboration partners for developing proactive projects across the entire continent that are suited to local operating contexts. These efforts also help overcome social inequalities that were either caused or revealed by the pandemic. The initiative's education materials are available online and offline, and teacher certification and advanced training programs have been improved with suitable Blended Learning Concepts. In close collaboration with local project partners, the foundation coordinates and evaluates the goals and impact of each project, ensuring the STEM initiative is an outstanding example of interregional cooperation that sets the course for innovative Blended Learning throughout Latin America.

STEM education is one of Siemens Stiftung's core areas of expertise. In Latin America, the foundation has worked with partners for ten years on futureproofing education and making it freely accessible for all. The new initiative pools these efforts, adapts them to suit the circumstances brought on by the pandemic, and creates sustainable development education materials that are digital and free – for now and the future.

Education is the foundation for change, and with the STEM Education for Innovation initiative, Siemens Stiftung is making a meaningful and timely contribution to STEM education in Latin America. Personal development and social engagement are among the benefits of a high-quality education.

III. The foundation: A network of STEM partners in Latin America

Siemens Stiftung is building upon a science and technology network in Latin America that has existed for ten years: Red STEM Latinoamérica currently includes 60 regional institutions in 11 Latin American countries and is permanently growing.

With the STEM Education for Innovation initiative, Siemens Stiftung is working to permanently expand and solidify the network's potential. Content and formats for teaching and learning can be combined in

new ways, providing new solutions for digital education during the pandemic. The initiative currently includes 14 projects in seven Latin American countries.

During the COVID-19 pandemic, the initiative supports

- creating innovative and appropriate implementation practices for Blended Learning – the combination of digital and analog content,
- digital teaching and learning materials that are easily accessible free of charge, and
- equal opportunities for learning, regardless of social background or location.

The improved, renewed, and interactive practices and materials for teaching and learning will become embedded in national education systems and impact education beyond the pandemic. In addition, all projects are designed as interregional collaborations, with education institutions and project partners across borders establishing permanent channels of communication and cooperation about STEM.

Siemens Stiftung is also working with UNESCO as part of the initiative. With its Global Education Coalition, UNESCO supports countries in mobilizing resources and finding suitable ways of providing teachers and learners with educational opportunities during the COVID-19 pandemic that are remote and utilize available digital possibilities. Through coordinated collaboration, UNESCO, Siemens Stiftung, and the Red STEM Latinoamérica are more effective in achieving collective impact in the region.

IV. Site: Latin America

The COVID-19 pandemic has hit Latin America hard: UNESCO estimates that around 160 million students have been affected by school closures.

The crisis will affect and alter education around the world for some time to come. It shows that Blended Learning – a mixture of offline and online education formats – is the answer to the challenges of these trying times.

Investing in equal access is as forward-thinking as it is essential for fulfilling basic rights: systematic action is the only way to permanently reduce the digital gap and social disparity, which both existed before the pandemic.

Latin America's ties to Siemens date back more than a century; the company has subsidiaries in nearly every country. But that is not the only link: in the past ten years, Siemens Stiftung has worked with a strong network of partners on funding and developing education programs. The partners include universities, education institutions and authorities, NGOs, teachers and academics in Colombia, Peru, Chile, Mexico, Ecuador, Brazil, Bolivia, and Argentina. Paraguay, Guatemala, and Uruguay are set to join the list soon.

Experience has shown that Latin America is particularly skilled in creating impact with modest resources. The broad willingness to collaborate on interregional initiatives can be traced back to years of trusting work with Siemens Stiftung. This confidence and the shared history enable additional models of cooperation when it comes to financing, conceptualization, and execution of projects.

Beyond sharing a common goal, the eagerness to collaborate on readily-available and free education materials reflects objectives Siemens Stiftung has been pursuing for years: Teachers and students can find more than 4,300 Open Educational Resources (OER) in the Siemens Stiftung Media Portal (<https://medienportal.siemens-stiftung.org/de/home>). The materials for diverse, exciting STEM lessons are available in German, Spanish, and English. By citing the original author, nearly all teaching materials can be implemented, modified, combined, and republished under the same licensing conditions.

Users in 120 countries have accessed these materials. At the start of the pandemic, access was broadened in Latin America with CREA (Centro Recursos Educativos Abiertos: <https://experimento.lat.siemens-stiftung.org/recursoseducativos/>). All partners with open teaching and learning materials in their portfolio have made these available on the CREA platform, which is growing even further as part of the STEM Education for Innovation initiative.

V. Target groups

The initiative addresses the following groups in Latin America:

- Teachers and their students
- Student teachers pursuing certification
- STEM and education professors at education institutions (schools, universities, technical colleges)
- Education systems (ministries, local authorities)

VI. Partners

- Pontificia Universidad Católica de Valparaíso (PUCV), Chile
- Centro de Investigación, Didáctica de las Ciencias y Educación STEM, CIDSTEM, Pontificia Universidad Católica de Valparaíso (PUCV), Chile
- Centro de Investigación de Estudios Avanzados de Educación, CIAE, Universidad de Chile, Chile
- Pontificia Universidad Católica de Chile (PUC), Facultad de Educación, Chile
- Pontificia Universidad Católica de Chile (PUC), CIDS – Complejo Interdisciplinario para el Desarrollo Sustentable, Campus Villarrica, Chile
- Universidad de Antioquía, Colombia
- Universidad de La Sabana, Colombia
- Pontificia Universidad Bolivariana, Colombia
- Universidad San Francisco de Quito, Ecuador
- Fundación Siemens Argentina, Argentina
- INNOVEC, Mexico
- Pontificia Universidad Católica del Perú, Peru
- LSI-TEC junto con Universidade de Sao Paulo, Brazil

VII. Impact

The contracts for each of the 14 projects include descriptions of the desired goals – qualitative and quantitative – and measures needed to achieve these goals by 2021. Over the next year, Siemens Stiftung staff in Chile will conduct regular evaluations of the 14 projects to assess progress against their stated goals.

The initiative can be considered a success if all quantitative goals in each participating region have been achieved within a year following close collaboration and exchange across the continent.

The initiative's long-term success will be best measured in the years to come if the materials and methods become permanently established in education agendas and certification curricula and are utilized throughout the continent in the Red STEM Latinoamérica network. Participating ministries and institutions will remain in regular contact with Siemens Stiftung beyond 2021 and will receive continual updates about the success and reach of the individual projects.

VIII. Timeframe

The initiative is scheduled to run from December 2020 to December 2021 with financial support from the Siemens Caring Hands e. V. association and Siemens Stiftung. The funding goes toward creating and expanding the 14 complimentary STEM Education for Innovation projects and supporting the work of partner institutions and education authorities. This creates momentum for developing STEM education in Latin America that extends far beyond the initiative's timeframe.

About Siemens Stiftung

As a nonprofit foundation, Siemens Stiftung promotes sustainable social development which is crucially dependent on access to basic services, high-quality education, and an understanding of culture. The foundation's international project work supports people in taking the initiative to responsibly address current challenges. Siemens Stiftung has worked closely with Latin American education ministries, universities, and STEM education projects for ten years in developing and implementing solutions and programs. Technological and social innovation plays a central role. Siemens Stiftung's actions are impact-oriented and conducted in a transparent manner.

About Siemens Caring Hands e. V.

Siemens Caring Hands e. V. is a charitable association that was founded at the initiative of Siemens AG in 2001. The association is especially active in providing support in major emergencies and pursues charitable and nonprofit purposes. These include the promotion of assistance for disaster victims, support for fire / disaster / civil protection and the promotion of the public health system. At the initiative of Siemens AG, a COVID-19 relief fund was set up under the auspices of Siemens Caring Hands in March 2020, in order to provide support, without red tape, to relief organizations and medical facilities as well as to individuals impacted by the COVID-19 crisis worldwide. The amount donated by Siemens employees was matched and doubled by Siemens AG. The collected funds are used to support important charitable COVID-19 aid projects worldwide.